San Gabriel Valley Council of Governments

AGENDA AND NOTICE OF THE MEETING OF THE SGVCOG PUBLIC WORKS TECHNICAL ADVISORY COMMITTEE

Monday, October 16, 2017 – 12:00 PM

2017/2018 OFFICERS

Chair: Rene Guerrero

Vice Chair: David Liu

Immediate Past Chair: Phil Doudar

Voting Members:

Arcadia
Azusa
Claremont
Diamond Bar
El Monte
Irwindale
Monrovia
Pasadena
Pomona
San Dimas
Temple City
West Covina
LA County DPW

Thank you for participating in today's meeting. The Public Works Technical Advisory Committee encourages public participation and invites you to comment on agenda items.

MEETINGS: ***Regular Meetings of the Public Works Technical Advisory Committee are held on the third Monday of each month at 12 PM at the Upper San Gabriel Valley Municipal Water District-602 E. Huntington Dr., Suite B, Monrovia, CA 91016.*** The Public Works Technical Advisory Committee agenda packet is available at the San Gabriel Valley Council of Government's (SGVCOG) Office, 1000 South Fremont Avenue, Suite 10210, Alhambra, CA, and on the website, www.sgvcog.org. Copies are available via email upon request (sgv@sgvcog.org). Documents distributed to a majority of the Committee after the posting will be available for review in the SGVCOG office and on the SGVCOG website. Your attendance at this public meeting may result in the recording of your voice.

CITIZEN PARTICIPATION: Your participation is welcomed and invited at all Public Works Technical Advisory Committee meetings. Time is reserved at each meeting for those who wish to address the Board. SGVCOG requests that persons addressing the Committee refrain from making personal, slanderous, profane, or disruptive remarks.

TO ADDRESS THE PUBLIC WORKS TECHNICAL ADVISORY COMMITTEE: At a regular meeting, the public may comment on any matter within the jurisdiction of the Committee during the public comment period and may also comment on any agenda item at the time it is discussed. At a special meeting, the public may only comment on items that are on the agenda. Members of the public wishing to speak are asked to complete a comment card or simply rise to be recognized when the Chair asks for public comments to speak. We ask that members of the public state their name for the record and keep their remarks brief. If several persons wish to address the Committee on a single item, the Chair may impose a time limit on individual remarks at the beginning of discussion. **The Public Works Technical Advisory Committee may not discuss or vote on items not on the agenda.**

AGENDA ITEMS: The Agenda contains the regular order of business of the Public Works Technical Advisory Committee. Items on the Agenda have generally been reviewed and investigated by the staff in advance of the meeting so that the Committee can be fully informed about a matter before making its decision.

CONSENT CALENDAR: Items listed on the Consent Calendar are considered to be routine and will be acted upon by one motion. There will be no separate discussion on these items unless a Committee member or citizen so requests. In this event, the item will be removed from the Consent Calendar and considered after the Consent Calendar. If you would like an item on the Consent Calendar discussed, simply tell Staff or a member of the Public Works Technical Advisory Committee.

In compliance with the Americans with Disabilities Act, if you need special assistance to participate in this meeting, please contact the SGVCOG office at (626) 457-1800. Notification 48 hours prior to the meeting will enable the SGVCOG to make reasonable arrangement to ensure accessibility to this meeting.

PRELIMINARY BUSINESS

1. Call to Order

2. Pledge of Allegiance

3. Roll Call

4. Public Comment *(If necessary, the Chair may place reasonable time limits on all public comments)*

CONSENT CALENDAR (*It is anticipated that the Committee may take action on the following matters)*

5. Review Public Works TAC Meeting Minutes: 9/18/2017
Recommended Action: Review and approve.

PRESENTATIONS

6. LA County Metro's "Measure Up" Project: Presentation by Eva Pan of LA County Metro
Recommended Action: for information.

ACTION ITEMS (*It is anticipated that the Committee may take action on the following matters)*

UPDATE ITEMS

7. ACE/COG Integration
Recommended Action: For information

8. SGVCOG General Assembly, Oct. 25, 2017
Recommended Action: For information

INFORMATION ITEMS

DISCUSSION ITEMS

EXECUTIVE DIRECTOR'S COMMENTS

ANNOUNCEMENTS

ADJOURN

SGVCOG SPECIAL Public Works TAC Meeting Minutes
Date: September 18, 2017
Time: 12:00 P.M.
Location: SCE Energy Education Center
6090 Irwindale Ave, Irwindale CA 91702

PRELIMINARY BUSINESS

1. Call to Order. The meeting was called to order at 12:05 p.m.

2. Pledge of Allegiance. R. Guerrero led the TAC in the Pledge of Allegiance.

3. Roll Call

Public Works TAC Members Present
D. Bobadilla, Azusa
D. Liu, Diamond Bar
J. Wu, El Monte
A. Tachiki, L. Marshal, Monrovia
B. Janka, Pasadena
R. Guerrero, Pomona
K. Patel, San Dimas
R. Salas, South El Monte
M. Forbes, Temple City
C. Consunji, West Covina
J. Lu, LACDPW

Public Works TAC Members Absent
Arcadia
Claremont
Irwindale

Guests
A. Sweet, Glendora
P. Pena, San Gabriel
F. Alamolhoda, LAE Associates
S. Ahmad, SA Associates
S. Ariannia, V. Sedaget, Geo-Advantec, Inc.
J. Martinez, C. Palmer, NCE
Bill Stracker, Onward Engineering

SGVCOG Staff
E. Wolf

4. Public Comment.

CONSENT CALENDAR

5. Review Public Works TAC Meeting Minutes: 8/21/2017
There was a motion to approve the minutes (M/S: C. Consunji/K. Patel).

[Motion Passed]

Ayes		Azusa, El Monte, Monrovia, Pasadena, Pomona, San Dimas, South El Monte, Temple City, West Covina, LACDPW
Noes		
Abstain		
Absent		Arcadia, Claremont, Diamond Bar, Irwindale

PRESENTATIONS
ACTION ITEMS (*It is anticipated that the Committee may take action on the following matters)*

UPDATE ITEMS

6. ACE/COG Integration

E. Wolf reviewed the ACE/COG working groups that have been formed to discuss issues such as integrating personnel systems, identifying a suitable location for the joined entity, working out a process for project selection and approval, and branding.

7. SGVCOG General Assembly, Oct 25, 2017

E. Wolf reviewed the agenda and speaker line up for the Assembly.

INFORMATION ITEMS

DISCUSSION ITEMS

8. Tour of Southern California Edison Emergency Operations Center

SCE staff provided a tour of the EOC, highlighting the staff structure and capabilities of the facility. Members wanted to know under what circumstances the EOC would be activated and how communication would flow to impacted cities. They also asked if mutual aid was available and how to access that.

EXECUTIVE DIRECTOR'S COMMENTS

E. Wolf reviewed the Sustainable Communities grant under SB1 and administered by Caltrans.

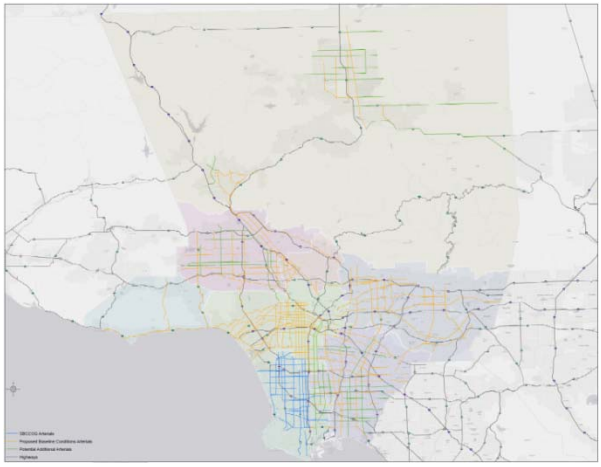
ANNOUNCEMENTS

ADJOURN

The meeting adjourned at 1:12 p.m.

Project Fact Sheet

Background



Over the years, the Los Angeles County Metropolitan Transportation Authority (Metro) has been closely collaborating with its local partner agencies to implement a wide range of arterial improvements including signal synchronization, ITS investments, and bus speed improvements to improve mobility and reliability in the County. Understanding how well a transportation system performs would greatly help target the right projects to address local and regional mobility and reliability needs.

In 2014, Metro conducted the Arterial Performance Measurement Framework initiative to assess the feasibility of developing a countywide Arterial Performance Measurement Program. The study demonstrated that the concept of a countywide Arterial Performance Measurement Program is feasible.

As an initial deployment, Metro completed last year the South Bay Cities Baseline Conditions Analysis that provides a summary of how that subregion's arterial network is performing. The Arterial Performance Measurement (APM) tool developed as part of that effort fused together the speed and traffic volume data to produce a wide range of travel demand, mobility, system reliability, and productivity measures. The findings from the tool were then used to create the Baseline Conditions Report. To ensure that the tool could be applied countywide for each subregion, Metro developed a methodology and User's Guide to support the APM Tool.

Countywide (Arterial Performance) Baseline Conditions Analysis

This Project will evaluate the performance of arterials throughout Los Angeles County to provide agencies and stakeholders with a detailed, reliable assessment of service on each part of the network, and to establish a baseline for evaluation of various arterial improvements and investments. To facilitate consistent and ongoing performance reporting, the project team is developing a custom performance measurement methodology and data processing tool, which will provide stakeholders with on-demand access to several key performance metrics at various levels of aggregation. This is a significant undertaking given the expansive arterial network in Los Angeles County with its nearly 20,500 miles of city and county road and tens of thousands of intersections.

With the collaboration of partner agencies, this Project hopes to achieve the following key objectives:

- Establish a list of arterials for the analysis
- Conduct traffic counts on major arterials
- Process INRIX crowd-sourced speed data
- Build an APM for each subregion
- Develop the Baseline Conditions Reports

Project Stakeholders and Participants

- Arroyo Verdugo
- California Department of Transportation (Caltrans)
- County of Los Angeles Department of Public Works (LA DPW)
- City of Los Angeles (LADOT)
- Gateway Cities
- North Los Angeles County
- San Gabriel Valley
- South Bay Cities
- Westside Cities
- Las Virgenes/Malibu
- San Fernando Valley
- Southern California Association of Governments (SCAG)

Project Timeline

Contact Us:

For more information about the project, please contact us

Eva Pan
(213) 922-5602
PanE@metro.net:


Metro
MEASURE UP
COUNTYWIDE BASELINE CONDITIONS ANALYSIS
San Gabriel Valley
October 16, 2017
Enhancing Performance-Based Decision Making

Project Purpose and Description

- Evaluate the performance of arterials throughout LA County to develop countywide **baseline** in support of Arterial Performance Measurement Framework (2015)

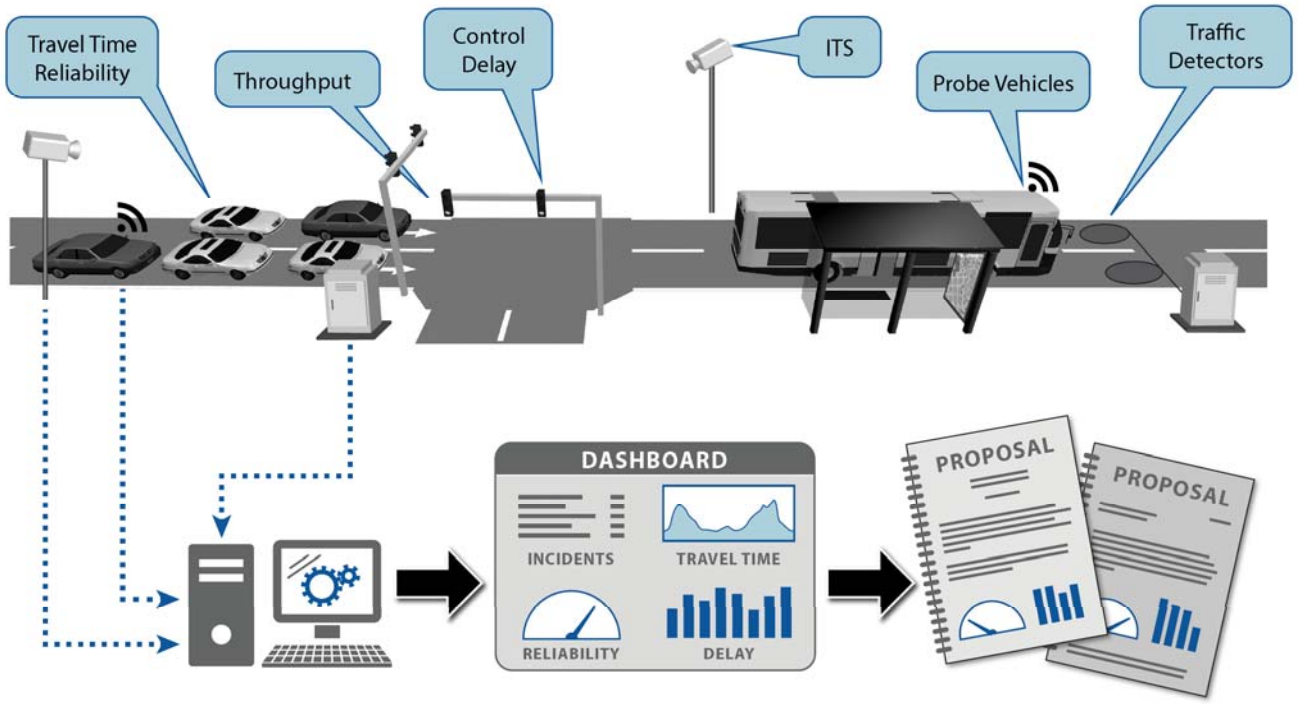
Arterial Performance Measurement Framework

- **Goals:**
  - Provide consistent performance measurement tool for ongoing monitoring
  - Provide on-demand evaluations
  - Provide support for grant applications and other operations/planning
- **Benefits:**
  - Consistent performance data across jurisdictions
  - Quantify outcomes of improvements
  - Inform for future project planning/system needs
  - Supportive resource for project planning for local agencies

Arterial Performance Measurement Framework

1. Select Performance Measures

2. Identify Data Sources



3. Data Management: Integrate and Validate Data

4. Develop Performance Measurement Tool

5. Apply Framework for Data-Driven Decisions

Performance Measures Selected:

Vehicle Miles Travelled (VMT)

Vehicle hours of delay

Hourly/daily volumes (flow)

Average travel speed

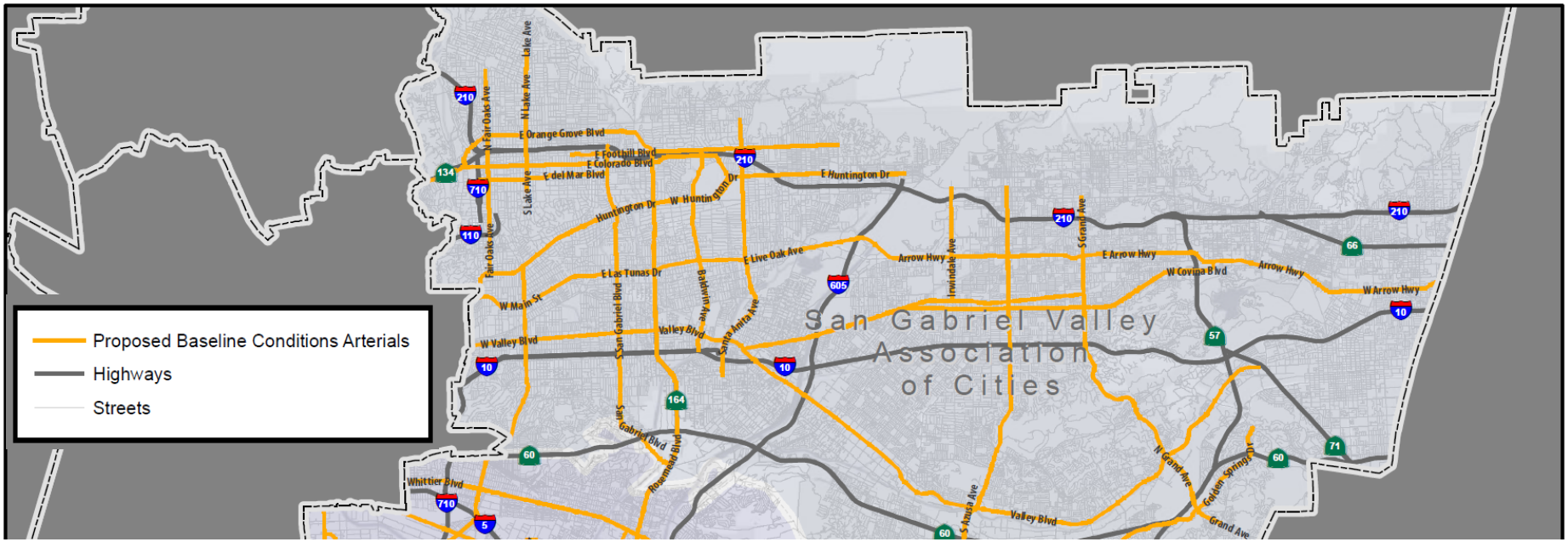
Average travel time

Travel time variability

(Travel time) Reliability

Others (persons, trucks)

Selected Arterials Corridors

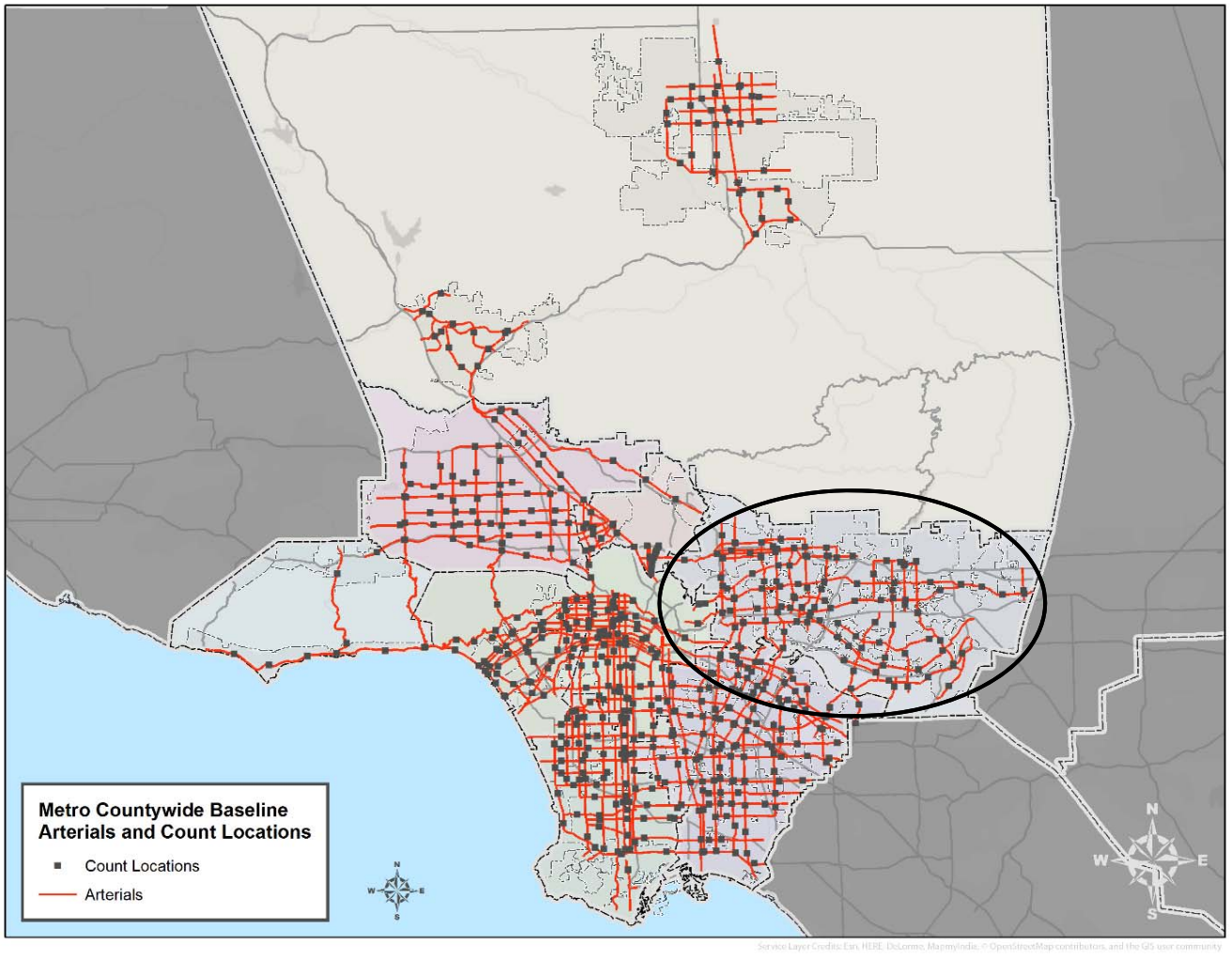


Data Collection and Processing

- About 200 arterial corridors
  - Over 360 manual field tube counts (3 count vendors) in Feb, March
  - Received recent count data from many local agencies
  - Purchased recent counts already conducted by a vendor (about 150 locations)
  - Organize data into common format and conduct QA/QC
- 2016 INRIX data (speed & travel times from GPS crowd-source)
  - Over 2 TB of data to extrapolate
  - Aggregate and average data by sub-segments (city, subregion, county)
  - Conduct QA/QC

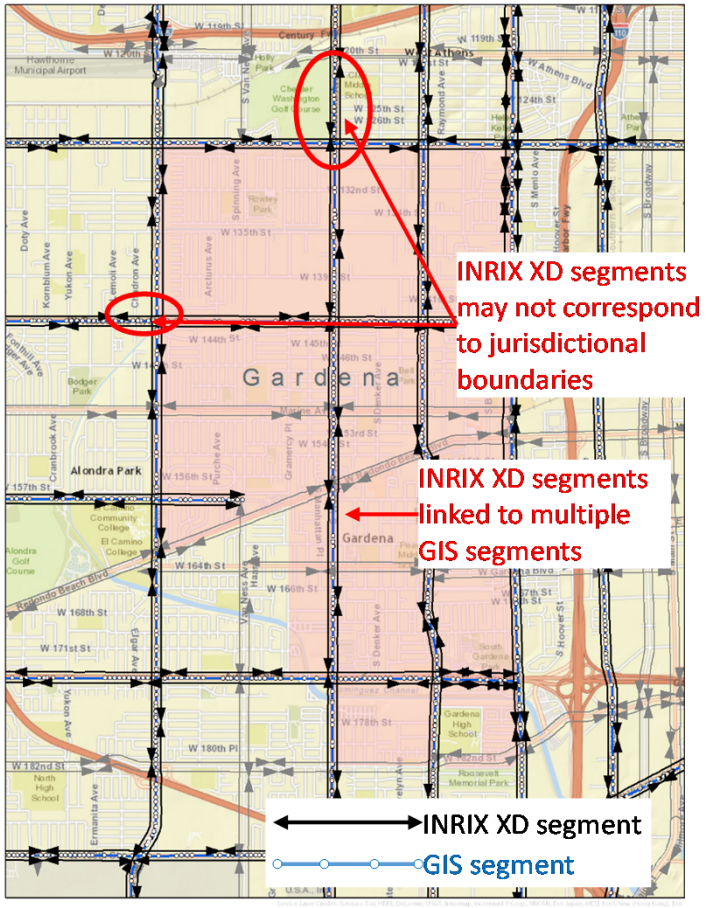
Data Collection and Processing

- Counted most locations between February and May 2017 (3 vendors) using tubes & videos
- Received count data from LACDPW, Glendale, Paramount, & Santa Monica
- Purchased recent count data that were available from one of the vendors



Data Collection and Processing

2016 INRIX data segmentation to fit jurisdictional boundaries and to align with GIS



Arterials Summary

- **Data** (by arterial link by link)
  - Hourly and daily volumes
  - Average speeds
  - Average travel times
- **Performance measures** (by corridor and by sub-segments)
  - Vehicle Miles Traveled (VMT)
  - Vehicle Hours Delay and Delay per Mile
  - Flows, Speeds, Travel Times
  - Reliability (travel time variability and planning time index)

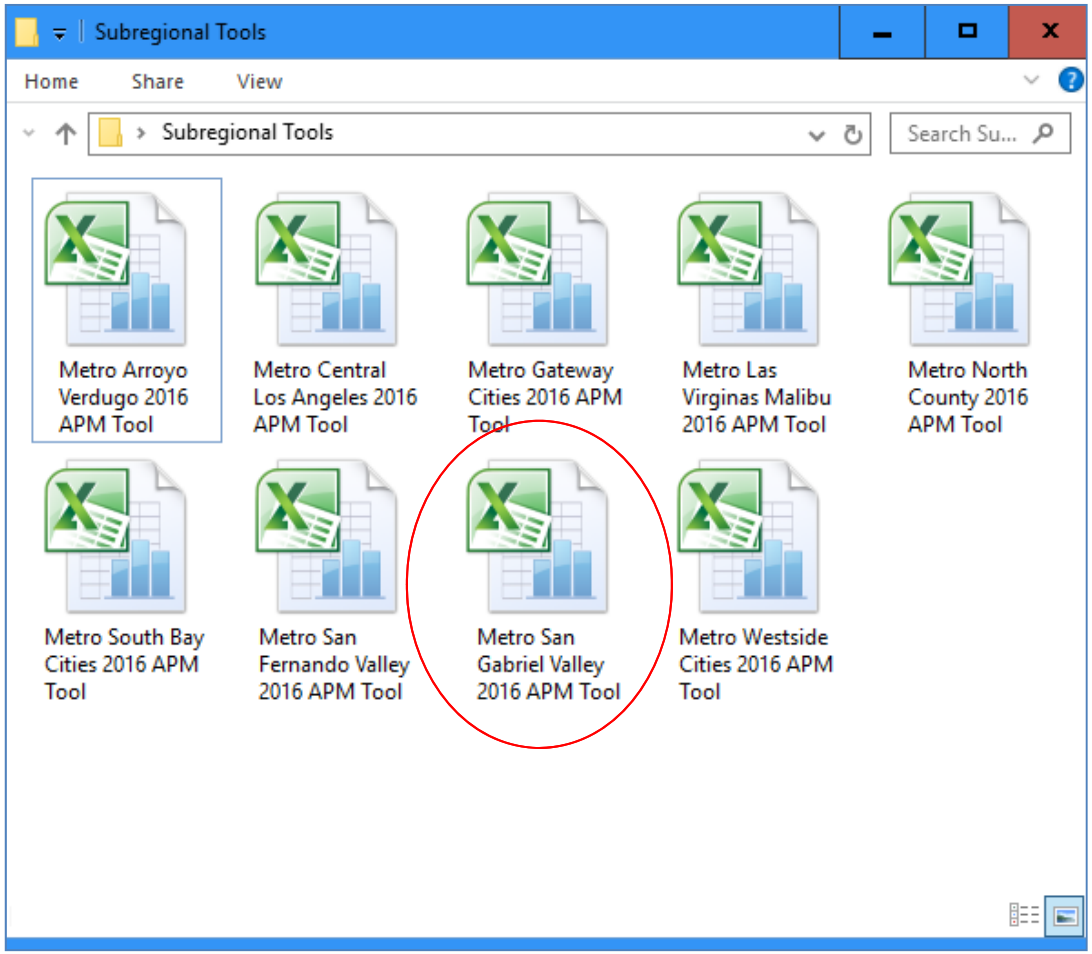
Performance Measurement Tool

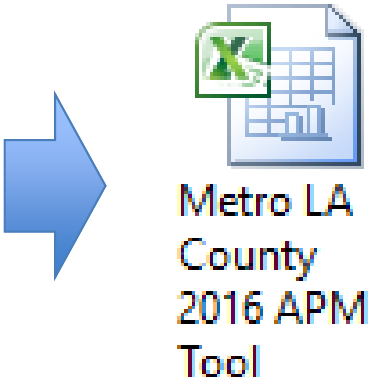
Metro Arterials Performance Measures Definitions

