Dynamic Implementation Tool for Flexible Mitigation Strategy

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1. Executive Summary

Like many jurisdictions, Sacramento County has historically conditioned development to implement roadway improvements and mitigations at "triggers" tied to a specific number of dwelling units or equivalents (DUEs). While this approach has been effective for smaller scale developments, it does not always dictate the appropriate timing and location of improvements for large specific or community plans. The County has developed an alternate approach to provide flexibility and align mitigations to the actual location of development.

This new strategy has led to what is currently referred to as the Dynamic Implementation Tool ("Tool"). Traffic impact studies (TIS) typically only analyze transportation impacts at full build-out, a process that would likely occur over many decades, or hypothetical phasing scenarios that inevitably change. The Tool provides for an understanding of the impacts incremental development would have on the transportation network. For any amount of phased development that might be implemented, a spreadsheet estimates volume changes through roadways and intersections and determines if the volume growth would trigger an impact.

The spreadsheet is based on the trip assignment from the regional travel demand model used for the TIS. The model tracks the origin and destination of each trip end by traffic analysis zones (TAZs), which are aggregated to larger traffic sheds called "districts." Select zone analysis determines the fair share allocation of volume growth to each district. Based on the amount of development assumed and entered into the tool by district, VMT-generation rates are applied to estimate volume increases of partial buildout. With this information, a nexus can be established between a phasing concept and infrastructure needs without the costly and time-consuming process of rerunning the demand model. This approach gives developers flexibility with project phasing and optimization, while ensuring that deficiencies are expeditiously addressed. The County has the tools to proactively monitor and manage the transportation network, ensuring transportation funds are spent where they are needed.

2. Background and Prior Policies

As of 2019, Sacramento County has a total population of 1,546,000, including 594,000 (38%) living in unincorporated areas.[1] The adopted 2020 Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS)[2] assumes a regional (six-county) increase of 260,000 housing units, 270,000 jobs, and 620,000 population by Year 2040, outpacing both California and the rest of the nation. By buildout, the six-county region expects to add a total of 663,000 new housing units and 1,100,000 new jobs. Sacramento County's numerous growth areas are shown as the colored areas in **Figure 2-1**. The large growth areas leads to a unique set

[1] https://www.saccounty.net/Government/Pages/DemographicsandFacts.aspx
[2] https://www.sacog.org/sites/main/files/file-attachments/chapter3_mtp-scs_0.pdf?1580327288

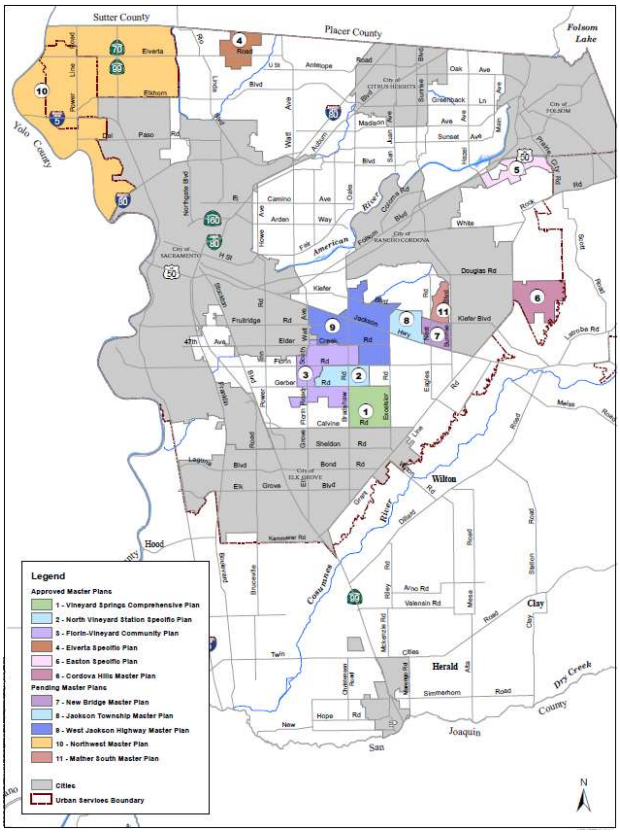

Figure 2-1: Growth Areas in Unincorporated Sacramento County

of challenges, compared to other parts of the state that are geographically constrained from further development. Areas that are mostly built-out must strive to get the most out of their constrained capacity through operational and ITS improvements, as well as fund ongoing maintenance and pedestrian, bicycle, and transit improvements. In addition to these challenges, Sacramento County must deliver over $3 billion in capital improvements[3], mostly roadway and intersection projects, to support and sustain growth.