Performance Outcome	Performance Measure	Definition	Data Source
Travel Demand	**Vehicle Miles Traveled (VMT)**	Number of vehicles multiplied by the distance traveled over a corridor.	· 24-hour traffic count data
Productivity	**Flow (Vehicles per Hour [VPH])**	Number of vehicles traveling along a corridor.	· 24-hour traffic count data
Mobility	**Speed (MPH)**	Corridor distance divided by travel time in hours.	· INRIX speed data
	Travel Time (minutes)	Time to traverse a corridor segment in minutes	· INRIX speed data
	Delay (Vehicle-Hours of Delay [VHD])	Difference in actual travel time compared to a threshold travel time (typically at the free-flow speed) along a segment. VHD is calculated as the delayed travel time multiplied by the number of vehicles experiencing that delay.	· 24-hour traffic count data · INRIX speed data
	Delay per Mile (VHD/Mile)	Ratio of VHD divided by corridor distance. A measure of congestion intensity.	· 24-hour traffic count data · INRIX speed data
	Peak Period Spreading	Average duration of peak period VHD in hours	· VHD
Reliability	**Travel Time Index**	Ratio of the average travel time divided by the threshold travel time (i.e., free-flow).	· INRIX speed data
	Planning Time Index	Ratio of 95th percentile travel time divided by average travel time. The 95th percentile travel time is 95th slowest day out of 100 days (approx. 1 day/month).	· INRIX speed data

References: *Metro Arterial Performance Measurement Tool Methodology and User's Guide, August 2017*
Metro Arterial Performance Measurement Framework, Concept of Operations, 2016

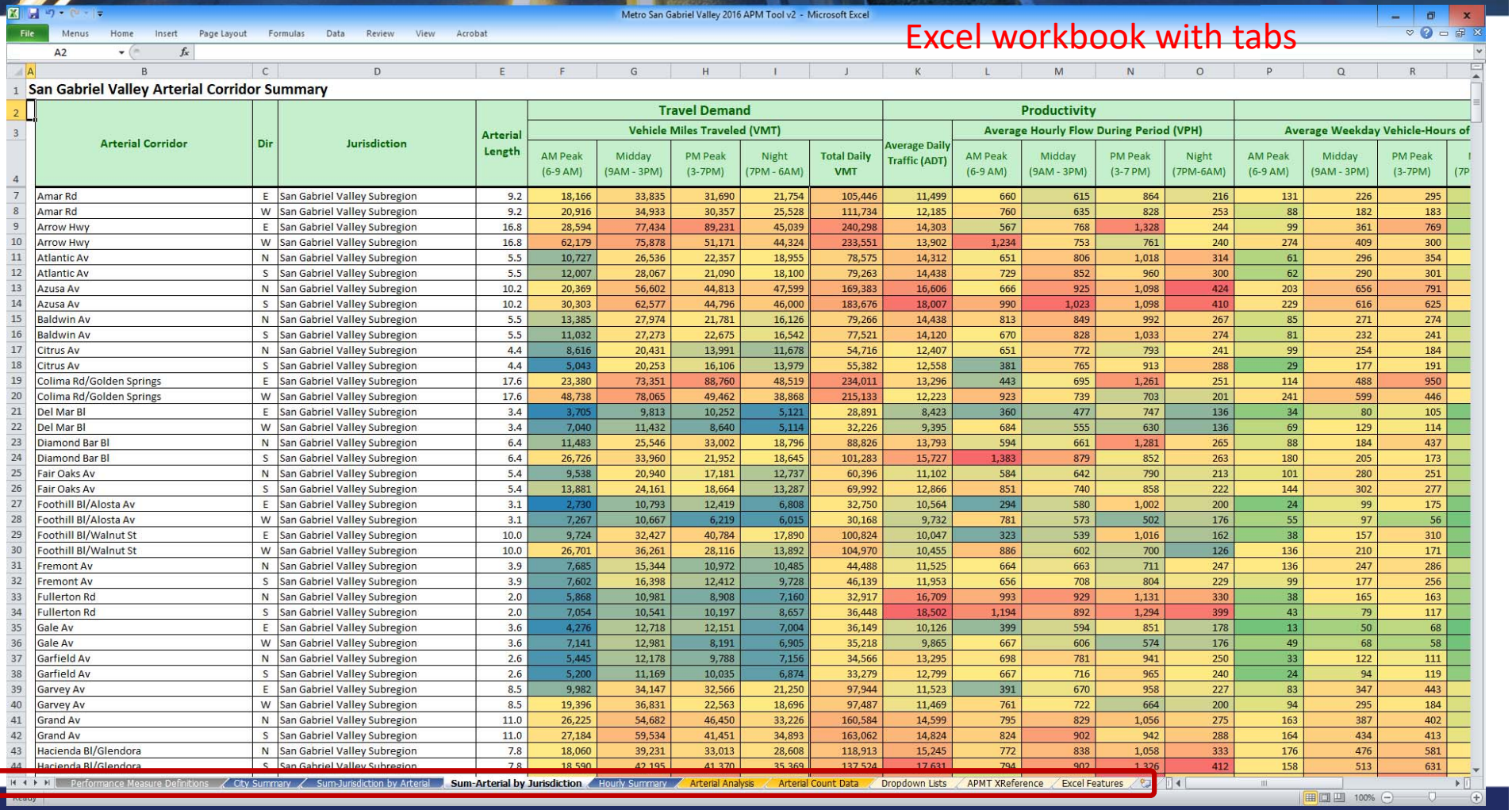
Performance Measurement Tool





Performance Measurement Tool

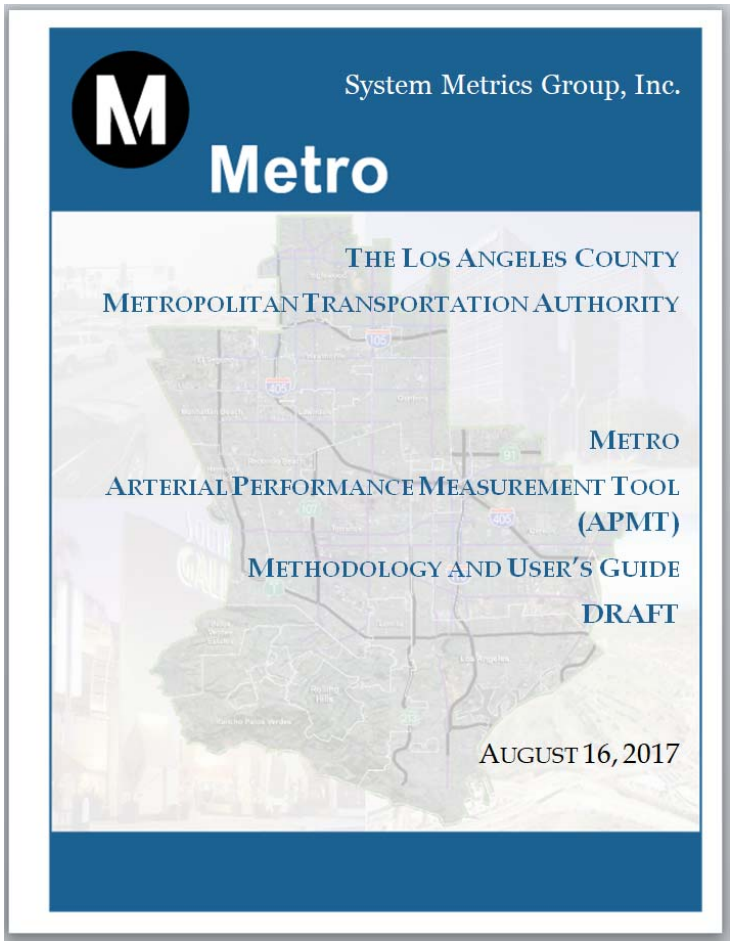
Excel workbook with tabs



San Gabriel Valley Arterial Corridor Summary

Arterial Corridor	Dir	Jurisdiction	Arterial Length	Travel Demand: Vehicle Miles Traveled (VMT)					Productivity								
										Average Hourly Flow During Period (VPH)				Average Weekday Vehicle-Hours of			
				AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7PM)	Night (7PM - 6AM)	Total Daily VMT	Average Daily Traffic (ADT)	AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7 PM)	Night (7PM-6AM)	AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7PM)	(7P
Amar Rd	E	San Gabriel Valley Subregion	9.2	18,166	33,835	31,690	21,754	105,446	11,499	660	615	864	216	131	226	295	
Amar Rd	W	San Gabriel Valley Subregion	9.2	20,916	34,933	30,357	25,528	111,734	12,185	760	635	828	253	88	182	183	
Arrow Hwy	E	San Gabriel Valley Subregion	16.8	28,594	77,434	89,231	45,039	240,298	14,303	567	768	1,328	244	99	361	769	
Arrow Hwy	W	San Gabriel Valley Subregion	16.8	62,179	75,878	51,171	44,324	233,551	13,902	1,234	753	761	240	274	409	300	
Atlantic Av	N	San Gabriel Valley Subregion	5.5	10,727	26,536	22,357	18,955	78,575	14,312	651	806	1,018	314	61	296	354	
Atlantic Av	S	San Gabriel Valley Subregion	5.5	12,007	28,067	21,090	18,100	79,263	14,438	729	852	960	300	62	290	301	
Azusa Av	N	San Gabriel Valley Subregion	10.2	20,369	56,602	44,813	47,599	169,383	16,606	666	925	1,098	424	203	656	791	
Azusa Av	S	San Gabriel Valley Subregion	10.2	30,303	62,577	44,796	46,000	183,676	18,007	990	1,023	1,098	410	229	616	625	
Baldwin Av	N	San Gabriel Valley Subregion	5.5	13,385	27,974	21,781	16,126	79,266	14,438	813	849	992	267	85	271	274	
Baldwin Av	S	San Gabriel Valley Subregion	5.5	11,032	27,273	22,675	16,542	77,521	14,120	670	828	1,033	274	81	232	241	
Citrus Av	N	San Gabriel Valley Subregion	4.4	8,616	20,431	13,991	11,678	54,716	12,407	651	772	793	241	99	254	184	
Citrus Av	S	San Gabriel Valley Subregion	4.4	5,043	20,253	16,106	13,979	55,382	12,558	381	765	913	288	29	177	191	
Colima Rd/Golden Springs	E	San Gabriel Valley Subregion	17.6	23,380	73,351	88,760	48,519	234,011	13,296	443	695	1,261	251	114	488	950	
Colima Rd/Golden Springs	W	San Gabriel Valley Subregion	17.6	48,738	78,065	49,462	38,868	215,133	12,223	923	739	703	201	241	599	446	
Del Mar Bl	E	San Gabriel Valley Subregion	3.4	3,705	9,813	10,252	5,121	28,891	8,423	360	477	747	136	34	80	105	
Del Mar Bl	W	San Gabriel Valley Subregion	3.4	7,040	11,432	8,640	5,114	32,226	9,395	684	555	630	136	69	129	114	
Diamond Bar Bl	N	San Gabriel Valley Subregion	6.4	11,483	25,546	33,002	18,796	88,826	13,793	594	661	1,281	265	88	184	437	
Diamond Bar Bl	S	San Gabriel Valley Subregion	6.4	26,726	33,960	21,952	18,645	101,283	15,727	1,383	879	852	263	180	205	173	
Fair Oaks Av	N	San Gabriel Valley Subregion	5.4	9,538	20,940	17,181	12,737	60,396	11,102	584	642	790	213	101	280	251	
Fair Oaks Av	S	San Gabriel Valley Subregion	5.4	13,881	24,161	18,664	13,287	69,992	12,866	851	740	858	222	144	302	277	
Foothill Bl/Alosta Av	E	San Gabriel Valley Subregion	3.1	2,730	10,793	12,419	6,808	32,750	10,564	294	580	1,002	200	24	99	175	
Foothill Bl/Alosta Av	W	San Gabriel Valley Subregion	3.1	7,267	10,667	6,219	6,015	30,168	9,732	781	573	502	176	55	97	56	
Foothill Bl/Walnut St	E	San Gabriel Valley Subregion	10.0	9,724	32,427	40,784	17,890	100,824	10,047	323	539	1,016	162	38	157	310	
Foothill Bl/Walnut St	W	San Gabriel Valley Subregion	10.0	26,701	36,261	28,116	13,892	104,970	10,455	886	602	700	126	136	210	171	
Fremont Av	N	San Gabriel Valley Subregion	3.9	7,685	15,344	10,972	10,485	44,488	11,525	664	663	711	247	136	247	286	
Fremont Av	S	San Gabriel Valley Subregion	3.9	7,602	16,398	12,412	9,728	46,139	11,953	656	708	804	229	99	177	256	
Fullerton Rd	N	San Gabriel Valley Subregion	2.0	5,868	10,981	8,908	7,160	32,917	16,709	993	929	1,131	330	38	165	163	
Fullerton Rd	S	San Gabriel Valley Subregion	2.0	7,054	10,541	10,197	8,657	36,448	18,502	1,194	892	1,294	399	43	79	117	
Gale Av	E	San Gabriel Valley Subregion	3.6	4,276	12,718	12,151	7,004	36,149	10,126	399	594	851	178	13	50	68	
Gale Av	W	San Gabriel Valley Subregion	3.6	7,141	12,981	8,191	6,905	35,218	9,865	667	606	574	176	49	68	58	
Garfield Av	N	San Gabriel Valley Subregion	2.6	5,445	12,178	9,788	7,156	34,566	13,295	698	781	941	250	33	122	111	
Garfield Av	S	San Gabriel Valley Subregion	2.6	5,200	11,169	10,035	6,874	33,279	12,799	667	716	965	240	24	94	119	
Garvey Av	E	San Gabriel Valley Subregion	8.5	9,982	34,147	32,566	21,250	97,944	11,523	391	670	958	227	83	347	443	
Garvey Av	W	San Gabriel Valley Subregion	8.5	19,396	36,831	22,563	18,696	97,487	11,469	761	722	664	200	94	295	184	
Grand Av	N	San Gabriel Valley Subregion	11.0	26,225	54,682	46,450	33,226	160,584	14,599	795	829	1,056	275	163	387	402	
Grand Av	S	San Gabriel Valley Subregion	11.0	27,184	59,534	41,451	34,893	163,062	14,824	824	902	942	288	164	434	413	
Hacienda Bl/Glendora	N	San Gabriel Valley Subregion	7.8	18,060	39,231	33,013	28,608	118,913	15,245	772	838	1,058	333	176	476	581	
Hacienda Bl/Glendora	S	San Gabriel Valley Subregion	7.8	18,590	42,195	41,370	35,369	137,524	17,631	794	902	1,326	412	158	513	631	

Performance Measurement Tool



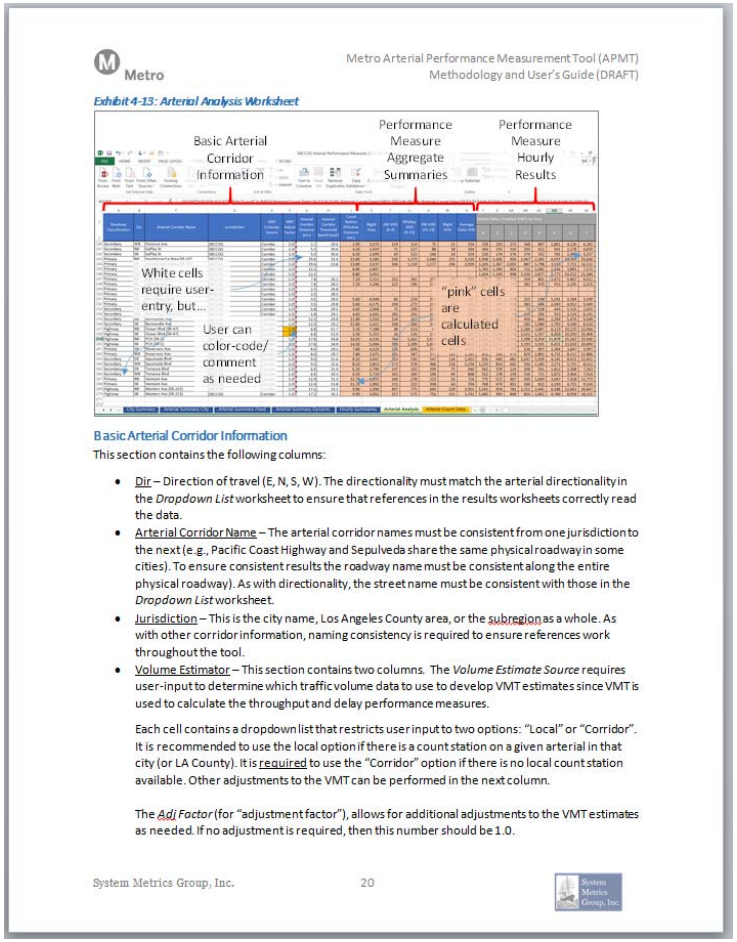
System Metrics Group, Inc.

Metro

THE LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

METRO
ARTERIAL PERFORMANCE MEASUREMENT TOOL (APMT)
METHODOLOGY AND USER'S GUIDE
DRAFT

AUGUST 16, 2017



Metro

Metro Arterial Performance Measurement Tool (APMT)
Methodology and User's Guide (DRAFT)

Exhibit 4-13: Arterial Analysis Worksheet

Basic Arterial Corridor Information

Performance Measure Aggregate Summaries

Performance Measure Hourly Results

White cells require user-entry, but...

User can color-code/ comment as needed

"pink" cells are calculated cells

Basic Arterial Corridor Information

This section contains the following columns:

- Dir – Direction of travel (E, N, S, W). The directionality must match the arterial directionality in the *Dropdown List* worksheet to ensure that references in the results worksheets correctly read the data.
- Arterial Corridor Name – The arterial corridor names must be consistent from one jurisdiction to the next (e.g., Pacific Coast Highway and Sepulveda share the same physical roadway in some cities). To ensure consistent results the roadway name must be consistent along the entire physical roadway). As with directionality, the street name must be consistent with those in the *Dropdown List* worksheet.
- Jurisdiction – This is the city name, Los Angeles County area, or the subregion as a whole. As with other corridor information, naming consistency is required to ensure references work throughout the tool.
- Volume Estimator – This section contains two columns. The *Volume Estimate Source* requires user-input to determine which traffic volume data to use to develop VMT estimates since VMT is used to calculate the throughput and delay performance measures.

  Each cell contains a dropdown list that restricts user input to two options: "Local" or "Corridor". It is recommended to use the local option if there is a count station on a given arterial in that city (or LA County). It is required to use the "Corridor" option if there is no local count station available. Other adjustments to the VMT can be performed in the next column.

  The *Adj Factor* (for "adjustment factor"), allows for additional adjustments to the VMT estimates as needed. If no adjustment is required, then this number should be 1.0.

System Metrics Group, Inc. 20

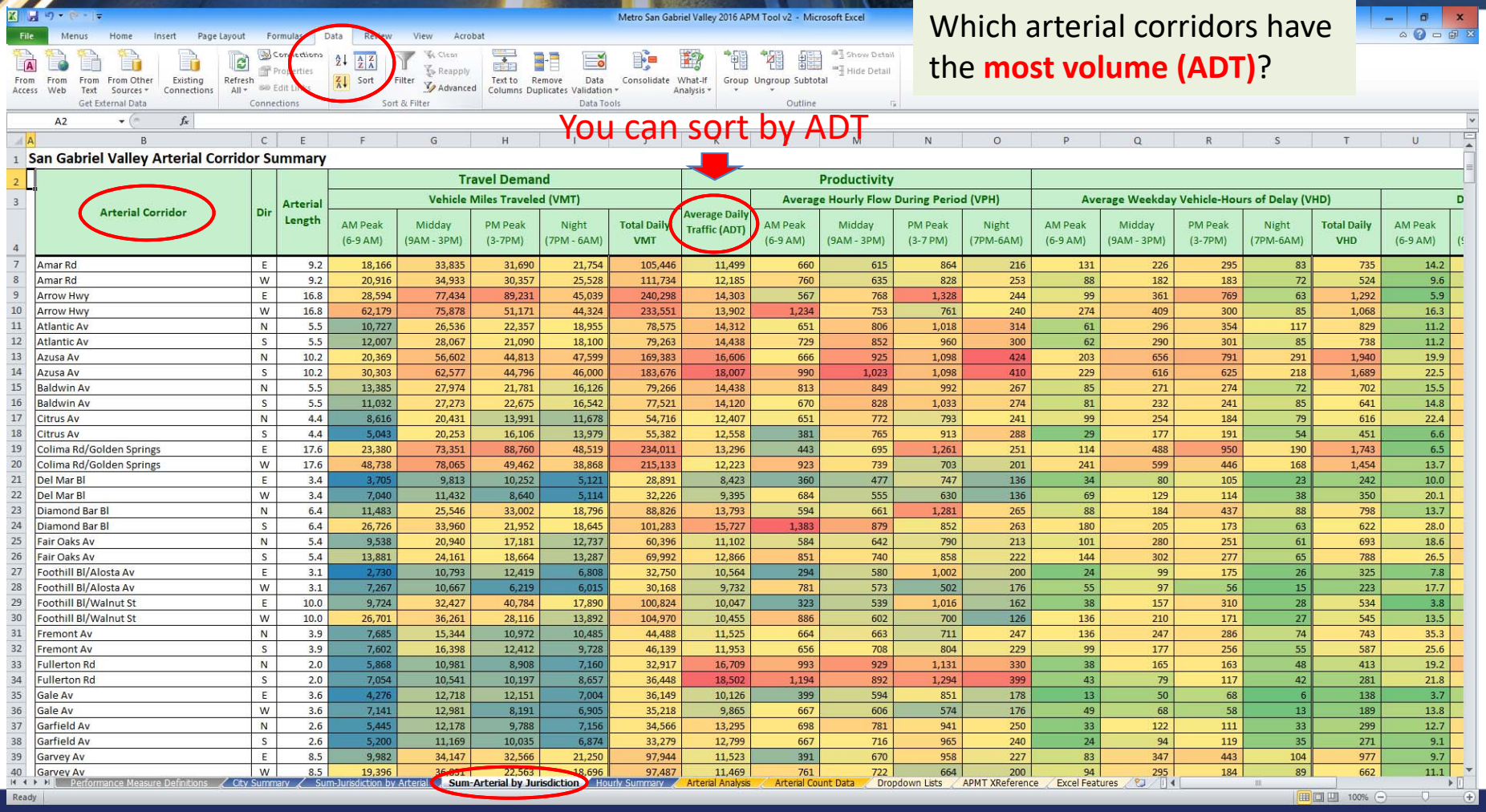
Performance Measurement Tool

- Performance measurement summary
  - Which arterial corridors have the most volume (ADT)?
  - Which arterial corridor is the longest in the subregion?
  - Which have the most travel demand (Vehicle Miles Traveled)?
  - Which have the most congestion delay (Total Daily Vehicle Hours)?
  - Which have the most congestion delay per mile (daily VHD/mile)?
  - Which have the least reliability in PM peak?
  - What are the peak period hours for the corridor with the most delay?

Performance Measurement Tool

Which arterial corridors have the **most volume (ADT)**?

You can sort by ADT



Performance Measurement Tool

Which arterial corridor is **longest** in the subregion?

You can sort by Arterial Length

Metro San Gabriel Valley 2016 APM Tool v2 - Microsoft Excel

San Gabriel Valley Arterial Corridor Summary

Arterial Corridor	Dir	Arterial Length	Travel Demand: Vehicle Miles Traveled (VMT) AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7PM)	Night (7PM - 6AM)	Total Daily VMT	Productivity: Average Daily Traffic (ADT)	Average Hourly Flow During Period (VPH) AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7 PM)	Night (7PM-6AM)	Average Weekday Vehicle-Hours of Delay (VHD) AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7PM)	Night (7PM-6AM)	Total Daily VHD	D AM Peak (6-9 AM)
Amar Rd	E	9.2	18,166	33,835	31,690	21,754	105,446	11,499	660	615	864	216	131	226	295	83	735	14.2
Amar Rd	W	9.2	20,916	34,933	30,357	25,528	111,734	12,185	760	635	828	253	88	182	183	72	524	9.6
Arrow Hwy	E	16.8	28,594	77,434	89,231	45,039	240,298	14,303	567	768	1,328	244	99	361	769	63	1,292	5.9
Arrow Hwy	W	16.8	62,179	75,878	51,171	44,324	233,551	13,902	1,234	753	761	240	274	409	300	85	1,068	16.3
Atlantic Av	N	5.5	10,727	26,536	22,357	18,955	78,575	14,312	651	806	1,018	314	61	296	354	117	829	11.2
Atlantic Av	S	5.5	12,007	28,067	21,090	18,100	79,263	14,438	729	852	960	300	62	290	301	85	738	11.2
Azusa Av	N	10.2	20,369	56,602	44,813	47,599	169,383	16,606	666	925	1,098	424	203	656	791	291	1,940	19.9
Azusa Av	S	10.2	30,303	62,577	44,796	46,000	183,676	18,007	990	1,023	1,098	410	229	616	625	218	1,689	22.5
Baldwin Av	N	5.5	13,385	27,974	21,781	16,126	79,266	14,438	813	849	992	267	85	271	274	72	702	15.5
Baldwin Av	S	5.5	11,032	27,273	22,675	16,542	77,521	14,120	670	828	1,033	274	81	232	241	85	641	14.8
Citrus Av	N	4.4	8,616	20,431	13,991	11,678	54,716	12,407	651	772	793	241	99	254	184	79	616	22.4
Citrus Av	S	4.4	5,043	20,253	16,106	13,979	55,382	12,558	381	765	913	288	29	177	191	54	451	6.6
Colima Rd/Golden Springs	E	17.6	23,380	73,351	88,760	48,519	234,011	13,296	443	695	1,261	251	114	488	950	190	1,743	6.5
Colima Rd/Golden Springs	W	17.6	48,738	78,065	49,462	38,868	215,133	12,223	923	739	703	201	241	599	446	168	1,454	13.7
Del Mar Bl	E	3.4	3,705	9,813	10,252	5,121	28,891	8,423	360	477	747	136	34	80	105	23	242	10.0
Del Mar Bl	W	3.4	7,040	11,432	8,640	5,114	32,226	9,395	684	555	630	136	69	129	114	38	350	20.1
Diamond Bar Bl	N	6.4	11,483	25,546	33,002	18,796	88,826	13,793	594	661	1,281	265	88	184	437	88	798	13.7
Diamond Bar Bl	S	6.4	26,726	33,960	21,952	18,645	101,283	15,727	1,383	879	852	263	180	205	173	63	622	28.0
Fair Oaks Av	N	5.4	9,538	20,940	17,181	12,737	60,396	11,102	584	642	790	213	101	280	251	61	693	18.6
Fair Oaks Av	S	5.4	13,881	24,161	18,664	13,287	69,992	12,866	851	740	858	222	144	302	277	65	788	26.5
Foothill Bl/Alosta Av	E	3.1	2,730	10,793	12,419	6,808	32,750	10,564	294	580	1,002	200	24	99	175	26	325	7.8
Foothill Bl/Alosta Av	W	3.1	7,267	10,667	6,219	6,015	30,168	9,732	781	573	502	176	55	97	56	15	223	17.7
Foothill Bl/Walnut St	E	10.0	9,724	32,427	40,784	17,890	100,824	10,047	323	539	1,016	162	38	157	310	28	534	3.8
Foothill Bl/Walnut St	W	10.0	26,701	36,261	28,116	13,892	104,970	10,455	886	602	700	126	136	210	171	27	545	13.5
Fremont Av	N	3.9	7,685	15,344	10,972	10,485	44,488	11,525	664	663	711	247	136	247	286	74	743	35.3
Fremont Av	S	3.9	7,602	16,398	12,412	9,728	46,139	11,953	656	708	804	229	99	177	256	55	587	25.6
Fullerton Rd	N	2.0	5,868	10,981	8,908	7,160	32,917	16,709	993	929	1,131	330	38	165	163	48	413	19.2
Fullerton Rd	S	2.0	7,054	10,541	10,197	8,657	36,448	18,502	1,194	892	1,294	399	43	79	117	42	281	21.8
Gale Av	E	3.6	4,276	12,718	12,151	7,004	36,149	10,126	399	594	851	178	13	50	68	6	138	3.7
Gale Av	W	3.6	7,141	12,981	8,191	6,905	35,218	9,865	667	606	574	176	49	68	58	13	189	13.8
Garfield Av	N	2.6	5,445	12,178	9,788	7,156	34,566	13,295	698	781	941	250	33	122	111	33	299	12.7
Garfield Av	S	2.6	5,200	11,169	10,035	6,874	33,279	12,799	667	716	965	240	24	94	119	35	271	9.1
Garvey Av	E	8.5	9,982	34,147	32,566	21,250	97,944	11,523	391	670	958	227	83	347	443	104	977	9.7
Garvey Av	W	8.5	19,396	36,651	22,563	18,696	97,487	11,469	761	722	664	200	94	295	184	89	662	11.1

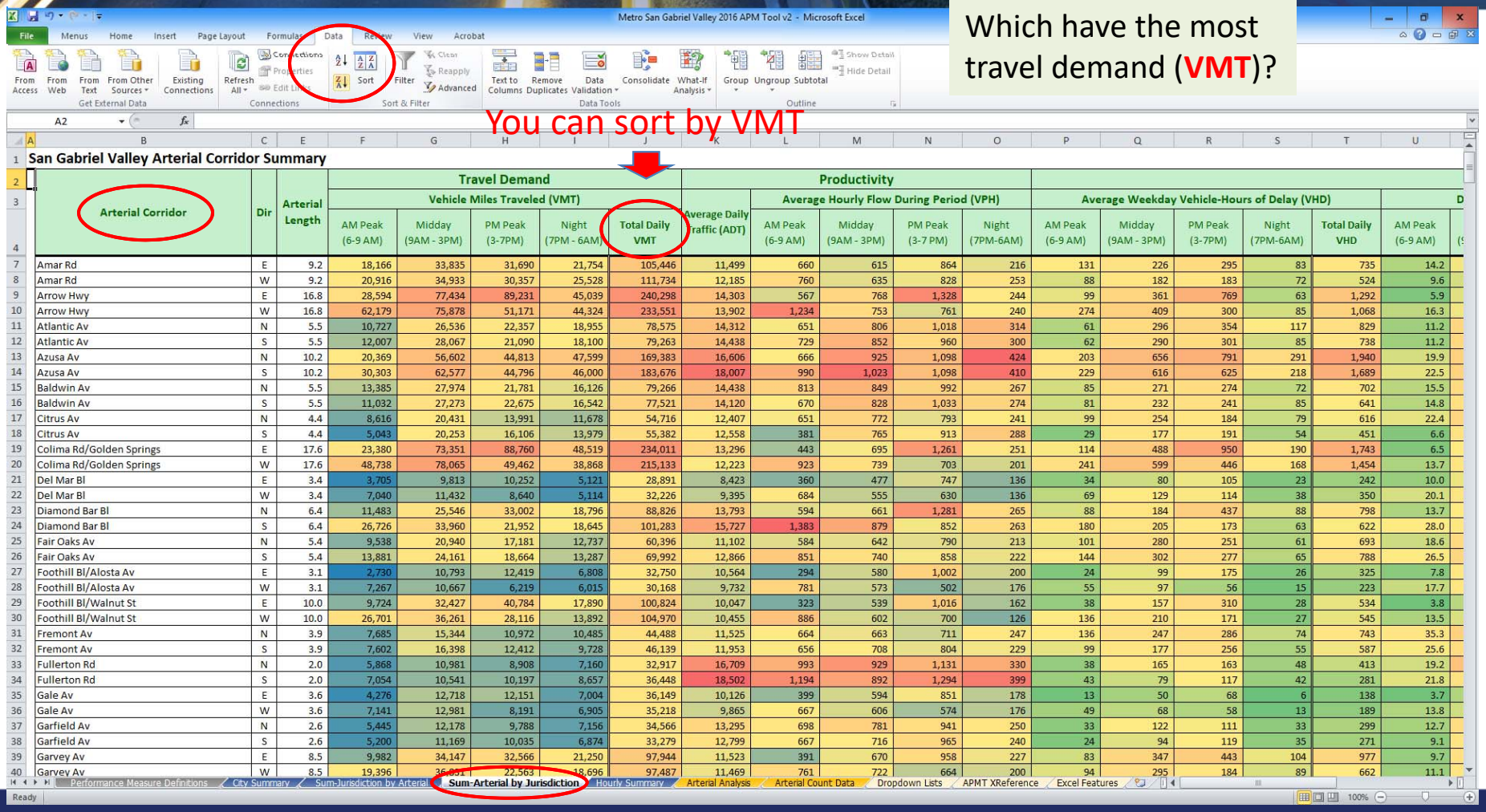
Performance Measure Definitions | City Summary | Sum-Jurisdiction by Arterial | Sum-Arterial by Jurisdiction | Hourly Summary | Arterial Analysis | Arterial Count Data | Dropdown Lists | APMT XReference | Excel Features

Ready

Performance Measurement Tool

Which have the most travel demand (**VMT**)?

You can sort by VMT



Metro San Gabriel Valley 2016 APM Tool v2 - Microsoft Excel

San Gabriel Valley Arterial Corridor Summary

Arterial Corridor	Dir	Arterial Length	Travel Demand: Vehicle Miles Traveled (VMT)					Productivity: Average Daily Traffic (ADT)	Productivity: Average Hourly Flow During Period (VPH)				Average Weekday Vehicle-Hours of Delay (VHD)					D
			AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7PM)	Night (7PM - 6AM)	Total Daily VMT		AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7 PM)	Night (7PM-6AM)	AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7PM)	Night (7PM-6AM)	Total Daily VHD	AM Peak (6-9 AM)
Amar Rd	E	9.2	18,166	33,835	31,690	21,754	105,446	11,499	660	615	864	216	131	226	295	83	735	14.2
Amar Rd	W	9.2	20,916	34,933	30,357	25,528	111,734	12,185	760	635	828	253	88	182	183	72	524	9.6
Arrow Hwy	E	16.8	28,594	77,434	89,231	45,039	240,298	14,303	567	768	1,328	244	99	361	769	63	1,292	5.9
Arrow Hwy	W	16.8	62,179	75,878	51,171	44,324	233,551	13,902	1,234	753	761	240	274	409	300	85	1,068	16.3
Atlantic Av	N	5.5	10,727	26,536	22,357	18,955	78,575	14,312	651	806	1,018	314	61	296	354	117	829	11.2
Atlantic Av	S	5.5	12,007	28,067	21,090	18,100	79,263	14,438	729	852	960	300	62	290	301	85	738	11.2
Azusa Av	N	10.2	20,369	56,602	44,813	47,599	169,383	16,606	666	925	1,098	424	203	656	791	291	1,940	19.9
Azusa Av	S	10.2	30,303	62,577	44,796	46,000	183,676	18,007	990	1,023	1,098	410	229	616	625	218	1,689	22.5
Baldwin Av	N	5.5	13,385	27,974	21,781	16,126	79,266	14,438	813	849	992	267	85	271	274	72	702	15.5
Baldwin Av	S	5.5	11,032	27,273	22,675	16,542	77,521	14,120	670	828	1,033	274	81	232	241	85	641	14.8
Citrus Av	N	4.4	8,616	20,431	13,991	11,678	54,716	12,407	651	772	793	241	99	254	184	79	616	22.4
Citrus Av	S	4.4	5,043	20,253	16,106	13,979	55,382	12,558	381	765	913	288	29	177	191	54	451	6.6
Colima Rd/Golden Springs	E	17.6	23,380	73,351	88,760	48,519	234,011	13,296	443	695	1,261	251	114	488	950	190	1,743	6.5
Colima Rd/Golden Springs	W	17.6	48,738	78,065	49,462	38,868	215,133	12,223	923	739	703	201	241	599	446	168	1,454	13.7
Del Mar Bl	E	3.4	3,705	9,813	10,252	5,121	28,891	8,423	360	477	747	136	34	80	105	23	242	10.0
Del Mar Bl	W	3.4	7,040	11,432	8,640	5,114	32,226	9,395	684	555	630	136	69	129	114	38	350	20.1
Diamond Bar Bl	N	6.4	11,483	25,546	33,002	18,796	88,826	13,793	594	661	1,281	265	88	184	437	88	798	13.7
Diamond Bar Bl	S	6.4	26,726	33,960	21,952	18,645	101,283	15,727	1,383	879	852	263	180	205	173	63	622	28.0
Fair Oaks Av	N	5.4	9,538	20,940	17,181	12,737	60,396	11,102	584	642	790	213	101	280	251	61	693	18.6
Fair Oaks Av	S	5.4	13,881	24,161	18,664	13,287	69,992	12,866	851	740	858	222	144	302	277	65	788	26.5
Foothill Bl/Alosta Av	E	3.1	2,730	10,793	12,419	6,808	32,750	10,564	294	580	1,002	200	24	99	175	26	325	7.8
Foothill Bl/Alosta Av	W	3.1	7,267	10,667	6,219	6,015	30,168	9,732	781	573	502	176	55	97	56	15	223	17.7
Foothill Bl/Walnut St	E	10.0	9,724	32,427	40,784	17,890	100,824	10,047	323	539	1,016	162	38	157	310	28	534	3.8
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Fullerton Rd	N	2.0	5,868	10,981	8,908	7,160	32,917	16,709	993	929	1,131	330	38	165	163	48	413	19.2
Fullerton Rd	S	2.0	7,054	10,541	10,197	8,657	36,448	18,502	1,194	892	1,294	399	43	79	117	42	281	21.8
Gale Av	E	3.6	4,276	12,718	12,151	7,004	36,149	10,126	399	594	851	178	13	50	68	6	138	3.7
Gale Av	W	3.6	7,141	12,981	8,191	6,905	35,218	9,865	667	606	574	176	49	68	58	13	189	13.8
Garfield Av	N	2.6	5,445	12,178	9,788	7,156	34,566	13,295	698	781	941	250	33	122	111	33	299	12.7
Garfield Av	S	2.6	5,200	11,169	10,035	6,874	33,279	12,799	667	716	965	240	24	94	119	35	271	9.1
Garvey Av	E	8.5	9,982	34,147	32,566	21,250	97,944	11,523	391	670	958	227	83	347	443	104	977	9.7
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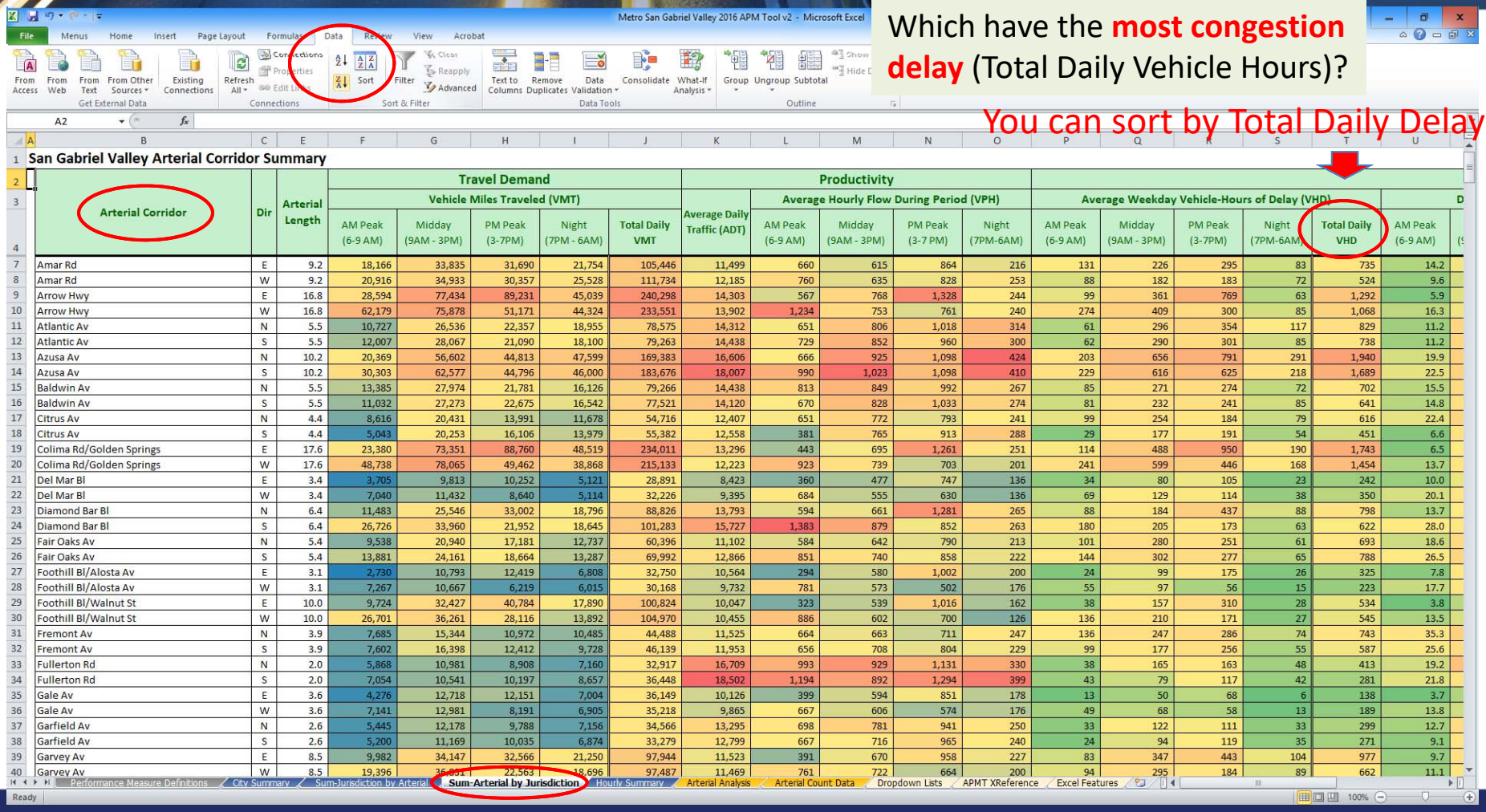
Sheet tabs: Performance Measure Definitions | City Summary | Sum-Jurisdiction by Arterial | Sum-Arterial by Jurisdiction | Hourly Summary | Arterial Analysis | Arterial Count Data | Dropdown Lists | APMT XReference | Excel Features

Performance Measurement Tool

Which have the **most congestion delay** (Total Daily Vehicle Hours)?

You can sort by Total Daily Delay



Metro San Gabriel Valley 2016 APM Tool v2 - Microsoft Excel

San Gabriel Valley Arterial Corridor Summary

Arterial Corridor	Dir	Arterial Length	Travel Demand: Vehicle Miles Traveled (VMT) AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7PM)	Night (7PM - 6AM)	Total Daily VMT	Productivity: Average Daily Traffic (ADT)	Average Hourly Flow During Period (VPH) AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7 PM)	Night (7PM-6AM)	Average Weekday Vehicle-Hours of Delay (VHD) AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7PM)	Night (7PM-6AM)	Total Daily VHD	D AM Peak (6-9 AM)
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Garfield Av	N	2.6	5,445	12,178	9,788	7,156	34,566	13,295	698	781	941	250	33	122	111	33	299	12.7
Garfield Av	S	2.6	5,200	11,169	10,035	6,874	33,279	12,799	667	716	965	240	24	94	119	35	271	9.1
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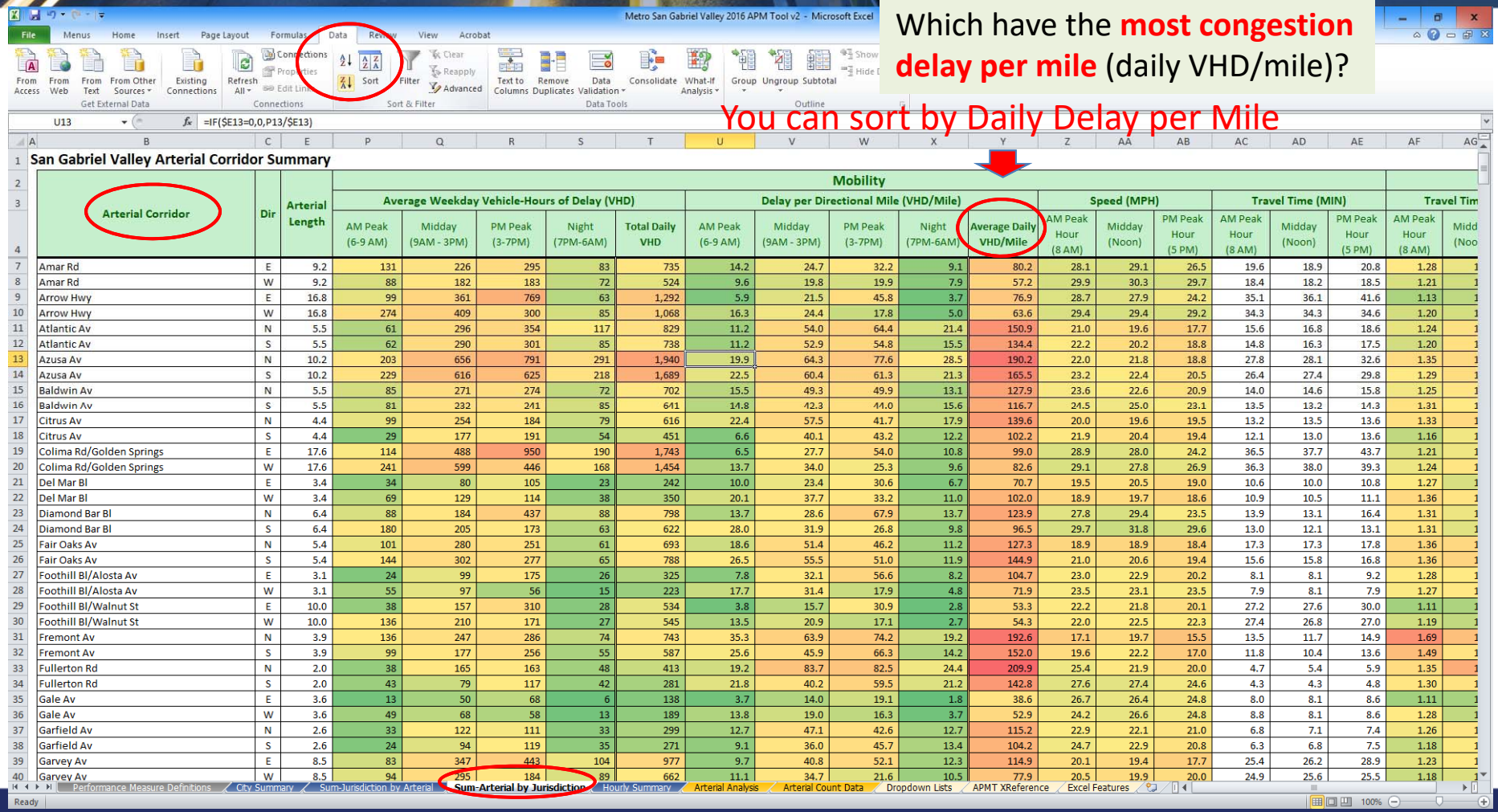
Performance Measure Definitions | City Summary | Sum-Jurisdiction by Arterial | Sum-Arterial by Jurisdiction | Hourly Summary | Arterial Analysis | Arterial Count Data | Dropdown Lists | APMT XReference | Excel Features

Performance Measurement Tool

Which have the **most congestion delay per mile** (daily VHD/mile)?