Early 1990's: "Fair Share" Approach

The County's first mitigation strategy simply required that developers pay fees to cover their fair share of improvements. The idea was that the County would take responsibility for delivering public roadway improvements necessary for development. This approach had significant problems, including difficulty delivering projects in the timeline needed to keep up with traffic demand. Additionally, the funds collected were not always sufficient.

Mid 2000's: "Trigger" Based Approach

In the mid-2000's, Sacramento County shifted to a "trigger" based system to address these shortcomings. These triggers required developers to deliver a set of improvements themselves once a specified level of development was reached. Specifically, this strategy ties a subset of transportation improvements from the list of mitigation measures in the environmental impact report (EIR) to a specific number of dwelling unit equivalents (DUEs), based on a phasing analysis. **Figure 2-2** shows an example of trigger-based conditions. For example, 2 roadway projects might be required prior to being allowed to exceed 2,020 units. This practice has been effective at ensuring that development cannot get out in front of the delivery of needed improvements. When the economy and housing market were booming, the strategy worked well. However now that the market has returned to normalcy, two major issues have developed:

Prior to recordation of 2021st residential building lot within the FVCP Area:

28. Reconstruct, widen existing two-lane road section, add southbound lane and frontage where necessary, and restripe existing French Road to a four-lane arterial from Florin Road to Gerber Road based on a 74-foot standard arterial (the 6-foot separated sidewalk shall be installed in an adjacent pedestrian/landscape easement). (12.1.1, 12.1.2, 12.1.3) Mitigation Measures: TC-1(l), TC-1(cc), TC-3(r) and TC-3(v).

29. Widen the existing bridge on French Road at the Elder Creek crossing based on a 74-foot standard arterial. (12.1d) Mitigation Measures: TC-1(l), TC-1(cc), TC-3(r) and TC-3(v).

Prior to recordation of 2126th residential building lot within the FVCP Area:

30. Widen the existing intersection of Florin Road at Florin-Perkins Road (French Road) by adding a westbound right-turn lane). (14) Mitigation Measures: TC-2(ee) and TC-4(s).

31. Widen existing intersection of Florin Road at South Watt Avenue from a partial 4X4 to a full 6X6 (relocate signal). (15) Mitigation Measure: TC-4(u).

Figure 2-2: Example Trigger-Based Conditions in the Florin-Vineyard Community Plan

[3] https://sacdot.saccounty.net/Pages/DevelopmentFees.aspx

- Triggers do not always approximate the appropriate timing and location of transportation improvements. Development in one corner of a plan area may trigger improvements located several miles away on other side of the plan area.

- Individual developers that reach the trigger cannot always afford to carry the cost of the improvements, resulting in development halting. For example, a trigger requiring that $11M worth of improvements will effectively stop a 40 unit independent developer. While in theory "no development equals no impacts," history has shown that traffic will continue to increase based on growth in other jurisdictions. The improvements will still be needed, and no revenue will be available for the County to implement them.

3. Dynamic Implementation Tool

Overview

In collaboration with consultant DKS Associates, the County has developed a new approach for improvement phasing, currently referred to as the Dynamic Implementation Tool ("Tool"). The Tool consists of (1) travel demand model trip assignment outputs; and (2) an Excel spreadsheet that provides an interface and post-model calculations. The Board of Supervisors recently adopted the Tool as the mitigation strategy for four ongoing development projects: the West Jackson Highway Master Plan, the Jackson Township Specific Plan, the NewBridge Specific Plan, and the Mather South Community Master Plan.

The Tool uses the vehicle trip assignment from the regional travel demand model (SACSIM) to estimate the trips added to the roadway network by incremental development. A model script tracks the origin and destination of each trip end by traffic analysis zones (TAZs), which are aggregated to larger traffic sheds called "districts." Select zone analysis determines the fair share allocation of volume growth to each district. Based on the amount of development assumed and entered into the tool by district, VMT-generation rates are applied to estimate volume increases of partial buildout. With this information, a nexus can be established between a phasing plan and infrastructure needs without the costly and time-consuming process of rerunning the demand model.