You can sort by Daily Delay per Mile



Metro San Gabriel Valley 2016 APM Tool v2 - Microsoft Excel

=IF($E13=0,0,P13/$E13)

San Gabriel Valley Arterial Corridor Summary

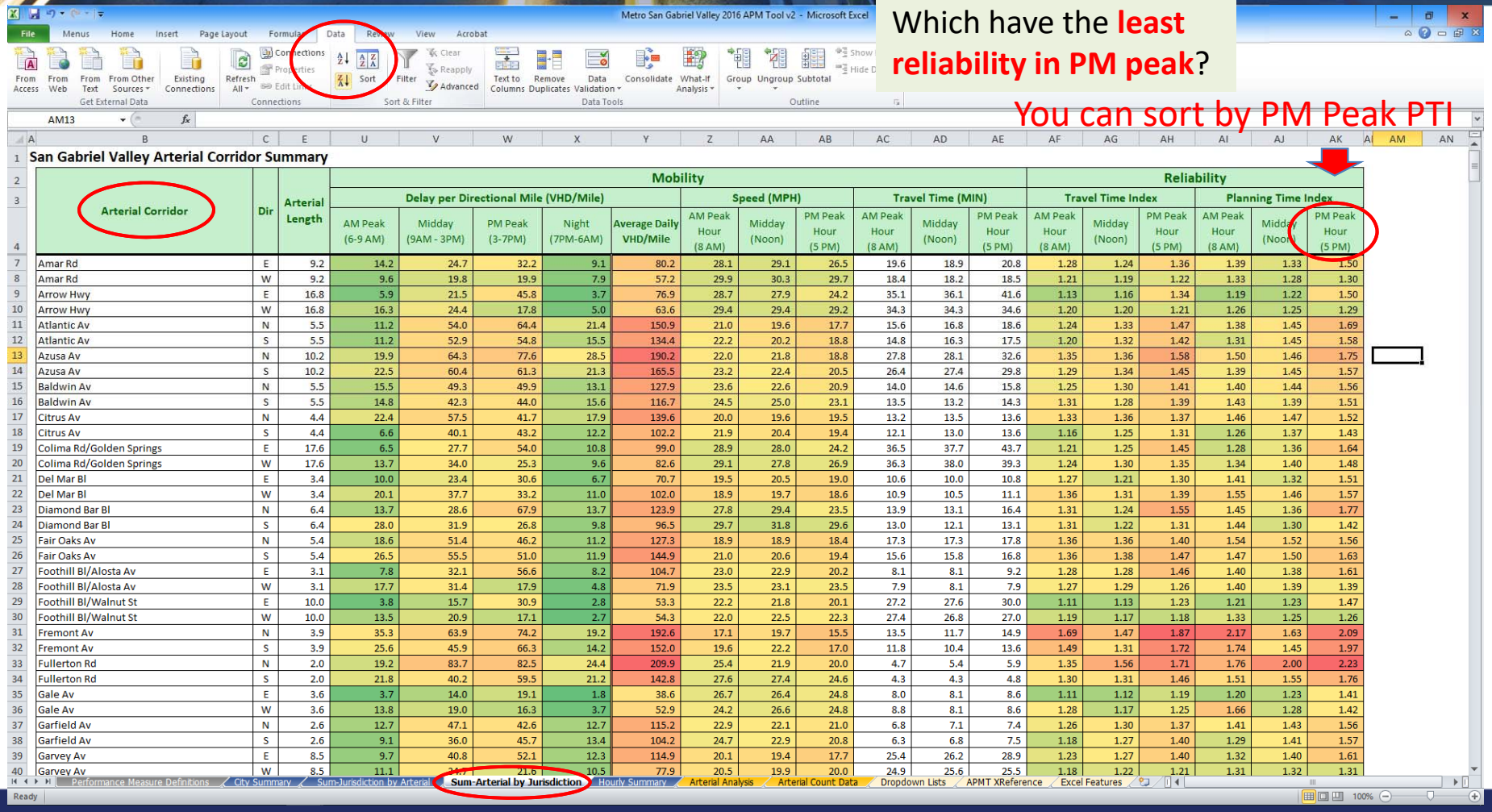
Arterial Corridor	Dir	Arterial Length	Mobility																			Travel Tim
			Average Weekday Vehicle-Hours of Delay (VHD)					Delay per Directional Mile (VHD/Mile)					Speed (MPH)			Travel Time (MIN)					
			AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7PM)	Night (7PM-6AM)	Total Daily VHD	AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7PM)	Night (7PM-6AM)	Average Daily VHD/Mile	AM Peak Hour (8 AM)	Midday (Noon)	PM Peak Hour (5 PM)	AM Peak Hour (8 AM)	Midday (Noon)	PM Peak Hour (5 PM)	AM Peak Hour (8 AM)	Midd (Noo
Amar Rd	E	9.2	131	226	295	83	735	14.2	24.7	32.2	9.1	80.2	28.1	29.1	26.5	19.6	18.9	20.8	1.28	1
Amar Rd	W	9.2	88	182	183	72	524	9.6	19.8	19.9	7.9	57.2	29.9	30.3	29.7	18.4	18.2	18.5	1.21	1
Arrow Hwy	E	16.8	99	361	769	63	1,292	5.9	21.5	45.8	3.7	76.9	28.7	27.9	24.2	35.1	36.1	41.6	1.13	1
Arrow Hwy	W	16.8	274	409	300	85	1,068	16.3	24.4	17.8	5.0	63.6	29.4	29.4	29.2	34.3	34.3	34.6	1.20	1
Atlantic Av	N	5.5	61	296	354	117	829	11.2	54.0	64.4	21.4	150.9	21.0	19.6	17.7	15.6	16.8	18.6	1.24	1
Atlantic Av	S	5.5	62	290	301	85	738	11.2	52.9	54.8	15.5	134.4	22.2	20.2	18.8	14.8	16.3	17.5	1.20	1
Azusa Av	N	10.2	203	656	791	291	1,940	19.9	64.3	77.6	28.5	190.2	22.0	21.8	18.8	27.8	28.1	32.6	1.35	1
Azusa Av	S	10.2	229	616	625	218	1,689	22.5	60.4	61.3	21.3	165.5	23.2	22.4	20.5	26.4	27.4	29.8	1.29	1
Baldwin Av	N	5.5	85	271	274	72	702	15.5	49.3	49.9	13.1	127.9	23.6	22.6	20.9	14.0	14.6	15.8	1.25	1
Baldwin Av	S	5.5	81	232	241	85	641	14.8	42.3	44.0	15.6	116.7	24.5	25.0	23.1	13.5	13.2	14.3	1.31	1
Citrus Av	N	4.4	99	254	184	79	616	22.4	57.5	41.7	17.9	139.6	20.0	19.6	19.5	13.2	13.5	13.6	1.33	1
Citrus Av	S	4.4	29	177	191	54	451	6.6	40.1	43.2	12.2	102.2	21.9	20.4	19.4	12.1	13.0	13.6	1.16	1
Colima Rd/Golden Springs	E	17.6	114	488	950	190	1,743	6.5	27.7	54.0	10.8	99.0	28.9	28.0	24.2	36.5	37.7	43.7	1.21	1
Colima Rd/Golden Springs	W	17.6	241	599	446	168	1,454	13.7	34.0	25.3	9.6	82.6	29.1	27.8	26.9	36.3	38.0	39.3	1.24	1
Del Mar Bl	E	3.4	34	80	105	23	242	10.0	23.4	30.6	6.7	70.7	19.5	20.5	19.0	10.6	10.0	10.8	1.27	1
Del Mar Bl	W	3.4	69	129	114	38	350	20.1	37.7	33.2	11.0	102.0	18.9	19.7	18.6	10.9	10.5	11.1	1.36	1
Diamond Bar Bl	N	6.4	88	184	437	88	798	13.7	28.6	67.9	13.7	123.9	27.8	29.4	23.5	13.9	13.1	16.4	1.31	1
Diamond Bar Bl	S	6.4	180	205	173	63	622	28.0	31.9	26.8	9.8	96.5	29.7	31.8	29.6	13.0	12.1	13.1	1.31	1
Fair Oaks Av	N	5.4	101	280	251	61	693	18.6	51.4	46.2	11.2	127.3	18.9	18.9	18.4	17.3	17.3	17.8	1.36	1
Fair Oaks Av	S	5.4	144	302	277	65	788	26.5	55.5	51.0	11.9	144.9	21.0	20.6	19.4	15.6	15.8	16.8	1.36	1
Foothill Bl/Alosta Av	E	3.1	24	99	175	26	325	7.8	32.1	56.6	8.2	104.7	23.0	22.9	20.2	8.1	8.1	9.2	1.28	1
Foothill Bl/Alosta Av	W	3.1	55	97	56	15	223	17.7	31.4	17.9	4.8	71.9	23.5	23.1	23.5	7.9	8.1	7.9	1.27	1
Foothill Bl/Walnut St	E	10.0	38	157	310	28	534	3.8	15.7	30.9	2.8	53.3	22.2	21.8	20.1	27.2	27.6	30.0	1.11	1
Foothill Bl/Walnut St	W	10.0	136	210	171	27	545	13.5	20.9	17.1	2.7	54.3	22.0	22.5	22.3	27.4	26.8	27.0	1.19	1
Fremont Av	N	3.9	136	247	286	74	743	35.3	63.9	74.2	19.2	192.6	17.1	19.7	15.5	13.5	11.7	14.9	1.69	1
Fremont Av	S	3.9	99	177	256	55	587	25.6	45.9	66.3	14.2	152.0	19.6	22.2	17.0	11.8	10.4	13.6	1.49	1
Fullerton Rd	N	2.0	38	165	163	48	413	19.2	83.7	82.5	24.4	209.9	25.4	21.9	20.0	4.7	5.4	5.9	1.35	1
Fullerton Rd	S	2.0	43	79	117	42	281	21.8	40.2	59.5	21.2	142.8	27.6	27.4	24.6	4.3	4.3	4.8	1.30	1
Gale Av	E	3.6	13	50	68	6	138	3.7	14.0	19.1	1.8	38.6	26.7	26.4	24.8	8.0	8.1	8.6	1.11	1
Gale Av	W	3.6	49	68	58	13	189	13.8	19.0	16.3	3.7	52.9	24.2	26.6	24.8	8.8	8.1	8.6	1.28	1
Garfield Av	N	2.6	33	122	111	33	299	12.7	47.1	42.6	12.7	115.2	22.9	22.1	21.0	6.8	7.1	7.4	1.26	1
Garfield Av	S	2.6	24	94	119	35	271	9.1	36.0	45.7	13.4	104.2	24.7	22.9	20.8	6.3	6.8	7.5	1.18	1
Garvey Av	E	8.5	83	347	443	104	977	9.7	40.8	52.1	12.3	114.9	20.1	19.4	17.7	25.4	26.2	28.9	1.23	1
Garvey Av	W	8.5	94	295	184	89	662	11.1	34.7	21.6	10.5	77.9	20.5	19.9	20.0	24.9	25.6	25.5	1.18	1

Performance Measure Definitions | City Summary | Sum-Jurisdiction by Arterial | **Sum-Arterial by Jurisdiction** | Hourly Summary | Arterial Analysis | Arterial Count Data | Dropdown Lists | APMT XReference | Excel Features

Performance Measurement Tool

Which have the **least reliability in PM peak**?

You can sort by PM Peak PTI



San Gabriel Valley Arterial Corridor Summary

Arterial Corridor	Dir	Arterial Length	Mobility: Delay per Directional Mile (VHD/Mile)					Mobility: Speed (MPH)			Mobility: Travel Time (MIN)			Reliability: Travel Time Index			Reliability: Planning Time Index		
			AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7PM)	Night (7PM-6AM)	Average Daily VHD/Mile	AM Peak Hour (8 AM)	Midday (Noon)	PM Peak Hour (5 PM)	AM Peak Hour (8 AM)	Midday (Noon)	PM Peak Hour (5 PM)	AM Peak Hour (8 AM)	Midday (Noon)	PM Peak Hour (5 PM)	AM Peak Hour (8 AM)	Midday (Noon)	PM Peak Hour (5 PM)
Amar Rd	E	9.2	14.2	24.7	32.2	9.1	80.2	28.1	29.1	26.5	19.6	18.9	20.8	1.28	1.24	1.36	1.39	1.33	1.50
Amar Rd	W	9.2	9.6	19.8	19.9	7.9	57.2	29.9	30.3	29.7	18.4	18.2	18.5	1.21	1.19	1.22	1.33	1.28	1.30
Arrow Hwy	E	16.8	5.9	21.5	45.8	3.7	76.9	28.7	27.9	24.2	35.1	36.1	41.6	1.13	1.16	1.34	1.19	1.22	1.50
Arrow Hwy	W	16.8	16.3	24.4	17.8	5.0	63.6	29.4	29.4	29.2	34.3	34.3	34.6	1.20	1.20	1.21	1.26	1.25	1.29
Atlantic Av	N	5.5	11.2	54.0	64.4	21.4	150.9	21.0	19.6	17.7	15.6	16.8	18.6	1.24	1.33	1.47	1.38	1.45	1.69
Atlantic Av	S	5.5	11.2	52.9	54.8	15.5	134.4	22.2	20.2	18.8	14.8	16.3	17.5	1.20	1.32	1.42	1.31	1.45	1.58
Azusa Av	N	10.2	19.9	64.3	77.6	28.5	190.2	22.0	21.8	18.8	27.8	28.1	32.6	1.35	1.36	1.58	1.50	1.46	1.75
Azusa Av	S	10.2	22.5	60.4	61.3	21.3	165.5	23.2	22.4	20.5	26.4	27.4	29.8	1.29	1.34	1.45	1.39	1.45	1.57
Baldwin Av	N	5.5	15.5	49.3	49.9	13.1	127.9	23.6	22.6	20.9	14.0	14.6	15.8	1.25	1.30	1.41	1.40	1.44	1.56
Baldwin Av	S	5.5	14.8	42.3	44.0	15.6	116.7	24.5	25.0	23.1	13.5	13.2	14.3	1.31	1.28	1.39	1.43	1.39	1.51
Citrus Av	N	4.4	22.4	57.5	41.7	17.9	139.6	20.0	19.6	19.5	13.2	13.5	13.6	1.33	1.36	1.37	1.46	1.47	1.52
Citrus Av	S	4.4	6.6	40.1	43.2	12.2	102.2	21.9	20.4	19.4	12.1	13.0	13.6	1.16	1.25	1.31	1.26	1.37	1.43
Colima Rd/Golden Springs	E	17.6	6.5	27.7	54.0	10.8	99.0	28.9	28.0	24.2	36.5	37.7	43.7	1.21	1.25	1.45	1.28	1.36	1.64
Colima Rd/Golden Springs	W	17.6	13.7	34.0	25.3	9.6	82.6	29.1	27.8	26.9	36.3	38.0	39.3	1.24	1.30	1.35	1.34	1.40	1.48
Del Mar Bl	E	3.4	10.0	23.4	30.6	6.7	70.7	19.5	20.5	19.0	10.6	10.0	10.8	1.27	1.21	1.30	1.41	1.32	1.51
Del Mar Bl	W	3.4	20.1	37.7	33.2	11.0	102.0	18.9	19.7	18.6	10.9	10.5	11.1	1.36	1.31	1.39	1.55	1.46	1.57
Diamond Bar Bl	N	6.4	13.7	28.6	67.9	13.7	123.9	27.8	29.4	23.5	13.9	13.1	16.4	1.31	1.24	1.55	1.45	1.36	1.77
Diamond Bar Bl	S	6.4	28.0	31.9	26.8	9.8	96.5	29.7	31.8	29.6	13.0	12.1	13.1	1.31	1.22	1.31	1.44	1.30	1.42
Fair Oaks Av	N	5.4	18.6	51.4	46.2	11.2	127.3	18.9	18.9	18.4	17.3	17.3	17.8	1.36	1.36	1.40	1.54	1.52	1.56
Fair Oaks Av	S	5.4	26.5	55.5	51.0	11.9	144.9	21.0	20.6	19.4	15.6	15.8	16.8	1.36	1.38	1.47	1.47	1.50	1.63
Foothill Bl/Alosta Av	E	3.1	7.8	32.1	56.6	8.2	104.7	23.0	22.9	20.2	8.1	8.1	9.2	1.28	1.28	1.46	1.40	1.38	1.61
Foothill Bl/Alosta Av	W	3.1	17.7	31.4	17.9	4.8	71.9	23.5	23.1	23.5	7.9	8.1	7.9	1.27	1.29	1.26	1.40	1.39	1.39
Foothill Bl/Walnut St	E	10.0	3.8	15.7	30.9	2.8	53.3	22.2	21.8	20.1	27.2	27.6	30.0	1.11	1.13	1.23	1.21	1.23	1.47
Foothill Bl/Walnut St	W	10.0	13.5	20.9	17.1	2.7	54.3	22.0	22.5	22.3	27.4	26.8	27.0	1.19	1.17	1.18	1.33	1.25	1.26
Fremont Av	N	3.9	35.3	63.9	74.2	19.2	192.6	17.1	19.7	15.5	13.5	11.7	14.9	1.69	1.47	1.87	2.17	1.63	2.09
Fremont Av	S	3.9	25.6	45.9	66.3	14.2	152.0	19.6	22.2	17.0	11.8	10.4	13.6	1.49	1.31	1.72	1.74	1.45	1.97
Fullerton Rd	N	2.0	19.2	83.7	82.5	24.4	209.9	25.4	21.9	20.0	4.7	5.4	5.9	1.35	1.56	1.71	1.76	2.00	2.23
Fullerton Rd	S	2.0	21.8	40.2	59.5	21.2	142.8	27.6	27.4	24.6	4.3	4.3	4.8	1.30	1.31	1.46	1.51	1.55	1.76
Gale Av	E	3.6	3.7	14.0	19.1	1.8	38.6	26.7	26.4	24.8	8.0	8.1	8.6	1.11	1.12	1.19	1.20	1.23	1.41
Gale Av	W	3.6	13.8	19.0	16.3	3.7	52.9	24.2	26.6	24.8	8.8	8.1	8.6	1.28	1.17	1.25	1.66	1.28	1.42
Garfield Av	N	2.6	12.7	47.1	42.6	12.7	115.2	22.9	22.1	21.0	6.8	7.1	7.4	1.26	1.30	1.37	1.41	1.43	1.56
Garfield Av	S	2.6	9.1	36.0	45.7	13.4	104.2	24.7	22.9	20.8	6.3	6.8	7.5	1.18	1.27	1.40	1.29	1.41	1.57
Garvey Av	E	8.5	9.7	40.8	52.1	12.3	114.9	20.1	19.4	17.7	25.4	26.2	28.9	1.23	1.27	1.40	1.32	1.40	1.61
Garvey Av	W	8.5	11.1	34.7	21.6	10.5	77.9	20.5	19.9	20.0	24.9	25.6	25.5	1.18	1.22	1.21	1.31	1.32	1.31

Performance Measurement Tool

What are the **peak period hours** for corridor with most delay?

Select jurisdiction and corridor

Look for Vehicle-Hours of Delay chart

Metro Metro San Gabriel Valley 2016 APM Tool v2 - Microsoft Excel

Analysis Jurisdiction	San Gabriel Valley Subregion	<----Select the Jurisdiction
Analysis Corridor	Valley Bl	<----Select the Arterial Corridor
Corridor Distance		

Ramona Bl/Badillo St
Rosemead Bl
San Gabriel Bl
San Gabriel Bl/Sierra Madre Bl
Santa Anita Av
Valley Bl
W Colorado St/E Colorado St/Colorado

Vehicles per Hour (VPH) for Valley Bl through San Gabriel Valley Subregion

Dir	Midnight	1	2	3	4	5	6	7	8	9	10	11	Noon	13	14	15	16	17	18	19	20	21	22	Midnight
EB VPH			53	99	167	300	666	731	614	590	652	743	799	985	1,168	1,270	1,367	1,238	798	506	381	283	179	3
WB VPH	49	37	49	108	301	724	962	973	790	682	674	702	739	724	755	735	835	738	528	412	343	265	160	3

Travel Time for Valley Bl through San Gabriel Valley Subregion

Dir	Midnight	1	2	3	4	5	6	7	8	9	10	11	Noon	13	14	15	16	17	18	19	20	21	22	Midnight
EB Travel Time	48.2	48.0	47.7	50.3	50.9	53.2	53.5	56.6	57.8	57.8	57.9	58.5	59.8	60.3	61.1	64.4	65.7	69.5	65.8	56.7	53.4	52.5	52.6	51.0
WB Travel Time	48.2	47.7	48.6	49.8	49.2	46.7	49.8	56.9	59.7	57.7	57.7	58.2	59.2	59.3	59.9	61.2	60.5	61.6	59.1	54.5	52.6	51.7	51.9	50.1
Reference Travel Time	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7

Vehicle-Hours of Delay for Valley Bl through San Gabriel Valley Subregion

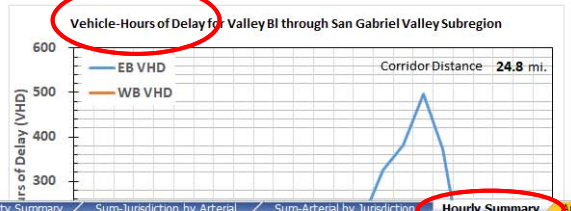
Dir	Midnight	1	2	3	4	5	6	7	8	9	10	11	Noon	13	14	15	16	17	18	19	20	21	22	Midnight
EB VHD	1	0	-	2	5	15	29	98	123	104	100	118	150	167	220	325	381	497	373	119	48	31	23	10
WB VHD	2	1	1	3	4	-	37	164	210	144	125	129	146	154	159	182	169	206	152	68	40	28	23	9

Reliability (Planning Time) for Valley Bl through San Gabriel Valley Subregion

Dir	Midnight	1	2	3	4	5	6	7	8	9	10	11	Noon	13	14	15	16	17	18	19	20	21	22	Midnight
EB Average Travel Time	48.2	48.0	47.7	50.3	50.9	53.2	53.5	56.6	57.8	57.8	57.9	58.5	59.8	60.3	61.1	64.4	65.7	69.5	65.8	56.7	53.4	52.5	52.6	51.0
EB Planning Time	54.1	53.6	53.5	57.9	60.9	59.6	56.5	59.1	60.9	60.7	61.0	61.6	63.5	64.0	65.7	73.4	75.9	80.1	74.9	60.8	56.0	55.6	56.6	55.9
WB Average Travel Time	48.2	47.7	48.6	49.8	49.2	46.7	49.8	56.9	59.7	57.7	57.7	58.2	59.2	59.3	59.9	61.2	60.5	61.6	59.1	54.5	52.6	51.7	51.9	50.1
WB Planning Time	52.8	53.4	55.0	58.7	55.1	50.4	52.3	62.7	66.3	61.4	60.4	61.0	62.5	62.3	63.2	64.8	64.2	66.0	62.9	56.8	54.9	54.1	55.8	54.9
Reference Travel Time	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7

Reliability (Travel Time & Planning Time Indices) for Valley Bl through San Gabriel Valley Subregion

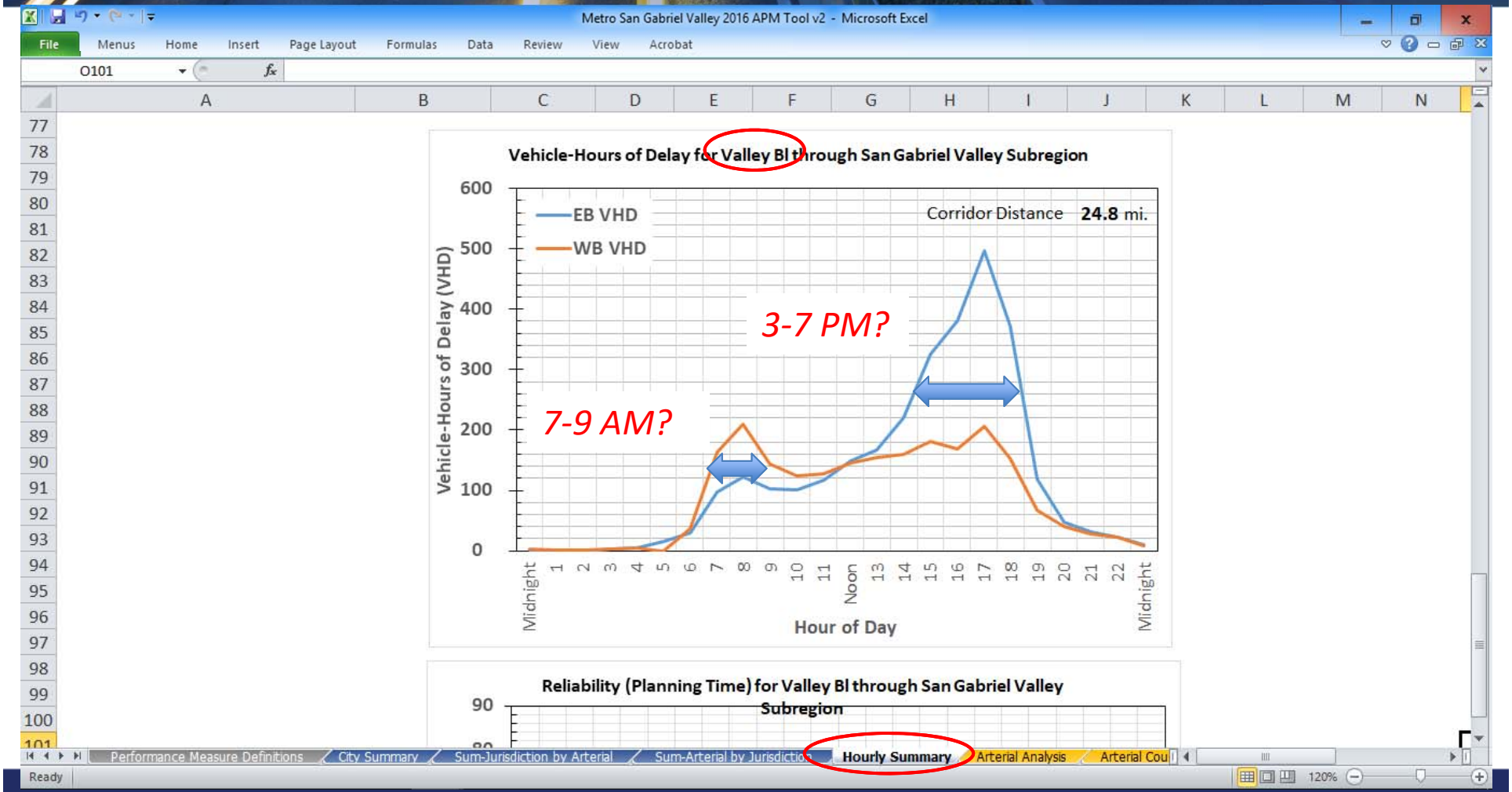
Dir	Midnight	1	2	3	4	5	6	7	8	9	10	11	Noon	13	14	15	16	17	18	19	20	21	22	Midnight
EB Travel Time Index	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.5	1.4	1.2	1.1	1.1	1.1	1.1
EB Planning Time Index	1.1	1.1	1.1	1.2	1.3	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.5	1.6	1.7	1.6	1.3	1.2	1.2	1.2	1.2
WB Travel Time Index	1.0	1.0	1.0	1.1	1.1	1.0	1.1	1.2	1.3	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.1	1.1	1.1	1.1
WB Planning Time Index	1.1	1.1	1.2	1.3	1.2	1.1	1.1	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.3	1.2	1.2	1.2	1.2	1.2



Performance Measure Definitions | City Summary | Sum-Jurisdiction by Arterial | Sum-Arterial by Jurisdiction | Hourly Summary | Arterial Analysis | Arterial Count Data | Dropdown Lists | APMT XReference | Excel Features

Ready

Performance Measurement Tool



Performance Measurement Tool

- Ways this tool can help
  - Identify problem areas and help prioritize needs
  - Help identify solutions (demand side or supply side)
  - Plan strategy for improvements (addressing need, phasing, grouping)
  - Plan types of improvements (widening, IC/IS modifications, signals)
  - Convey data and information to funding decision-makers
  - Assess progress (to meeting goals & objectives)
  - Before – after evaluations to make better future decisions
  - Conduct benefit-cost analysis

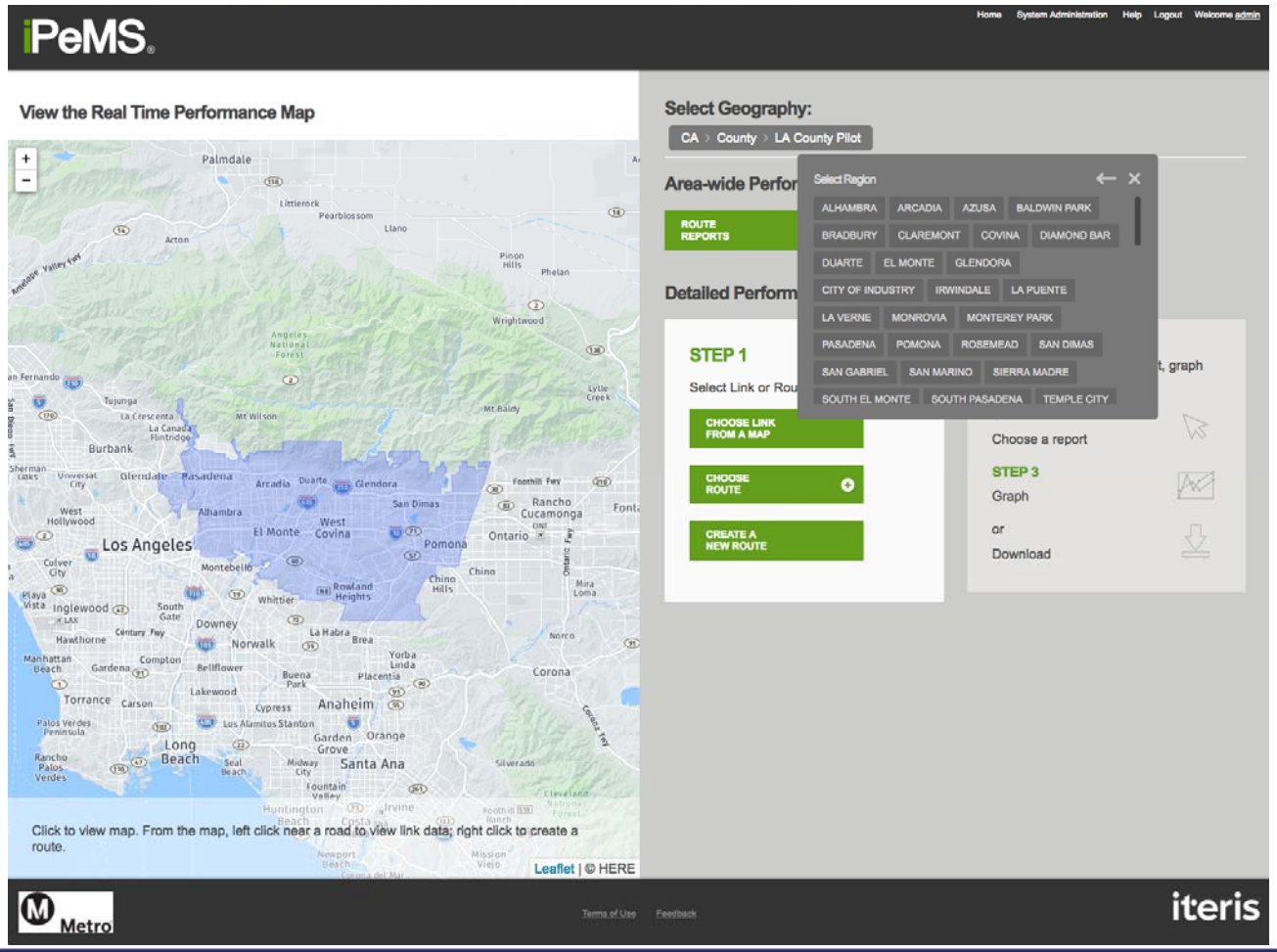
Performance Measurement Tool

- Types of projects this tool can help facilitate
  - Capital improvements (widening, IC modifications, alignments, etc.)
    - Corridor approach to achieve progressive gains not move problems downstream
    - Coordinate project sequencing to minimize traffic circulation disruption
    - Ensure positive impacts to transit
  - Transportation System Management & Operations (TSM&O)
    - Signal Synchronization, Bus Speed Improvements, Signal Priority/Pre-emption
    - Integrated Corridor Management (ICM)
    - Intelligent Transportation System (ITS)
    - Future Connected Vehicles/Autonomous Vehicle (CV/AV)
    - Multi-modal (transit, parking, bikes, peds, hubs, etc.)

Project Schedule

1	• Project management	Throughout
2	• Identify major corridors for each subregion	January 2017
3	• Identify major data collection locations	February 2017
4	• Purchase third party (INRIX) data	February 2017
5	• Conduct data collection	March 2017
6	• Develop baseline conditions analysis tool	July 2017
7	• Develop arterial performance analysis methodology	August 2017
8	• Perform arterial performance analysis & final report	October 2017

Pilot Project



System Metrics Group, Inc.

Metro

THE LOS ANGELES COUNTY METROPOLITAN TRANSPORTATION AUTHORITY

METRO ARTERIAL PERFORMANCE MEASUREMENT TOOL (APMT)

METHODOLOGY AND USER'S GUIDE

SEPTEMBER 18, 2017

Table of Contents

List of Exhibits

This document details the methodology used to develop an arterial performance measurement tool (APMT) to establish baseline performance conditions for selected subregional arterial corridors in Los Angeles County.

The documentation also serves as a User's Guide and describes how to use various features of the APMT and describes how the APMT is to be updated. The APMT contains traffic data inputs and automated analytical tools to produce arterial performance results.

1. Background

The Los Angeles County Metropolitan Transportation Authority (Metro) has been closely collaborating with its local partner agencies to implement a wide range of arterial improvements including signal synchronization, ITS investments, and bus speed improvements to improve mobility and reliability in the County. Understanding how well a transportation system performs would greatly help target the right projects to address local and regional mobility and reliability needs.

In 2014, Metro launched a performance monitoring initiative to assess the feasibility of developing a countywide Arterial Performance Measurement Program. The study demonstrated that the concept of a countywide Arterial Performance Measurement Program is feasible, and a framework was developed.

In 2015, Metro completed an initial deployment of a Baseline Conditions Analysis for the South Bay Cities subregion that provided a summary of how the regional arterial network was performing. The first generation APMT developed as part of that effort fused together speed and traffic volume data to produce travel demand, mobility, system reliability, and productivity measures. To ensure that the tool could be applied countywide, Metro developed a Methodology and User's Guide to support the APMT.

In late 2015, Metro completed the Arterial Performance Measurement Framework and developed the Concept of Operations. Subsequently, Metro initiated the Countywide Arterial Performance Measurement Baseline Conditions Analysis study to develop the APMT for all nine subregions in Los Angeles County. The resulting APMT is the second generation APMT that included enhancements and improvements to the initial APMT developed for the South Bay.

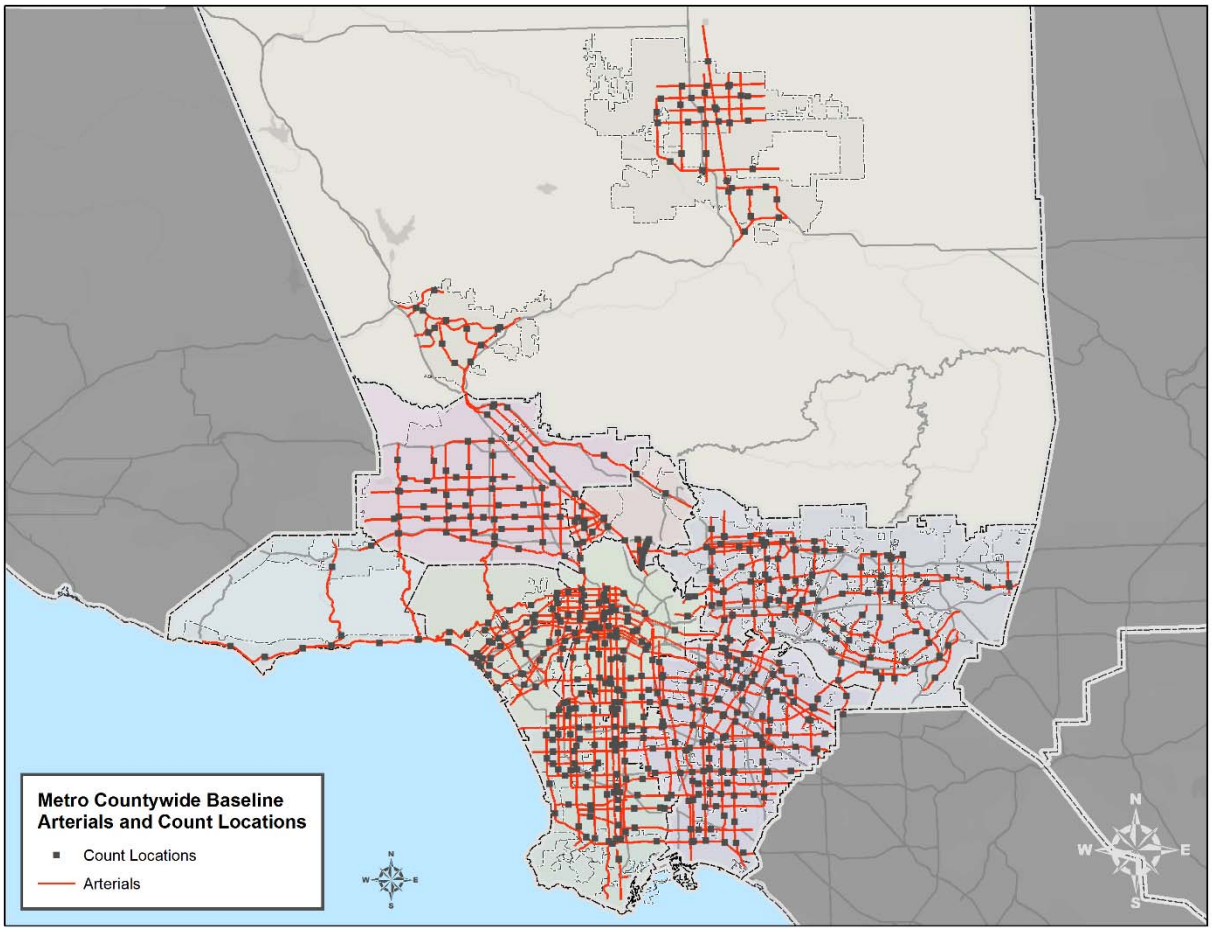
The subregional APMTs speed data comes from INRIX®, Inc. (http://inrix.com/) and traffic volume data was collected from various sources, including manual traffic counts conducted from February to May 2017, counts from public agency sources, and purchased data from private data collection vendors.

This document details the methodology behind the data analysis in the subregional APMTs and provides a User's Guide on how to use the tool. Following a description in Section 2 of how arterial corridors were selected and defined for the tool, an overview of the performance measures is provided in Section 3. Section 4 describes features of the APMT, how data was integrated into the tool, and how to update the tool in the future.

2. Overview of Arterial Corridors

The map in Exhibit 2-1, below, shows the county arterials that have been analyzed in the subregional APMTs. The map also shows the locations where vehicle traffic volume data was collected for this study. Appendix A of this methodology presents the complete list of arterials included in the tools.

Exhibit 2-1: Los Angeles County Evaluation Arterials



The arterial corridors in the APMTs were selected using both quantitative and qualitative factors with the final corridors being approved by Metro's regional partners. Metro's Recommended Framework Network (RFN) arterials were used as the source for the arterial selection process, which was developed as part of the Arterial Performance Measurement Framework. The RFN includes the Metro Countywide Significant Arterial Network (CSAN) and the Countywide Significant Truck Arterial Network (CSTAN). From the RFN, an initial list of corridors was selected based on the following quantitative and qualitative criteria:

- Corridor identified as a Priority Route by Metro's subregional partners
- Corridor carries high traffic volumes (typically exceeding 40,000 average daily traffic)
- Corridor is multi-jurisdictional that provides intercity/subregional connectivity
- Corridor has unique regional operational characteristic such as being an Integrated Corridor Management (ICM) project facility or directly parallel to a proposed future ICM corridor
- Corridor has programmed or planned ITS projects along the corridor.

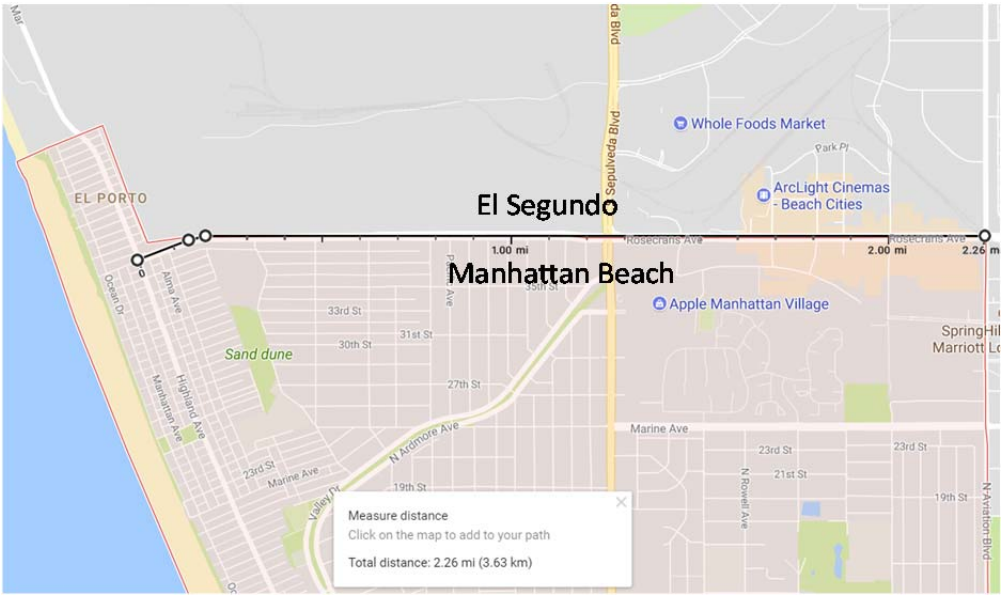
This draft list was provided to Metro's partners for review in January 2017. Follow-up outreach meetings were conducted in January and February 2017. Metro received feedback from regional partners, which resulted in arterial corridors being added, extents being modified, and in some cases arterials being removed. The comments were incorporated and the final list of arterials was developed.

2.1 Arterial Corridor Segmentation

In the APMT, an arterial corridor is defined as a roadway segment that runs within or adjacent to a jurisdiction. A jurisdiction is a Metro subregion (e.g., Gateway Cities), a city (e.g., Duarte), or county unincorporated sub-area (e.g., unincorporated Westwood).

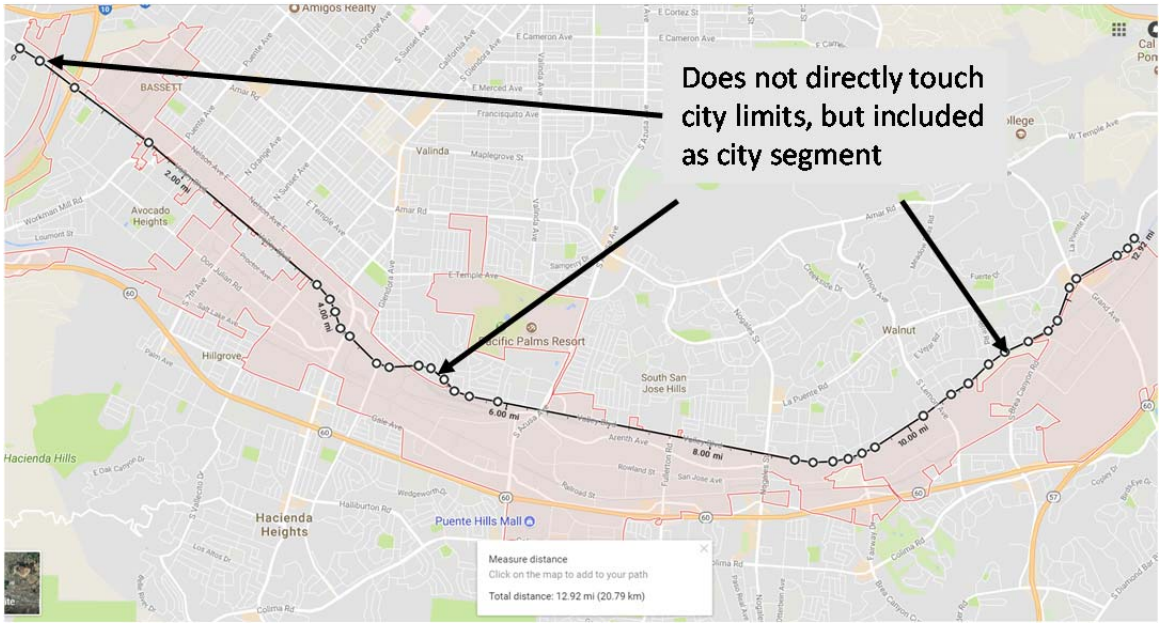
Segmenting the corridors by jurisdiction was done using Geographic Information System (GIS) software. The segmentation was fairly straightforward for arterials that traverse through a jurisdiction. In some cases, where two or more jurisdictions "share" an arterial, manual adjustments were made. Exhibit 2-2, below provides an example of how jurisdictions share an arterial using Rosecrans Avenue in the South Bay Cities subregion where El Segundo and Manhattan Beach lie on either side of the street. In the analysis worksheet of the APMT there will be two rows of identical directional data for this same section of Rosecrans Avenue for these two cities (eastbound Rosecrans will be presented for El Segundo as well as for Manhattan Beach even though El Segundo lies on the westbound side of the street).

Exhibit 2-2: Illustrative Arterial Segmentation



The example above, however, is an atypical case when there is a straight jurisdictional boundary along an entire APMT arterial segment. Many jurisdictional boundaries tend to be more irregular, which makes defining the arterial segments more challenging. In such cases, judgments were made concerning whether an arterial segment was assigned to a particular jurisdiction. Exhibit 2-3 on the following page illustrates such a case showing Valley Boulevard running approximately 12.9 miles from east to west in the vicinity of the City of Industry. There are short segments of Valley Boulevard that do not pass through the city or pass along the city limits. However, these short segment distances were included as part of the continuous segment assigned to the city.

Exhibit 2-3: Illustrative Example of Arterial Segmentation



3 Performance Measures Overview

Exhibit 3-1 is a table that summarizes the performance outcomes and measures evaluated in the APMT. The following sections describe each of these performance measures in more detail and explain how they are estimated in the tool.

Exhibit 3-1: Metro Arterials Performance Measures

Performance Outcome	Performance Measure	Definition	Data Source
Travel Demand	Vehicle Miles Traveled (VMT)	Number of vehicles multiplied by the distance traveled over a corridor.	• 24-hour traffic count data
Productivity	Flow in Vehicles per Hour (VPH)	Number of vehicles traveling along a corridor.	• 24-hour traffic count data
Mobility	Speed (MPH)	Corridor distance divided by travel time in hours.	• INRIX speed data
	Travel Time (minutes)	Time to traverse a corridor segment in minutes	• INRIX speed data
	Delay in Vehicle-Hours of Delay (VHD)	Difference in actual travel time compared to a threshold travel time (typically at the free-flow speed) along a segment. VHD is calculated as the delayed travel time multiplied by the number of vehicles experiencing that delay.	• 24-hour traffic count data • INRIX speed data
	Delay per Mile (VHD/Mile)	Ratio of VHD divided by corridor distance. A measure of congestion intensity.	• 24-hour traffic count data • INRIX speed data
	Peak Period Spreading	Average duration of peak period VHD in hours	• VHD
Reliability	Travel Time Index	Ratio of the average travel time divided by the threshold travel time (i.e., free-flow)	• INRIX speed data
	Planning Time Index	Ratio of the 95th percentile travel time divided by the average travel time. The 95th percentile travel time is the 95th slowest day out of 100 days (approx. 1 day per month).	• INRIX speed data

3.1 Travel Demand

Vehicle-Miles Traveled (VMT) is the measure used to identify the demand for travel along an arterial corridor. VMT is calculated in the APMT by multiplying the traffic volume from a specific count location by the "effective distance" of that segment.

An example of how the effective distance is calculated is illustrated in Exhibit 3-2. For a given count location that distance is measured between the midpoints of the nearest upstream and downstream count locations. In the case where there is a subregional boundary or a road terminates, the effective distance is measured as the full distance between the boundary and one-half the distance between the specified count location and the nearest count location.

In the effective distance exhibit (Exhibit 3-2) described uses Nordhoff Street in the San Fernando Valley as an example. The western end of the corridor is at Topanga Canyon Boulevard (SR-27). The first count station is located just east of Canoga Avenue approximately ½ mile from SR-27. The next count station on the corridor (station 2 in our example) is located just west of Corbin Avenue, which is approximately two miles from station 1. The effective distance for station 1 is 1.5 miles – the full 0.5 mile distance to SR-27 and ½ the distance to station 2 (1.0 mile). The effective distance for Station 2 is 2.3 miles (½ the distance between Station 1 and Station 2 and ½ the distance between Station 2 and Station 3).

Estimating corridor level VMT in this way allows the tool to calculate VMT for a jurisdiction along an arterial even if that jurisdiction did not have any count stations by adjusting the VMT by taking the proportion of the corridor distance in that city to the total corridor distance. For example, if the actual distance of a corridor in a given city is 3.2 miles, but the distance over which the VMT was estimated is 4.0 miles, then the VMT for that city is increased by a ratio of 3.2/4.0.

Exhibit 3-2: Count Station Effective Distance Example

3.1.1 Productivity

Throughput or flow is the measure used to evaluate productivity and is defined as the average number of vehicles that move along a corridor per unit of time. In the APMT, productivity is reported as vehicles per hour (VPH). Arterial productivity for a jurisdiction or subregion is calculated by summing hourly VMT and the effective distances for all the count stations associated with that jurisdiction along that arterial, then dividing by the total VMT by the total effective distances.

3.1.2 Mobility

Mobility is evaluated using five measures of traffic performance: average speed, travel time, vehicle-hours of delay (VHD), VHD per mile, and peak period spreading.

The average annual non-holiday, weekday ***speed*** (in miles-per-hour or mph) over a corridor is calculated using the INRIX data by estimating the average travel time along the corridor and dividing that time by the distance for each arterial corridor and dividing by the average travel time to traverse that distance. Low speeds are indicative of congestion, but speeds depend on other characteristics of the roadway such as geometrics (e.g., shoulder widths or curvature) or other speed restrictions (e.g., school zones).

Average ***travel times*** are reported in the APMT in minutes and average travel times in minutes over a year (current year is 2016) computed using INRIX speed data described above. Since travel times vary by the distance of a corridor, they are best used to compare a corridor's performance over time rather than to compare performance across corridors.

Delay is reported as vehicle-hours of delay (VHD) and measures the overall congestion levels on a corridor. The measure is computed by identifying a reference or threshold travel time against which to determine if vehicles were delayed. This time is defined as the free-flow time that is determined by reviewing the fastest constrained and is determined by reviewing the fastest average INRIX speeds during an off-peak period, typically during the middle of the night. Delay is the corridor VMT multiplied by the difference in travel time along the corridor from the actual travel time compared against the threshold travel time. When the actual travel time is equal to or less than the threshold travel time, then the delay is equal to zero.

Delay per Mile or VHD/mile is a measure of congestion intensity and is measured by taking VHD and dividing that number by the directional miles of corridor. Since VHD can vary by both the demand and the length of the corridor, VHT/mile allows for a comparison across corridors that reflects an individual driver's experience of congestion along a corridor.

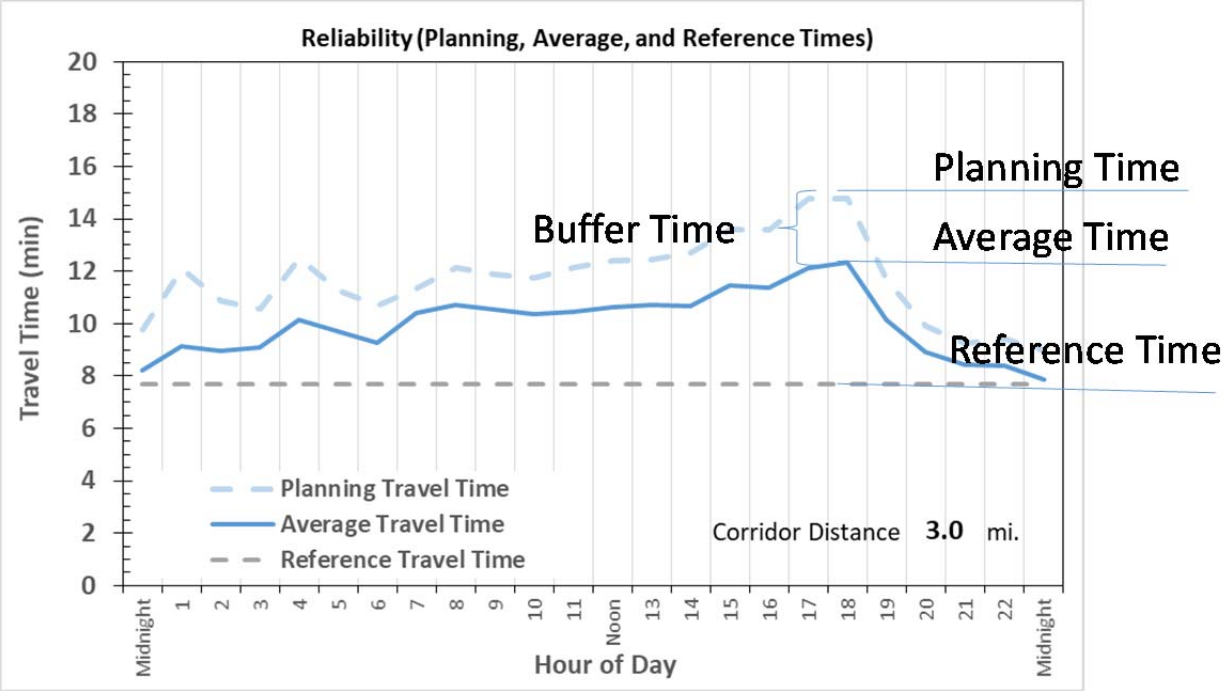
Peak Period Spreading measures the change in the congested time period for a corridor over time and is measure in hours. That is, it attempts to answer whether the duration of the congestion expanding (or contracting) from one year to the next.

3.1.3 Reliability

Travel time reliability attempts to capture the extent of unexpected delays that can occur from day to day. While average travel times can give an indication of how bad congestion can be, reliability metrics quantify the impact of those really bad days that travelers remember. The APMT uses the ***Travel Time Index*** to evaluate the intensity of congestion. The travel time index is calculated by taking the ratio of the average travel over the free-flow travel time.