The Tool outputs (1) roadway segment volumes and level of service; and (2) intersection peak hour turning movement volumes, which can be imported into intersection analysis software. After determining if any significant impacts would result, the County can assign transportation improvements and/or fee payments to the increment of development.

Modeling Methodology

For most large transportation studies in the Sacramento region, the Sacramento Area Council of Governments' (SACOG's) SACSIM travel demand model is used to forecast travel patterns and volumes. SACSIM is an activity-based model that tracks the travel of individuals throughout the day in trip tours. SACSIM thus requires a detailed definition of household population, demographics, and employment type at a parcel-level of geography. This allows the model to capture smaller-scale land use changes and differences. SACSIM is sensitive to the local physical environment, including pedestrian and bicycle facilities, the patterns of local street

networks (e.g., grid vs. cul-de-sacs), and the density, proximity and mix of surrounding land uses (i.e. employment destinations, schools, retail, parks, etc.). SACSIM forecasts automobile, transit, bicycle, and walk trips.

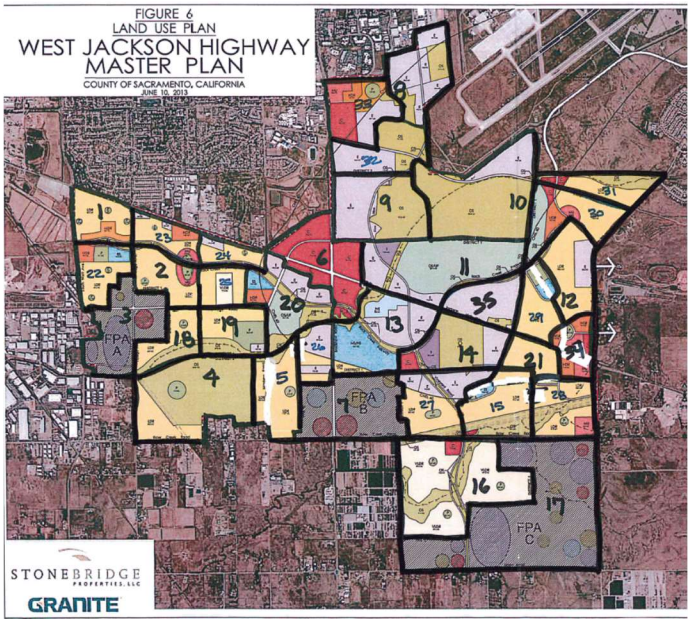

Figure 3-1: West Jackson Hwy Master Plan District Map

Large development projects can be represented by upwards of 50 traffic analysis zones (TAZs), in order to provide sufficiently detailed network loading for intersection analysis. A model script tracks the origin and destination of each trip by TAZ. For simplification purposes, TAZs are aggregated to larger traffic sheds called "districts" (with each district containing an average of 2.2 TAZs). An example of districts within a master plan area is shown in **Figure 3-1**. Select zone analysis determines the fair share allocation of volume to each district. The script outputs spreadsheet files containing the total volume for every selected link and turning movement, split out into different columns for existing trips, growth from districts 1 through *n*, and through trips (i.e. external growth).

Spreadsheet Methodology

The purpose of the spreadsheet is to translate the static model data into forecasts that can be used for traffic analysis through dynamic adjustments to development assumptions. The spreadsheet is comprised of the following components:

1) Model Data: contains static traffic data (volume growth attributed to every project district at buildout) from the model run output
2) Control Panel: allows dynamic adjustments to development assumptions. A percentage of assumed development to buildout VMT in each district is estimated.
3) Forecasting: the percent of buildout from step 2) is applied to the buildout traffic growth from step 1) and added to an existing count.
4) Traffic Analysis: the segment volumes and levels of service are displayed in the spreadsheet. The intersection turning movement volumes are formatted for importing into traffic analysis software.

<u>Control Panel</u>

The control panel tab, shown in **Figure 3-2**, processes all user inputs. The 'Assumed' column allows the user to specify how much development should be assumed in the forecast. The 'Buildout' column shows what was assumed in the model runs at project buildout. The user may enter an 'Assumed' value greater than the 'Buildout' value; however, the usual cautions about extrapolation apply. Additional model runs should typically be completed whenever land use or transportation changes are expected to cause significant shifts in travel patterns.