The ***Planning Time Index*** is a measure of reliability and is the ratio of the 95th percentile travel time as compared to the free-flow travel time. The 95th percentile time is the time at which 95 percent of the travel times are faster. As an example, out of 100 weekdays, travel times on 95 of the weekdays will be slower than the 95th percentile travel time. Conversely, five days will take longer. If a commuter wants to get to work on time 95 days out of 100, that person should allow the 95th percentile travel time to get to work. The difference between the planning time and the average travel time is called the buffer time. Exhibit 3-3, below, illustrates these concepts.

Exhibit 3-3: Travel Time Reliability Example



4 Arterial Performance Measures Tool Overview

This section presents the APMT, describes its features, and discusses how the Metro arterial performance measures are calculated and reported.

APMT users must have basic familiarity with Microsoft Excel™ workbooks and should be comfortable navigating within and among worksheets. The APMT is designed to be transparent using basic Excel features and formulas that can be traced to the source data without more sophisticated features such as macros. Once the user has a basic knowledge of the Excel functions used in the tool and an understanding of the approaches used in processing the data, the user will be able to update the tool when updated data becomes available.

The APMT workbook is presented in Exhibit 4-1, below. The sections below describe the workbook in more detail. The workbook has 12 color-coded worksheet tabs. At the left of the workbook, are four **blue**-colored tabs containing tables and charts that summarize the arterial performance measurement results.

Exhibit 4-1: Overview of the APMT

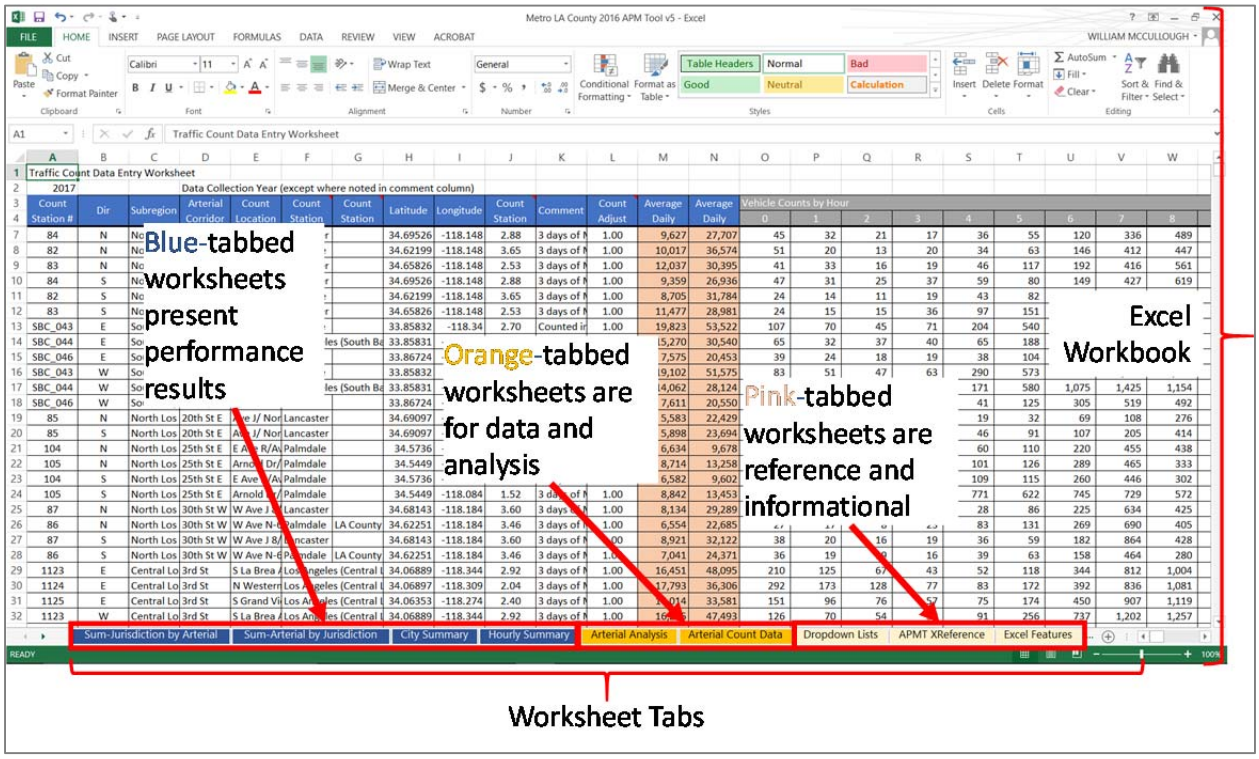


Exhibit 4-2 on the following page lists the four results worksheet and describes the performance measures reported in each one. The results worksheets reference data contained in-colored analysis worksheets that contain the speed and volume data used to calculate the results and perform the analysis. Finally, the two lighter gold-tabbed sheets at the far right provide reference information and resources to assist the user in learning more about the Excel functions and features used to present the results.

Exhibit 4-2: Performance Measures in the Results Worksheets

Worksheet Tab	Travel Demand	Productivity	Mobility			Reliability	
	Vehicle Miles Traveled (VMT)	Throughput (Vehicles per Hour)	Speed	Travel Time	Delay	Travel Time Variance	Planning Time Index
City Summary	◆				◆		
Arterial by Jurisdiction	◆	◆	◆		◆	◆	◆
Jurisdiction by Arterial	◆	◆		◆	◆	◆	◆
Hourly Summaries		◆		◆	◆	◆	◆

The following bullets briefly summarize each worksheet tab in the APMT (each tab is discussed in more detail in the following sections):

- ***Performance Measure Definitions*** – provides the definitions as presented in the performance measures summary table presented above in Exhibit 3-1.
- ***City Summary*** – reports measures that can be aggregated to the jurisdictional level (e.g., subregions, individual cities, county sub-areas). This can be used to compare overall performance among jurisdictions.
- ***Sum-Jurisdiction by Arterial*** – presents arterial specific performance measures that can be aggregated to the jurisdictional level. This can be used to compare performance for a single arterial corridor across multiple jurisdictions.
- ***Sum-Arterial by Jurisdiction*** – presents arterial corridor performance results for all jurisdictions and arterial corridors. For each jurisdiction, the performance results for each arterial in that jurisdiction are provided.
- ***Hourly Summaries*** – details hourly performance results for individual arterial corridors in a user-specified jurisdiction. Charts provide hour-of-day results for a number of performance metrics.
- ***Arterial Analysis*** - This worksheet is where the arterial performance measures are calculated. It also includes the hourly travel time, speed, and 95th percentile travel time inputs (i.e., the INRIX XD data). This worksheet is referenced by all the previously described results sheets.
- ***Arterial Count Data*** – Worksheet for the input of hourly arterial count data. This sheet also calculates the VMT for each hour of the day for individual count stations and calculates average daily traffic (ADT) and average daily VMT for each count station. This worksheet is also referenced by all the previously described results sheets.
- ***Dropdown Lists*** – Several worksheets use dropdown menu options to reference information. This worksheet contains the jurisdictional and arterial information used by the dropdown options.
- ***Excel Features*** – This worksheet provides details on key Microsoft Excel features that are used in this workbook. It also provides online references for additional information.

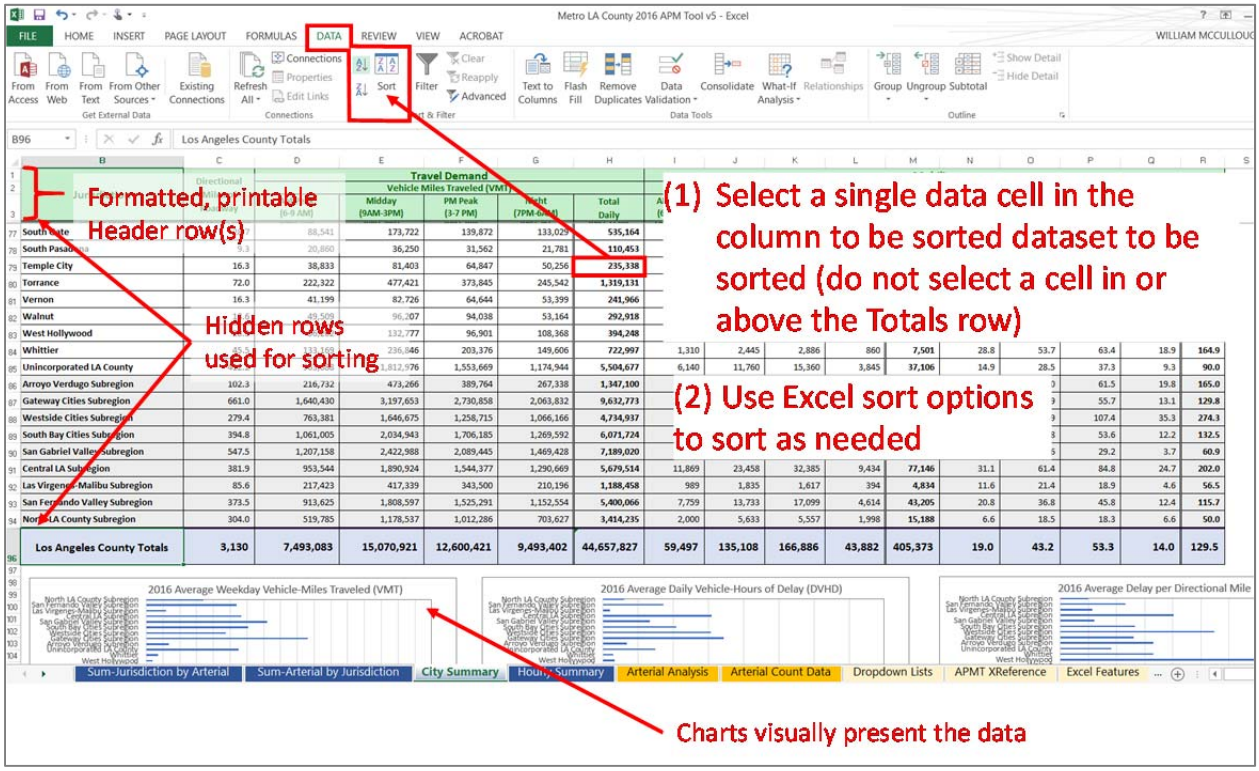
4.1 City Summary

This worksheet summarizes travel demand (i.e., VMT), delay and delay per directional mile indicators at the jurisdictional level. Other performance measures cannot be aggregated to the jurisdiction in a way that provides meaningful results, so they are not included in this worksheet.

Exhibit 4-3 shows the *City Summary* table and charts. Formulas in the data cells reference results from the *Arterial Analysis* worksheet. Cells shown in dark gray represent jurisdictions for which there is no data available to calculate the performance metrics. Below the table in Exhibit 4-3 are bar charts to visually present the performance measures. Users can modify or even add additional charts as needed for their analysis.

A feature of the *City Summary* and other worksheets in the APMT allows for the data portion of the tables to be sorted or filtered for analysis. This is also illustrated in Exhibit 4-3.

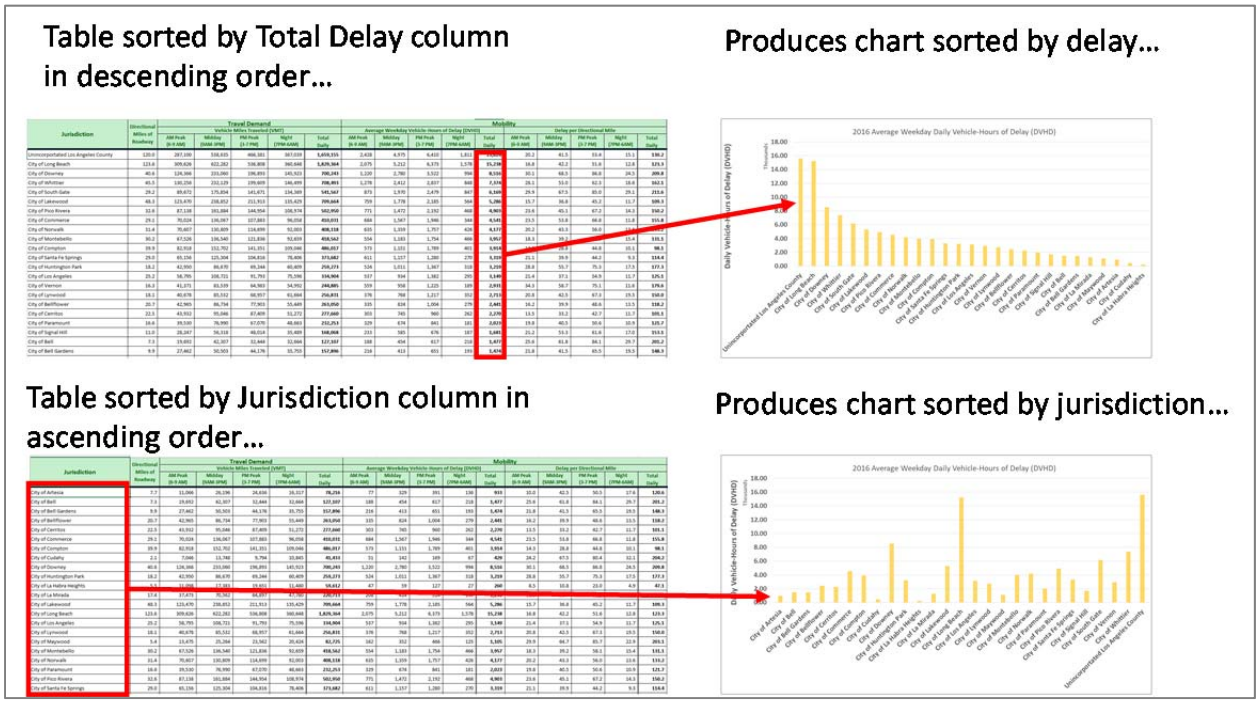
Exhibit 4-3: City Summary Table Example



At the top of each table are formatted, printable header rows that contain merged cells for ease of reading. Below this header row there are two additional rows that are set to a row height of "1" to make them invisible to the eye when printed. Excel does not allow the user to sort on merged cells, so the purpose of these two additional rows is to allow for sorting of the data in the table.

To sort the data for any column or combination of columns containing data, the user simply clicks on a single cell in the dataset below the header rows and hidden rows. Then the user can use the Excel sort features to sort the data as needed. Exhibit 4-4 on the following page show how the bar charts change based on the sorting performed on the table. The user can select the type of sorting needed for analysis.

Exhibit 4-4: Jurisdiction Summary Bar Chart Example



It should be pointed out that the APMT is designed to be as transparent as possible, using the most basic formulas and Excel features available to calculate and present results. One of the most commonly used formulas in the APMT is the Excel SUMIFS function. This function is used in the *City Summary* worksheet and all others to reference results in the *Arterial Analysis* worksheet. The function can use multiple matching criteria (e.g., jurisdiction, direction) to sum up the values in a column. Exhibit 4-5 briefly describes this formula. The *Excel Features* worksheet contains references to online resources to assist the user with data sorting features.

Exhibit 4-5: Excel SUMIF Function Example

Sum all the values in column "M" (PM Peak VMT) from row 5 to row 298 of the *Arterial Analysis* worksheet

where…

all the values in column "D" (jurisdiction) from row 5 to row 298 of the *Arterial Analysis* worksheet

match…

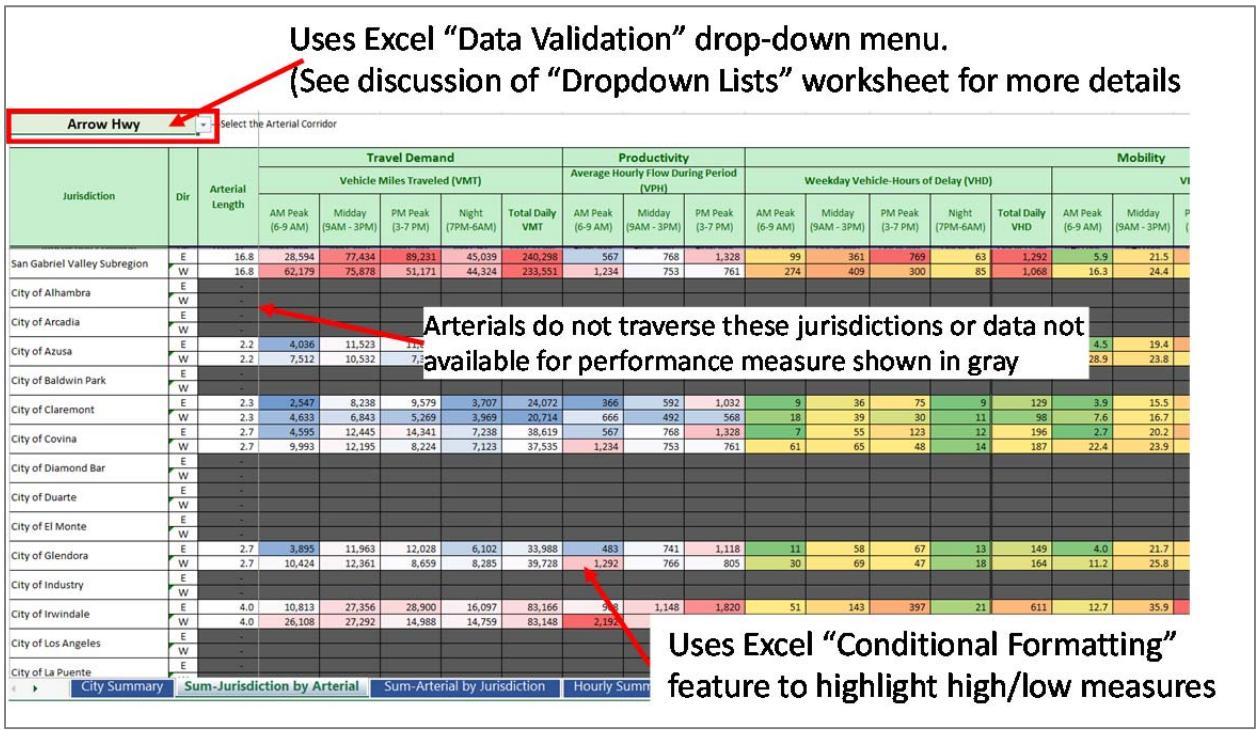
the value in cell "A8" (jurisdiction) from this current worksheet

```
=SUMIFS('Arterial Analysis'!M$5:M$298,'Arterial Analysis'!$D$5:$D$298,$A8)
```

4.2 Sum-Jurisdiction by Arterial

This worksheet, illustrated in Exhibit 4-6, summarizes all the performance measures for a single, user-selected arterial for all jurisdictions through which that arterial traverses. The arterial is selected by a dropdown menu which is located on the top left. The data in the table and charts will update automatically.

Exhibit 4-6: Arterial Performance Summary by Jurisdiction Example



Jurisdiction	Dir	Arterial Length	Travel Demand: Vehicle Miles Traveled (VMT) AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7 PM)	Night (7PM-6AM)	Total Daily VMT	Productivity: Average Hourly Flow During Period (VPH) AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7 PM)	Mobility: Weekday Vehicle-Hours of Delay (VHD) AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7 PM)	Night (7PM-6AM)	Total Daily VHD	V… AM Peak (6-9 AM)	Midday (9AM - 3PM)	P…
San Gabriel Valley Subregion	E	16.8	28,594	77,434	89,231	45,039	240,298	567	768	1,328	99	361	769	63	1,292	5.9	21.5	
	W	16.8	62,179	75,878	51,171	44,324	233,551	1,234	753	761	274	409	300	85	1,068	16.3	24.4	
City of Alhambra	E	-																
	W	-																
City of Arcadia	E	-																
	W	-																
City of Azusa	E	2.2	4,036	11,523	11,…											4.5	19.4	
	W	2.2	7,512	10,532	7,…											28.9	23.8	
City of Baldwin Park	E	-																
	W	-																
City of Claremont	E	2.3	2,547	8,238	9,579	3,707	24,072	366	592	1,032	9	36	75	9	129	3.9	15.5	
	W	2.3	4,633	6,843	5,269	3,969	20,714	666	492	568	18	39	30	11	98	7.6	16.7	
City of Covina	E	2.7	4,595	12,445	14,341	7,238	38,619	567	768	1,328	7	55	123	12	196	2.7	20.2	
	W	2.7	9,993	12,195	8,224	7,123	37,535	1,234	753	761	61	65	48	14	187	22.4	23.9	
City of Diamond Bar	E	-																
	W	-																
City of Duarte	E	-																
	W	-																
City of El Monte	E	-																
	W	-																
City of Glendora	E	2.7	3,895	11,963	12,028	6,102	33,988	483	741	1,118	11	58	67	13	149	4.0	21.7	
	W	2.7	10,424	12,361	8,659	8,285	39,728	1,292	766	805	30	69	47	18	164	11.2	25.8	
City of Industry	E	-																
	W	-																
City of Irwindale	E	4.0	10,813	27,356	28,900	16,097	83,166	9…	1,148	1,820	51	143	397	21	611	12.7	35.9	
	W	4.0	26,108	27,292	14,988	14,759	83,148	2,192										
City of Los Angeles	E	-																
	W	-																
City of La Puente	E	-																

Cells shown in dark gray indicate that the arterial does not run through or traverse the boundary of that jurisdiction or that results could not be calculated because no data was available to compute the metric. This worksheet uses the Excel dropdown list feature as well as conditional formatting. These two features are discussed below starting on the following page.

Unlike the *City Summary* worksheet from above, the data table in this worksheet cannot be sorted. This is because the jurisdiction column has merged cells to enhance readability. Microsoft Excel cannot sort data in data ranges containing merged cells.

As with the *City Summary* worksheet, there are a series of bar charts that visually show the data represented in the table. An example of a bar chart is shown in Exhibit 4-7 on the following page.

Exhibit 4-7: Arterial Performance Summary by Jurisdiction Bar Chart Example

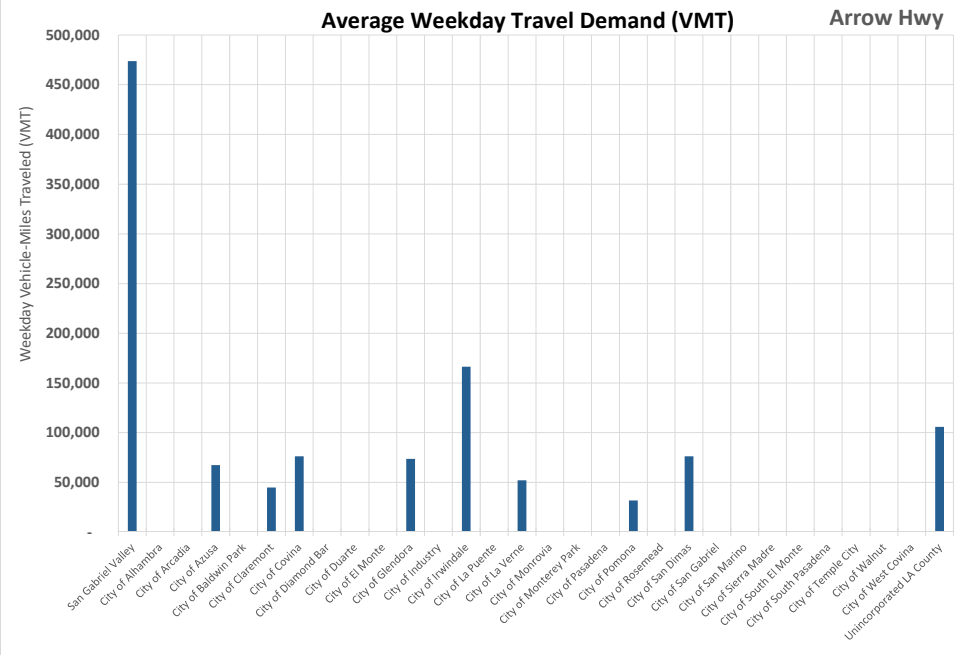


Exhibit 4-8, below, shows an example of Excel dropdown lists, and Exhibit 4-9 shows an example of Excel's conditional formatting.

The dropdown list example in Exhibit 4-8 shows how the tool uses the data validation feature to develop the dropdown menu that is used to select an arterial. Under the *Data* ribbon, selecting the *Data Validation-Data Validation* option brings up a window. To create the dropdown menu, the APMT uses the *List* option and identifies as the source of this list as the "Dropdown Lists" worksheet tab (described in more detail in a section below).

Exhibit 4-8: Excel Dropdown Lists Illustrated

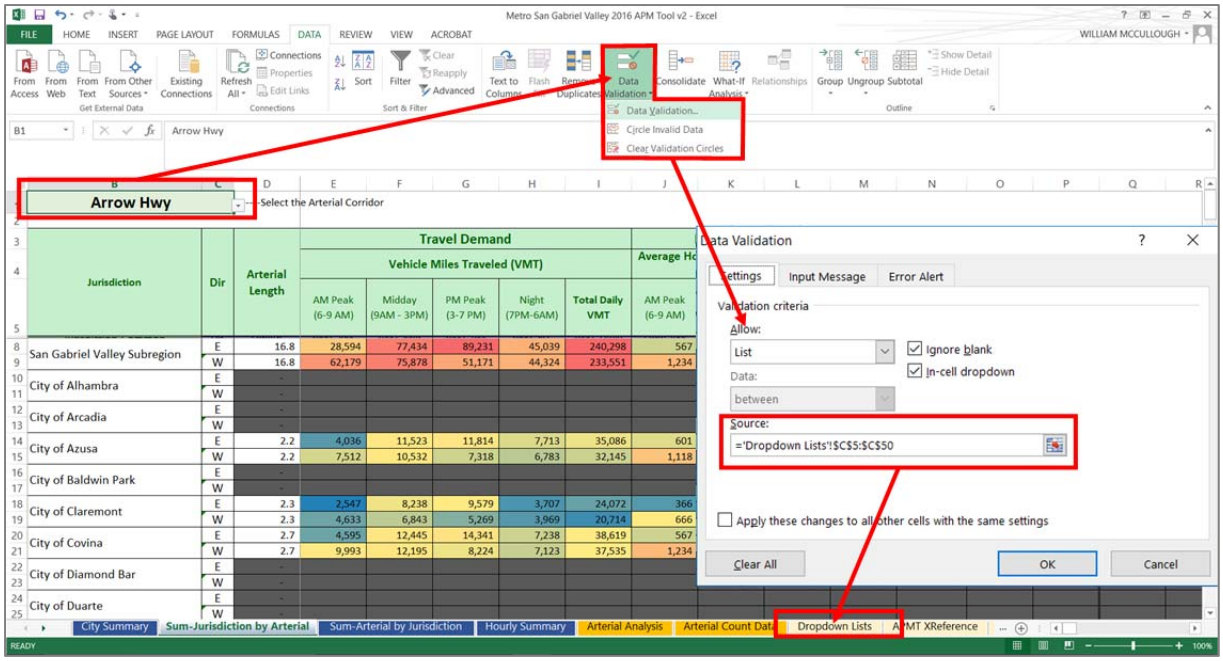
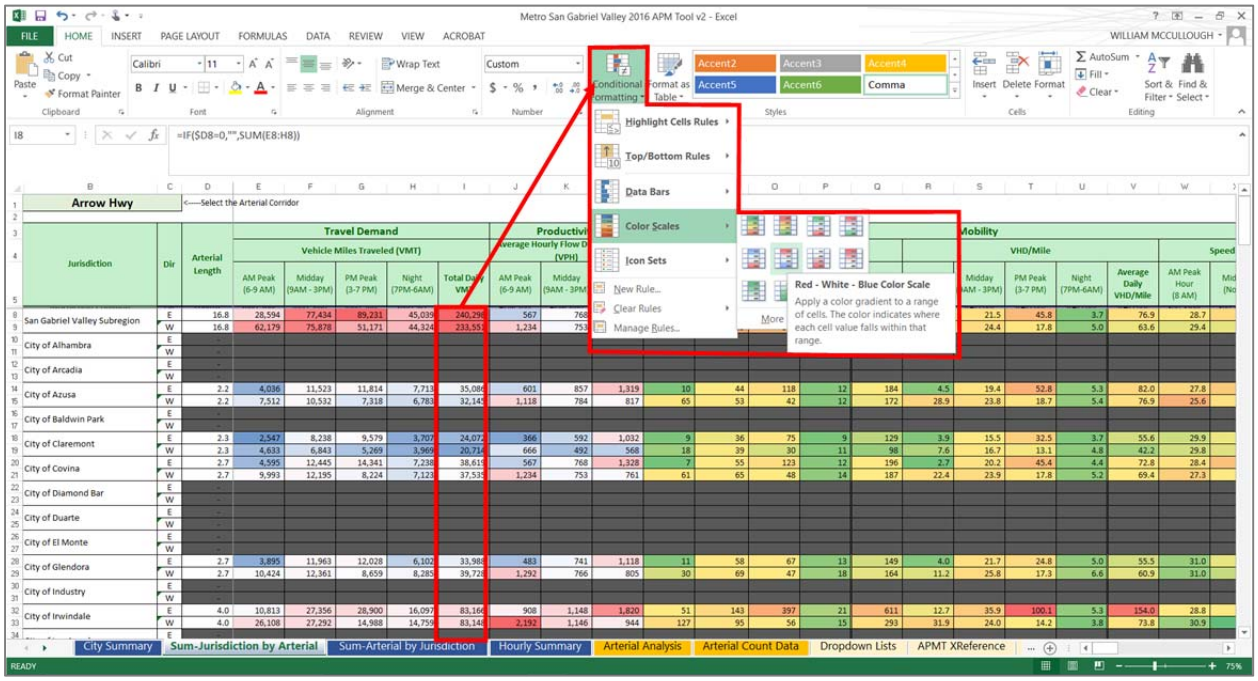


Exhibit 4-9 on the following page illustrates the *conditional formatting* option that is used to color-code the various performance measures in the tool. The purpose of using conditional formatting is to quickly highlight extreme values and allow the user to visually see performance ranges.

The tool uses the default color-palettes for Excel. However, users can change the conditional formatting as needed to meet their needs. In the default APMT, gray is used to denote a cell that does not have any data. Data may be missing because the selected arterial does not traverse through the jurisdiction. It could also be that there was no data available for that arterial. There are some arterials in Los Angeles County for which there is no INRIX data available.

The default APMT uses blue to red color palette to denote demand values (e.g., blue = lowest demand, red=highest demand). A red to green palette is used to denote speed, and reliability ranges (e.g., red = slowest speed, green = highest speed). Finally, a green to red palette is used to denote delay ranges (e.g., green = lowest delay, red = highest delay). The standard Excel palettes used in the APMT Excel use a "3-color" scheme to create the range with the lowest value, median, and highest value of the data in the range used to denote the three primary colors in the palette.

Exhibit 4-9: Excel Conditional Formatting Example



4.3 Sum-Arterial by Jurisdiction

This worksheet, shown in Exhibit 4-10 summarizes performance results by arterial, direction, and by jurisdiction. In contrast to the previously discussed *Sum-Jurisdiction by Arterial* worksheet, which summarizes results for a specified arterial for all jurisdictions, this worksheet summarizes all arterial results for a specific jurisdiction.

The *Sum-Jurisdiction by Arterial* worksheet has separate data tables for each jurisdiction. These tables can be sorted (see the *City Summary* worksheet discussion in Section 4.1 above for details on sorting), and they are color-coded using the Excel conditional formatting features (described above in Section 4.2) to make them easier to identify trends.

Exhibit 4-10: Sum-Arterial by Jurisdiction Example

City of Azusa

Arterial Corridor	Dir	Jurisdiction	Arterial Length	Travel Demand					Product	
				Vehicle Miles Traveled (VMT)					Average Daily Traffic (ADT)	Peak
				AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7PM)	Night (7PM - 6AM)	Total Daily		AM Peak (6-9 AM)	Midd (9AM - 3
Arrow Hwy	E	Azusa	2.2	4,036	11,523	11,814	7,713	35,086	15,663	778	
Arrow Hwy	W	Azusa	2.2	7,512	10,532	7,318	6,783	32,145	14,350	1,302	
Azusa Av	N	Azusa	2.9	5,811	16,148	12,785	13,580	48,324	16,606	848	
Azusa Av	S	Azusa	2.9	8,645	17,853	12,780	13,123	52,402	18,007	1,163	
Citrus Av	N	Azusa	1.4	3,375	7,312	4,843	3,948	19,477	14,217	1,156	
Citrus Av	S	Azusa	1.4	1,913	6,841	5,721	5,303	19,778	14,436	582	
Foothill Bl/Alosta Av	E	Azusa	2.9	2,536	10,027	11,538	6,325	30,426	10,564	362	
Foothill Bl/Alosta Av	W	Azusa	2.9	6,752	9,910	5,777	5,588	28,027	9,732	952	
Irwindale Av	N	Azusa	0.5	1,509	2,473	1,659	1,379	7,020	13,766	1,071	
Irwindale Av	S	Azusa	0.5	1,029	2,359	2,240	1,510	7,138	13,997	872	
City of Azusa Totals			**19.8**	**43,118**	**94,978**	**76,475**	**65,252**	**279,823**	**141,339**		

City of Baldwin Park

Arterial Corridor	Dir	Jurisdiction	Arterial Length	Travel Demand					Product	
				Vehicle Miles Traveled (VMT)					Average Daily Traffic (ADT)	Peak
				AM Peak (6-9 AM)	Midday (9AM - 3PM)	PM Peak (3-7PM)	Night (7PM - 6AM)	Total Daily		AM Peak (6-9 AM)	Midd (9AM - 3
Ramona Bl/Badillo St	E	Baldwin Park	3.4	5,717	15,704	19,092	12,114	52,628	15,710	714	
Ramona Bl/Badillo St	W	Baldwin Park	3.4	10,620	14,714	9,999	9,931	45,264	13,512	1,218	
City of Baldwin Park Totals			**6.7**	**16,337**	**30,419**	**29,091**	**22,045**	**97,892**			

City of Claremont

Arterial Corridor	Dir	Jurisdiction	Arterial	Travel Demand	Product
				Vehicle Miles Traveled (VMT)	Average Daily Traffic (ADT) / Peak

City Summary | Sum-Jurisdiction by Arterial | Sum-Arterial by Jurisdiction | Hourly Summary | Arterial Analysis | Arterial Count Data

4.4 Hourly Summaries

This worksheet presents hourly performance results based on a user selected jurisdiction and arterial using the dropdown menus at the top left of the worksheet as shown in Exhibit 4-11 on the following page. The corridor distance is automatically generated and the directional performance results are shown in the tables below the dropdown menus (these tables are not sortable).

Exhibit 4-11: Hourly Summary Worksheet Table Example

Analysis Jurisdiction	SBCCOG	----Select the Jurisdiction
Analysis Corridor	Imperial Hwy	<-----Select the Arterial Corridor
Corridor Distance	8.5	

Dir	Vehicles per Hour (VPH) for Imperial Hwy through SBCCOG														
	Midnight	1	2	3	4	5	6	7	8	9	10	11	Noon	13	14
EB	144	97	66	58	88	175	318	586	676	615	685	802	855	906	1,198
WB	131	96	77	117	235	472	1,146	1,764	1,553	975	719	751	784	794	792

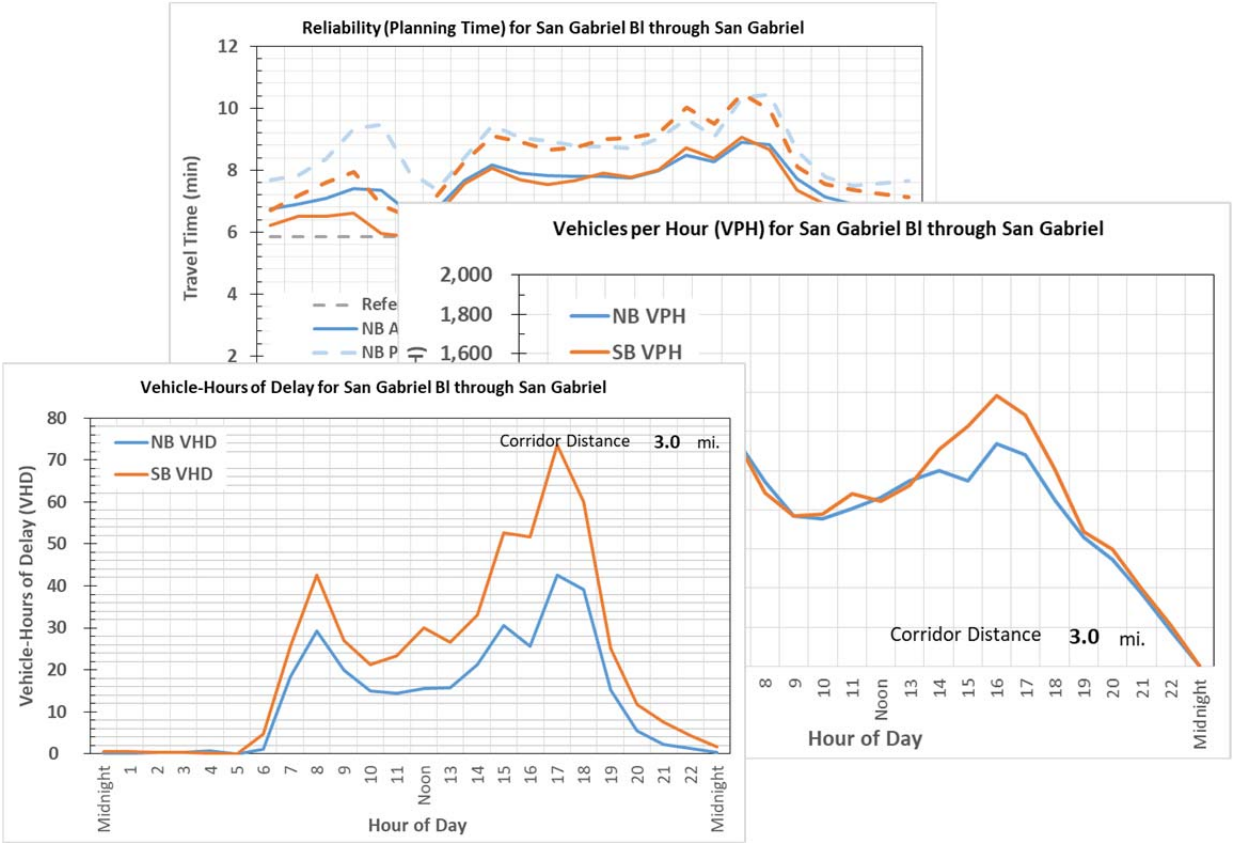
Dir	Travel Time for Imperial Hwy through SBCCOG														
	Midnight	1	2	3	4	5	6	7	8	9	10	11	Noon	13	14
EB	19.6	19.6	19.7	19.6	16.6	17.6	18.1	18.5	19.0	18.7	18.8	19.0	19.1	19.1	19.1
WB	18.7	18.8	18.8	18.7	16.3	17.1	17.8	19.5	19.7	18.9	19.0	19.2	19.4	19.3	19.3
Reference Travel Time	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6

Dir	Vehicle-Hours of Delay for Imperial Hwy through SBCCOG														
	Midnight	1	2	3	4	5	6	7	8	9	10	11	Noon	13	14
EB	7	5	3	3	-	3	8	19	28	21	26	33	36	38	52
WB	5	4	3	5	-	6	29	94	89	42	32	36	40	40	39

Dir	Reliability (Planning Time) for Imperial Hwy through SBCCOG														
	Midnight	1	2	3	4	5	6	7	8	9	10	11	Noon	13	14
EB- Average Travel Time	19.6	19.6	19.7	19.6	16.6	17.6	18.1	18.5	19.0	18.7	18.8	19.0	19.1	19.1	19.1
EB- Planning Time	20.1	20.0	19.9	19.9	17.5	19.1	19.9	21.0	21.6	21.0	21.2	21.4	21.5	21.5	21.6
WB- Average Travel Time	18.7	18.8	18.8	18.7	16.3	17.1	17.8	19.5	19.7	18.9	19.0	19.2	19.4	19.3	19.3
WB- Planning Time	19.0	19.3	19.0	18.9	17.2	18.7	20.2	23.1	23.3	21.6	21.4	21.6	21.7	21.6	21.7
Reference Travel Time	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6

As with other results worksheets, there are line charts below the tables that visually present the results. The chart titles automatically update when the user selects the jurisdiction and arterial corridor from the dropdown menus at the top of the worksheet as shown in Exhibit 4-12, below.

Exhibit 4-12: Hourly Summary Chart Examples

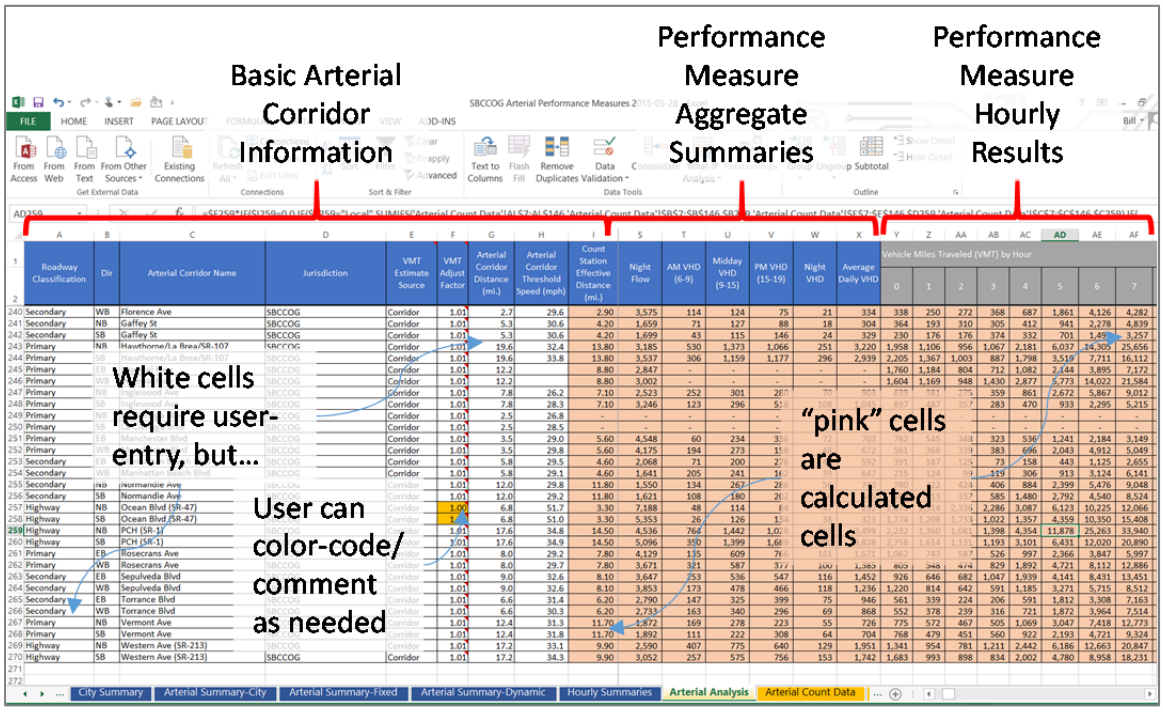


4.5 Arterial Analysis

The previous worksheets presented the arterial performance measurement results. The *Arterial Analysis* sheet is the heart of the APMT and is where the arterial performance results are calculated.

Exhibit 4-13 provides an overview of some of the key features of this worksheet. The unfilled or "white" cells require user entry. The pink cells contain formulas that calculate results or reference other information. As with other tables in the APMT, this table can be sorted by clicking on a single cell and using the Excel sort feature. The user can also make edits and color-code any cell as needed.

Exhibit 4-13: Arterial Analysis Worksheet



The worksheet is divided into three general sections. At the far left, general arterial information is provided that describes each arterial corridor. Each row in the sheet represents a single directional arterial corridor in a single jurisdiction. For example, Vermont Avenue in the South Bay Cities subregional tool has eight data rows, two directions for four jurisdictions: Gardena, City of Los Angeles City, Los Angeles County, and for the entire South Bay Cities subregion.

Next to the basic arterial information are the performance measure aggregates. This section essentially sums up various hourly results located in the 192 data items located to the right of the sheet (i.e., 24-hours for 8 different performance items: VMT, VHT, delay, speed, travel time, 95th percentile travel time, travel time index, and planning time index). The discussion below describes each of these parts of the worksheet in more detail.

4.5.1 Basic Arterial Corridor Information

This section contains the following columns:

- Dir – Direction of travel (E, N, S, W). The directionality must match the arterial directionality in the *Dropdown List* worksheet to ensure that references in the results worksheets correctly read the data.
- Arterial Corridor Name – The arterial corridor names must be consistent from one jurisdiction to the next (e.g., Pacific Coast Highway and Sepulveda share the same physical roadway in some cities). To ensure consistent results the roadway name must be consistent along the entire physical roadway). As with directionality, the street name must be consistent with those in the *Dropdown List* worksheet.
- Jurisdiction – This is the city name, Los Angeles County area, or the subregion as a whole. As with other corridor information, naming consistency is required to ensure references work throughout the tool.
- Jurisdiction (For Aggregation) – This is similar to the jurisdiction, but this allows the user to aggregate sub-areas in jurisdictions to larger areas. For example, in the APMT, the Los Angeles County sub areas are aggregated to "LA County" in the *City Summary* results worksheet.
- Comment – This column allows for the user to input comments regarding each arterial corridor.
- Volume Estimator – This section contains two columns. The *Volume Estimate Source* requires user-input to determine which traffic volume data to use to develop VMT estimates since VMT is used to calculate the throughput and delay performance measures.
    - Each cell in the *Volume Estimate Source* column contains a dropdown list that restricts user input to two options: "Local" or "Corridor". It is recommended to use the local option if there is a count station on a given arterial in that city (or LA County). It is required to use the "Corridor" option if there is no local count station available. Other adjustments to the VMT can be performed in the next column.
    - The *Adj Factor* (for "adjustment factor"), allows for additional adjustments to the VMT estimates as needed. If no adjustment is required, then this number should be 1.0.
    - An adjustment may be needed to account for different years of data. For example, if speed and travel time data is from a different year than the count data, then other sources can be used to identify a traffic growth rate to adjust the VMT to match speed and travel time data.
    - One recommendation to identify if an adjustment is needed is to examine the "Average Daily Traffic (ADT)" column. Since it is common to report ADT in General Plans or other arterial planning documents, this column can be compared to other sources to verify if the VMT estimate used is appropriate for the arterial. Changing the value in the VMT Adjust Factor column will change the ADT value.

- Arterial Corridor Threshold Speed (mph) – reference or threshold speed used to calculate delay and the travel time and planning time indices. It is important to establish a threshold speed that is appropriate for the corridor. For the APMT, the maximum average hourly INRIX speed was used to as the basis for the threshold speed. Typically, these maximum speeds occur during early morning hours (e.g., 3AM).
- Count Station Effective Distance (mi.) – used in the *Arterial Count Data* worksheet to convert screenline traffic counts into VMT. This is reported in this worksheet to further assist the user in

determining if a VMT adjustment is warranted. A VMT adjustment may be warranted if the count station effective distance is significantly different from the actual arterial corridor distance.

- Arterial Corridor Distance (mi.) – actual distance along the arterial corridor. Arterial corridor segmentation is discussed in more detail above in Section2.

4.5.2 Performance Measure Aggregate Summaries

This section of the *Arterial Analysis* worksheet simply aggregates the hourly performance results to various time periods (AM, Midday, PM, and Night) for those measures that can be readily aggregated: VMT, ADT (which is VMT/Arterial Corridor Distance), and delay in Vehicle-Hours (VHD). If desired, users with Excel experience can add columns as needed to produce aggregated results as needed.

4.5.3 Performance Measure Hourly Results

The hourly results are calculated in a 192 grey columns extending to the right of the worksheet (24 hours x 8 performance measures). These performance results are discussed below:

- Vehicle Miles Traveled (VMT) – is estimated by using a local or corridor VMT estimate from the *Arterial Count Data*, which is then adjusted first by the ratio of the Count Station Effective Distance divided by the Actual Corridor Distance. The second adjustment is done by multiplying the VMT by the VMT adjustment factor described previously.
- Vehicle Hours Traveled (VHT) – is simply calculated by multiplying VMT from above to the average travel time.
- Vehicle-Hours of Delay (VHD) - is calculated by multiplying the adjusted VMT from above by the difference between the average travel time and the travel time based on the threshold speed (if the average travel time is greater than the threshold travel time. If not, then the delay is zero.)
- Travel Time Index – is calculated by taking the average travel time and dividing by the travel time along the corridor based on the threshold speed.
- Planning Time Index – is calculated by taking the planning travel time (i.e., the 95th percentile travel time and dividing by the travel time along the corridor based on the threshold speed.

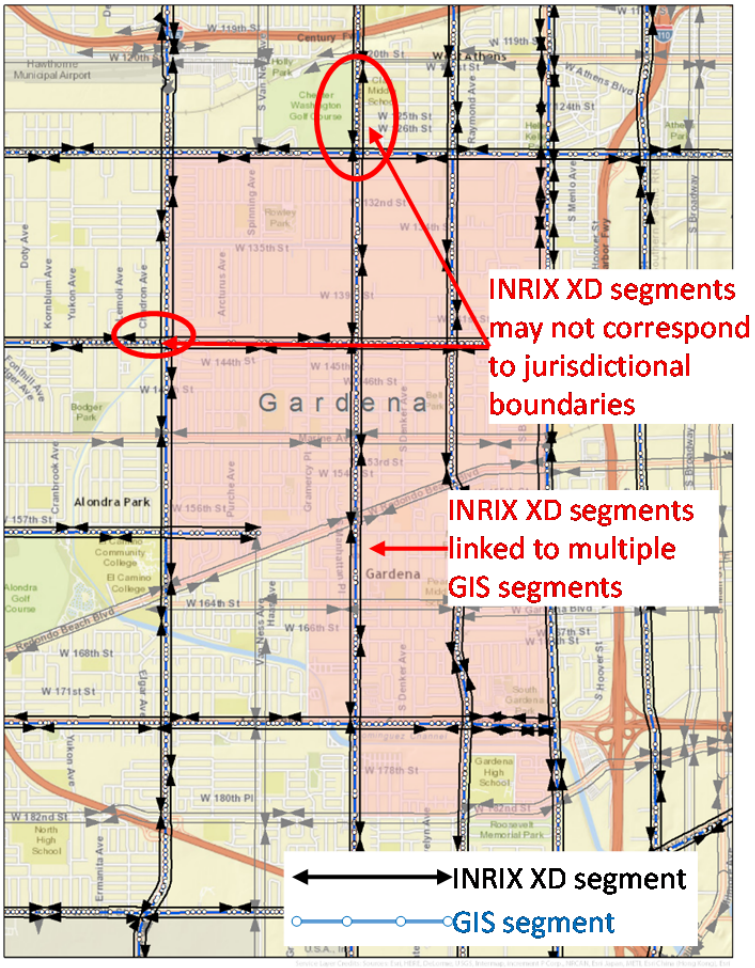
4.5.4 INRIX XD Data Processing

Metro has purchased INRIX, Inc. speed and travel time traffic data for each day of 2016 at the one-minute interval. For the APMT, the INRIX data processing followed three general steps: (1) link INRIX XD segments to arterial segments, (2) pull appropriate one-minute INRIX data corresponding to INRIX XD segments that lie on an APMT arterial corridor and aggregate INRIX XD data to hourly (i.e., 60-minute) intervals for non-holiday weekdays, (3) Calculate average hourly travel times and 95th percentile travel times for APMT corridors. The following sections describe these steps in more detail.

4.5.5 Link INRIX XD Segments to APMT Arterial Corridors

Given the very large size of the INRIX XD 30-second data, the XD segments were linked to APMT arterial corridor segments in order to extract only the data required for the tool development. The INRIX XD segment identification codes were linked to a more detailed GIS network shapefile. This linkage was done because the INRIX XD segments tend to be relatively long; averaging nearly ¾ miles long with some arterial XD segments up to nearly 1.6 miles. Because of these distances, XD segments often do not align with jurisdictional boundaries as illustrated in Exhibit 4-14, below.

Exhibit 4-14: INRIX XD Segmentation Illustrative Example



4.5.6 Pull and Aggregate INRIX XD Data

Once the appropriate XD segments were identified and linked to a specific arterial corridor and jurisdiction or all subregions, the one minute data was extracted for all non-holiday weekdays for the entire year. The following fields are included in the one minute data:

- **Date Time** - Date and time in zone of machine originating/generating this report.
- **Segment ID** - The associated INRIX XD unique identification code. This code was linked to arterial GIS segments.
- **UTC Date Time** - Date and time in UTC.
- **Speed(miles/hour)** - The current estimated harmonic mean speed for the roadway segment in miles per hour.
- **Hist Av Speed(miles/hour)** - The historical average speed for the roadway segment for that hour of the day and day of the week in miles per hour.
- **Ref Speed(miles/hour)** - The calculated "free flow" mean speed for the roadway segment in miles per hour.
- **Travel Time(Minutes)** - The time it will take to traverse the roadway segment in minutes.

- **CValue** - Indicates confidence value, probability the current probe reading represents the actual roadway conditions based on recent and historic trends. This value is only used when the confidence score is 30. - (0= low probability, 100 = high probability)
- **Pct Score30** – High confidence data. The percentage of observations where score = 30 (Real Time).
- **Pct Score20** - Medium confidence data, based on real-time data across multiple segments and/or based on a combination of expected and real-time data. Percentage of observations where score = 20 (National Average Speeds).
- **Pct Score10** – Low confidence data. Percentage of observations where score = 10 (Free Flow or historical average speeds).

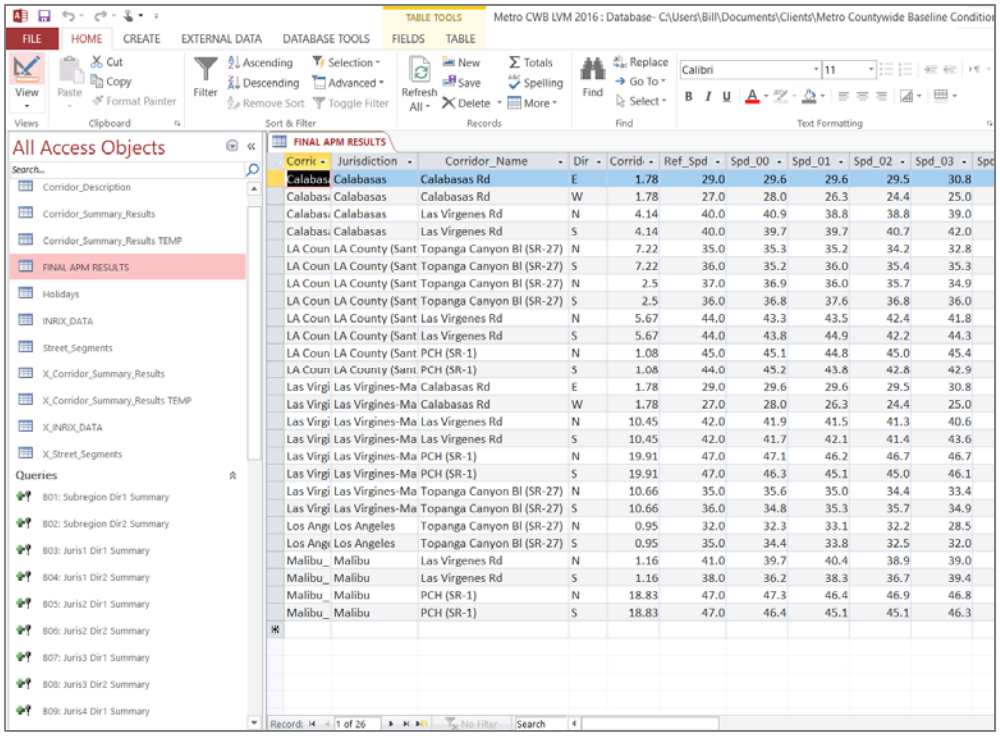
This data was then aggregated to hourly intervals by taking a straight average of the speeds (i.e., for each INRIX XD segment for each weekday of the year for each hour there will be 60 intervals). This was done using a combination of the open-source programming language Python and the PostgresSQL object-relational database system.

Python was used to decompress and extract the INRIX XD data and for file handling. The PostgresSQL database was used to pull only the APMT XD segments and to aggregate each XD segment into hourly intervals. This process produced a data file that was greatly reduced by 1/60 of the original size.

4.5.7 Calculate Average Travel Times, 95th Percentile Travel Times, and Average Speeds

Once these segments were linked, INRIX XD data extracted, and the data aggregated to hourly intervals, the data was imported into a Microsoft Access database for the final processing as illustrated in Exhibit 4-15. Access was selected for ease of use and because it is a commonly used database so that the processed hourly data could be made accessible to Metro.

Exhibit 4-15: Example Access Database



Corric	Jurisdiction	Corridor_Name	Dir	Corrid	Ref_Spd	Spd_00	Spd_01	Spd_02	Spd_03
Calabas	Calabasas	Calabasas Rd	E	1.78	29.0	29.6	29.6	29.5	30.8
Calabas	Calabasas	Calabasas Rd	W	1.78	27.0	28.0	26.3	24.4	25.0
Calabas	Calabasas	Las Virgenes Rd	N	4.14	40.0	40.9	38.8	38.8	39.0
Calabas	Calabasas	Las Virgenes Rd	S	4.14	40.0	39.7	39.7	40.7	42.0
LA Coun	LA County (Sant	Topanga Canyon Bl (SR-27)	N	7.22	35.0	35.3	35.2	34.2	32.8
LA Coun	LA County (Sant	Topanga Canyon Bl (SR-27)	S	7.22	36.0	35.2	36.0	35.4	35.3
LA Coun	LA County (Sant	Topanga Canyon Bl (SR-27)	N	2.5	37.0	36.9	36.0	35.7	34.9
LA Coun	LA County (Sant	Topanga Canyon Bl (SR-27)	S	2.5	36.0	36.8	37.6	36.8	36.0
LA Coun	LA County (Sant	Las Virgenes Rd	N	5.67	44.0	43.3	43.5	42.4	41.8
LA Coun	LA County (Sant	Las Virgenes Rd	S	5.67	44.0	43.8	44.9	42.2	44.3
LA Coun	LA County (Sant	PCH (SR-1)	N	1.08	45.0	45.1	44.8	45.0	45.4
LA Coun	LA County (Sant	PCH (SR-1)	S	1.08	44.0	45.2	43.8	42.8	42.9
Las Virgi	Las Virgines-Ma	Calabasas Rd	E	1.78	29.0	29.6	29.6	29.5	30.8
Las Virgi	Las Virgines-Ma	Calabasas Rd	W	1.78	27.0	28.0	26.3	24.4	25.0
Las Virgi	Las Virgines-Ma	Las Virgenes Rd	N	10.45	42.0	41.9	41.5	41.3	40.6
Las Virgi	Las Virgines-Ma	Las Virgenes Rd	S	10.45	42.0	41.7	42.1	41.4	43.6
Las Virgi	Las Virgines-Ma	PCH (SR-1)	N	19.91	47.0	47.1	46.2	46.7	46.7
Las Virgi	Las Virgines-Ma	PCH (SR-1)	S	19.91	47.0	46.3	45.1	45.0	46.1
Las Virgi	Las Virgines-Ma	Topanga Canyon Bl (SR-27)	N	10.66	35.0	35.6	35.0	34.4	33.4
Las Virgi	Las Virgines-Ma	Topanga Canyon Bl (SR-27)	S	10.66	36.0	34.8	35.3	35.7	34.9
Los Ange	Los Angeles	Topanga Canyon Bl (SR-27)	N	0.95	32.0	32.3	33.1	32.2	28.5
Los Ange	Los Angeles	Topanga Canyon Bl (SR-27)	S	0.95	35.0	34.4	33.8	32.5	32.0
Malibu_	Malibu	Las Virgenes Rd	N	1.16	41.0	39.7	40.4	38.9	39.0
Malibu_	Malibu	Las Virgenes Rd	S	1.16	38.0	36.2	38.3	36.7	39.4
Malibu_	Malibu	PCH (SR-1)	N	18.83	47.0	47.3	46.4	46.9	46.8
Malibu_	Malibu	PCH (SR-1)	S	18.83	47.0	46.4	45.1	45.1	46.3

In the Access database, the data first underwent a data quality check. The data quality check only accepted an hour of data if the "CValue" and the sum of the "PctScore30" and "PctScore20" fields were greater than 67%. This was done to ensure that the best data was available to compute the average travel times and speeds.

The INRIX XD speeds that were assigned to GIS segments were then used to calculate the travel time along that GIS segment, where travel time is equal to the GIS segment distance divided by the INRIX XD speed assigned to the segment.

Since an arterial corridor in a jurisdiction is comprised of many smaller GIS segments (illustrated by the blue lines in Exhibit 4-14 above that shows how arterials were segmented for the INRIX XD data), the travel times along the segments were summed to obtain the travel time along a directional corridor for the jurisdiction for a single hour of a single day (e.g., Northbound Normandie Avenue through the City of Gardena at 8:00 AM on September 21, 2016).

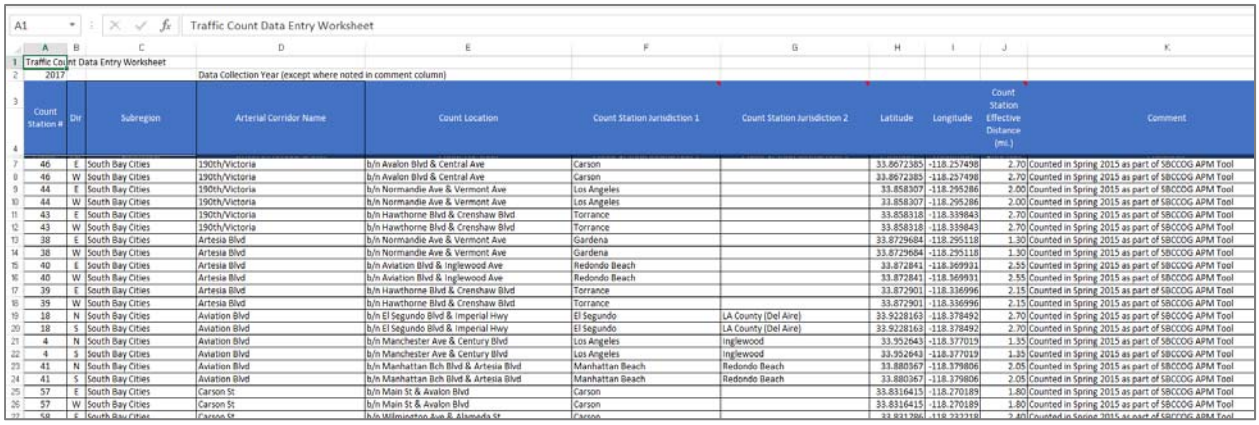
Once the hourly travel times have been calculated for each jurisdictional directional corridor, the average travel time is calculated for all non-holiday weekdays. Another data quality check is performed at this stage that compares the distance covered by segments with available INRIX XD data to the total directional arterial corridor distance for that jurisdiction for a given date and hour. If the INRIX XD available segments covers less than ½ the total corridor, then that day is rejected from the analysis. The average speed is then calculated for the corridor by taking the average travel time and dividing that by the jurisdictional arterial corridor distance to get the average travel time for that segment.

The 95th percentile travel time calculation is more involved technically. In short, the 95th percentile, as defined in Section 2 above, is the travel time on the 95th day out of 100 days of data when sorted in ascending order from the fastest travel time to the longest travel time. That approach picks the element of the data that corresponds to the 95th percentile value. If an exact 95th percentile element does not exist, the Access database is designed to interpolate the 95th percentile based on the 95th value and the 96th value. There are several commonly accepted approaches used to estimate the 95th percentile, and the approach selected for this analysis is the same approach used in used in Microsoft Excel.

4.6 Arterial Count Data

This worksheet is the repository for hourly traffic count data for each arterial location with a count station. The worksheet is shown in Exhibit 4-16, below.

Exhibit 4-16: Arterial Count Data Worksheet



Count Station #	Dir	Subregion	Arterial Corridor Name	Count Location	Count Station Jurisdiction 1	Count Station Jurisdiction 2	Latitude	Longitude	Count Station Effective Distance (mi.)	Comment
46	E	South Bay Cities	190th/Victoria	b/n Avalon Blvd & Central Ave	Carson		33.8672385	-118.257498	2.70	Counted in Spring 2015 as part of SBCCOG APM Tool
46	W	South Bay Cities	190th/Victoria	b/n Avalon Blvd & Central Ave	Carson		33.8672385	-118.257498	2.70	Counted in Spring 2015 as part of SBCCOG APM Tool
44	E	South Bay Cities	190th/Victoria	b/n Normandie Ave & Vermont Ave	Los Angeles		33.858307	-118.295286	2.00	Counted in Spring 2015 as part of SBCCOG APM Tool
44	W	South Bay Cities	190th/Victoria	b/n Normandie Ave & Vermont Ave	Los Angeles		33.858307	-118.295286	2.00	Counted in Spring 2015 as part of SBCCOG APM Tool
43	E	South Bay Cities	190th/Victoria	b/n Hawthorne Blvd & Crenshaw Blvd	Torrance		33.858318	-118.339843	2.70	Counted in Spring 2015 as part of SBCCOG APM Tool
43	W	South Bay Cities	190th/Victoria	b/n Hawthorne Blvd & Crenshaw Blvd	Torrance		33.858318	-118.339843	2.70	Counted in Spring 2015 as part of SBCCOG APM Tool
38	E	South Bay Cities	Artesia Blvd	b/n Normandie Ave & Vermont Ave	Gardena		33.8729684	-118.295118	1.30	Counted in Spring 2015 as part of SBCCOG APM Tool
38	W	South Bay Cities	Artesia Blvd	b/n Normandie Ave & Vermont Ave	Gardena		33.8729684	-118.295118	1.30	Counted in Spring 2015 as part of SBCCOG APM Tool
40	E	South Bay Cities	Artesia Blvd	b/n Aviation Blvd & Inglewood Ave	Redondo Beach		33.872841	-118.369931	2.55	Counted in Spring 2015 as part of SBCCOG APM Tool
40	W	South Bay Cities	Artesia Blvd	b/n Aviation Blvd & Inglewood Ave	Redondo Beach		33.872841	-118.369931	2.55	Counted in Spring 2015 as part of SBCCOG APM Tool
39	E	South Bay Cities	Artesia Blvd	b/n Hawthorne Blvd & Crenshaw Blvd	Torrance		33.872901	-118.336996	2.15	Counted in Spring 2015 as part of SBCCOG APM Tool
39	W	South Bay Cities	Artesia Blvd	b/n Hawthorne Blvd & Crenshaw Blvd	Torrance		33.872901	-118.336996	2.15	Counted in Spring 2015 as part of SBCCOG APM Tool
18	N	South Bay Cities	Aviation Blvd	b/n El Segundo Blvd & Imperial Hwy	El Segundo	LA County (Del Aire)	33.9228163	-118.378492	2.70	Counted in Spring 2015 as part of SBCCOG APM Tool
18	S	South Bay Cities	Aviation Blvd	b/n El Segundo Blvd & Imperial Hwy	El Segundo	LA County (Del Aire)	33.9228163	-118.378492	2.70	Counted in Spring 2015 as part of SBCCOG APM Tool
4	N	South Bay Cities	Aviation Blvd	b/n Manchester Ave & Century Blvd	Los Angeles	Inglewood	33.952643	-118.377019	1.35	Counted in Spring 2015 as part of SBCCOG APM Tool
4	S	South Bay Cities	Aviation Blvd	b/n Manchester Ave & Century Blvd	Los Angeles	Inglewood	33.952643	-118.377019	1.35	Counted in Spring 2015 as part of SBCCOG APM Tool
41	N	South Bay Cities	Aviation Blvd	b/n Manhattan Bch Blvd & Artesia Blvd	Manhattan Beach	Redondo Beach	33.880367	-118.379806	2.05	Counted in Spring 2015 as part of SBCCOG APM Tool
41	S	South Bay Cities	Aviation Blvd	b/n Manhattan Bch Blvd & Artesia Blvd	Manhattan Beach	Redondo Beach	33.880367	-118.379806	2.05	Counted in Spring 2015 as part of SBCCOG APM Tool
57	E	South Bay Cities	Carson St	b/n Main St & Avalon Blvd	Carson		33.8316415	-118.270189	1.80	Counted in Spring 2015 as part of SBCCOG APM Tool
57	W	South Bay Cities	Carson St	b/n Main St & Avalon Blvd	Carson		33.8316415	-118.270189	1.80	Counted in Spring 2015 as part of SBCCOG APM Tool

The worksheet has the following columns:

- Count Station # - is a unique identifying code used to identify the count location. The code varies by count vendor or public agency source of the data.
- Dir – Direction of travel (E, N, S, W). The directionality must match the directionality in the *Dropdown List* and in the *Arterial Analysis* worksheets to ensure that references in the results worksheets correctly read the data.
- Arterial Corridor Name – Referenced by other worksheets so this must be consistent from one jurisdiction to the next (e.g., Pacific Coast Highway and Sepulveda share the same roadway in some cities. To ensure consistent results the roadway name must be consistent along the entire physical roadway in the subregion).
- Count Location – is a text description that indicates where the count station is located or the manual count was conducted. This information is not referenced by other worksheets, but is provided for informational purposes.
- Count Station Jurisdiction 1 and 2- These two columns represent the jurisdiction name (i.e., city, Los Angeles County area, or subregion). As with other corridor information, spelling consistency is required to ensure references work throughout the APMT. The APMT allows for a single count location to represent two locations. For example, in Exhibit 2-2 from above that shows above that shows Rosecrans Avenue splitting El Segundo and Manhattan Beach, a count station on that arterial can have "El Segundo" as jurisdiction 1 and "Manhattan Beach" as jurisdiction 2. This way each of those jurisdictions can have a "local" count location as a volume estimate source in the *Arterial Analysis* worksheet. This helps to ensure that each jurisdiction has the most accurate volume estimate possible.
- Latitude and Longitude- provides the location of the count stations for mapping purposes.
- Count Station Effective Distance (mi.) – used in the *Arterial Count Data* worksheet to convert screenline traffic counts into VMT. This is reported in this worksheet to further assist the user in

determining if a VMT adjustment is warranted. A VMT adjustment may be warranted if the count station effective distance is significantly different that the actual arterial corridor distance.

- Comment – allows for the user to add comments about each count location. It is current used to provide details on the count data including the data collection dates, count vendor/public agency, and original data file name.
- Count Adjust Ratio – this allows the user to adjust volumes based on a ratio, which is useful for applying growth factors to data that was collected in the past. For example, if a count location had data collected a few years in the past and the user estimates that traffic has grown by 3 percent between the count date and the current analysis date, 1.03 can be entered in this location and average daily traffic and VMT will be increased by a factor of 1.03 (i.e., 3%).
- Average Daily Volume - is the summation of the hourly counts. This column can be used to verify the screenline counts against other data sources, if needed.
- Average Daily VMT Over Effective Distance – is the summation of the VMT by hour.
- Vehicle Counts by Hour - is input from any traffic count source.
- Estimated Count Station Vehicle Miles Traveled (VMT) by Hour – is the hourly count multiplied by the count station effective distance.

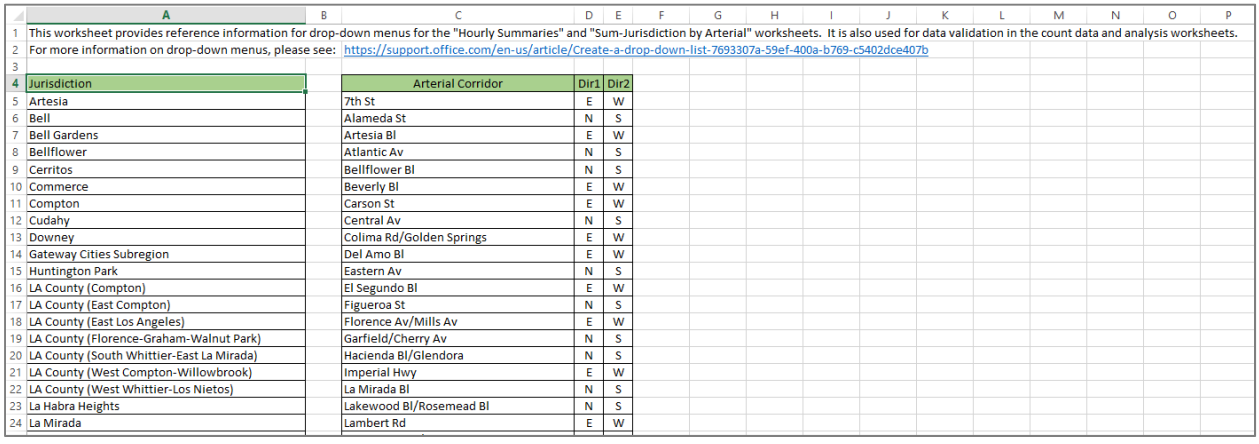
4.7 Dropdown Lists

This worksheet contains the drop down lists used by the following worksheets:

- Arterial Count Data
- Hourly Summaries
- Arterial Summary-Dynamic
- City Summary.

There are two dropdown lists used referenced in this worksheet that are also presented in Exhibit 4-17, below: One for the jurisdictions, and one for the arterial names. Note that the jurisdiction and street names in this list must exactly match those used in the *Arterial Analysis* and *Arterial Count Data* worksheets. The reason is that the dropdown menus in the analysis results worksheets (the ones with the blue tabs) reference both the lists shown below and the jurisdictions and streets in the analysis worksheets (the sheets with the orange tabs).

Exhibit 4-17: Dropdown Lists for Jurisdictions and Arterial Corridors



This worksheet provides reference information for drop-down menus for the "Hourly Summaries" and "Sum-Jurisdiction by Arterial" worksheets. It is also used for data validation in the count data and analysis worksheets.
For more information on drop-down menus, please see: https://support.office.com/en-us/article/Create-a-drop-down-list-7693307a-59ef-400a-b769-c5402dce407b

Jurisdiction	Arterial Corridor	Dir1	Dir2
Artesia	7th St	E	W
Bell	Alameda St	N	S
Bell Gardens	Artesia Bl	E	W
Bellflower	Atlantic Av	N	S
Cerritos	Bellflower Bl	N	S
Commerce	Beverly Bl	E	W
Compton	Carson St	E	W
Cudahy	Central Av	N	S
Downey	Colima Rd/Golden Springs	E	W
Gateway Cities Subregion	Del Amo Bl	E	W
Huntington Park	Eastern Av	N	S
LA County (Compton)	El Segundo Bl	E	W
LA County (East Compton)	Figueroa St	N	S
LA County (East Los Angeles)	Florence Av/Mills Av	E	W
LA County (Florence-Graham-Walnut Park)	Garfield/Cherry Av	N	S
LA County (South Whittier-East La Mirada)	Hacienda Bl/Glendora	N	S
LA County (West Compton-Willowbrook)	Imperial Hwy	E	W
LA County (West Whittier-Los Nietos)	La Mirada Bl	N	S
La Habra Heights	Lakewood Bl/Rosemead Bl	N	S
La Mirada	Lambert Rd	E	W

4.8 APMT XReference Features

Since there are nine subregions in Los Angeles County, a cross-reference worksheet is provided to show where each jurisdiction's results can be found. This is shown in Exhibit 4-18, below.

Exhibit 4-18: APMT Cross Reference Example

Jurisdiction	Arroyo Verdugo	Central Los Angeles	Gateway Cities	Las Virgenes/Malibu	North Los Angeles County	San Fernando Valley	San Gabriel Valley	South Bay Cities	Westside Cities
Alhambra							■		
Arcadia							■		
Artesia			■						
Azusa							■		
Baldwin Park							■		
Bell			■						
Bell Gardens			■						
Bellflower			■						
Beverly Hills									■
Burbank	■								
Calabasas				■					
Carson								■	
Cerritos			■						
Claremont							■		
Commerce			■						

4.9 Excel Features

This final worksheet, as shown below in Exhibit 4-19, is a table that summarizes commonly used Microsoft Excel functions used in the APMT (e.g., "SUMIF", "VLOOKUP") and other key Excel features used in the tool (e.g., charts and data validation). The worksheet also provides links to internet resources that explain these functions and features in more detail.

Exhibit 4-19: Excel References Example

Excel Function	Description	Where to get more information
=B7*B8	Multiplies the numbers in two cells.	http://office.microsoft.com/en-us/excel-help/multiply-numbers-HP010070516.aspx?CTT=1
=B7/B8	Divides the number in one cell into the number from another cell	http://office.microsoft.com/en-us/excel-help/divide-numbers-HP010342450.aspx?CTT=5&origin=HP010342486
=B7+B8	Adds the numbers in two cells	http://office.microsoft.com/en-us/excel-help/add-numbers-HP010342146.aspx?CTT=1#_Toc262647455
=OR(Y254="",DQ254="")	In this tool, used primarily to determine if a cell is blank.	http://www.techonthenet.com/excel/formulas/or.php
=IF(K7<=3,1,K3)	IF/THEN statement. A logical statement. IF the first condition is true, then perform the second condition, else do something else. For example, if Weekday=Saturday, then classify as "Weekend".)	http://office.microsoft.com/en-us/performancepoint-server/entering-if-then-else-statements-in-management-rep
=ISERROR(N7)	If cell being referenced has an error, then this returns "NA"	http://office.microsoft.com/en-us/excel-help/information-functions-reference-HP010342611.aspx?CTT=1
=SUM(J3:J14) or SUM(BU254:BZ254,CN254:CR254)	Sums or adds up all the numbers in a range of cells. Used in various worksheets to add up total annual values (e.g., VMT, Delay)	http://office.microsoft.com/en-us/excel-help/sum-function-HP010342931.aspx?CTT=1

This document presented the Los Angeles Metro Arterial Performance Measurement Tools. The documentation includes a brief history and background to the APMT. It also provided a summary of the performance measures used in the tools and described the data and methods used to develop the tools. Finally, it describes each worksheet in the APMT and provides information on how to effectively use the tool.