Model Assumption at Project Buildout

Growth Increment to be analyzed

= Development in (C) through (P) x VMT Generation Rate per SCTDF

Percentage of district's buildout vehicle trips that will be used in traffic analysis. =(R)/(Q)

		District	Single Family Dwelling Units (du)		Multi Family Dwelling Units (du)		Retail (s.f.)		Office (s.f.)		Industrial (s.f.)		Employment (s.f.)		School (students)		Calculated VMT by District		
			Buildout	Assumed	Buildout	Assumed	Buildout	Assumed	Buildout	Assumed	Buildout	Assumed	Buildout	Assumed	Buildout	Assumed	*Buildout*	*Assumed Development*	% of Traffic Assumed
39	Jackson Township Project	1	288	144	430	215	191,600	0	0	0	0	0	0	0	0	0	3866.87	1393.70	36.0%
40		2	534	267	0	0	0	0	0	0	0	0	0	0	0	0	2696.70	1348.35	50.0%
41		3	0	0	0	0	0	0	0	0	0	0	0	0	3,750	0	833.39	0.00	0.0%
42		4	149	0	0	0	304,850	0	0	0	0	0	0	0	0	0	2469.97	0.00	0.0%
43		5	1,080	0	276	0	0	0	0	0	0	0	0	0	750	0	6309.60	0.00	0.0%
44		6	477	0	0	0	0	0	0	0	0	0	0	0	0	0	2408.85	0.00	0.0%
45		7	0	0	391	0	0	0	731,800	0	0	0	0	0	0	0	5453.61	0.00	0.0%
46		8	305	0	225	0	0	0	0	0	0	0	0	0	0	0	2237.75	0.00	0.0%
47		9	253	0	292	0	0	0	0	0	0	0	0	0	0	0	2182.85	0.00	0.0%
48		10	516	0	453	0	0	0	0	0	0	0	0	0	750	0	4010.10	0.00	0.0%
49		11	557	0	0	0	0	0	0	0	0	0	0	0	750	0	2812.85	0.00	0.0%
50		12	100	0	438	0	767,850	0	0	0	0	0	0	0	0	0	6188.87	0.00	0.0%
51		***Total***	***4,259***	***411***	***2,505***	***215***	***1,264,300***	***0***	***731,800***	***0***	***0***	***0***	***0***	***0***	***6,000***	***0***	***41471.42***	***2742.05***	***6.6%***
52	NewBridge Project	1	75	0	427	0	170,000	0	0	0	0	0	0	0	0	0	2660.23	0.00	0.0%
53		2	240	0	0	0	30,000	0	180,000	0	0	0	0	0	0	0	2424.30	0.00	0.0%
54		3	365	0	0	0	0	0	0	0	0	0	0	0	750	0	1843.25	0.00	0.0%
55		4	521	0	0	0	0	0	0	0	0	0	0	0	0	0	2631.05	0.00	0.0%
56		5	230	0	187	0	120,000	0	0	0	0	0	0	0	0	0	2417.28	0.00	0.0%
57		6	210	0	240	0	0	0	0	0	0	0	0	0	0	0	1804.50	0.00	0.0%
58		7	255	0	405	0	60,000	0	0	0	0	0	0	0	750	0	2881.29	0.00	0.0%
59		8	324	0	369	0	0	0	0	0	0	0	0	0	0	0	2780.10	0.00	0.0%
60		***Total***	***2,220***	***0***	***1,628***	***0***	***380,000***	***0***	***180,000***	***0***	***0***	***0***	***0***	***0***	***1,500***	***0***	***19442.00***	***0.00***	***0.0%***

Figure 3-2: Spreadsheet Control Panel Tab

Forecasting

The model output data contains the total volume on every roadway segment and turning movement attributable to every district at buildout. To estimate the growth increment at a development level less than buildout, the spreadsheet multiplies the growth at buildout by the ratio of development VMT to buildout VMT (i.e. the percentage in the red cell in Figure 3-2). The County has adopted VMT generation rates for different land use types (i.e. trip generation rate multiplied by average trip length) for the Sacramento County Transportation Development Fee Program (SCTDF). The total VMT generated by the development assumption and at buildout are calculated using these rates. For example, if a district contains only single family dwelling units, then 50% of the units built would result in 50% of the VMT generated. But if a district contains multiple land use types, a smaller percentage of a higher-intensity land use type will cause a higher percentage of the district's VMT to be generated. The estimated growth is then added to an existing count to produce roadway segment and intersection turning movement forecasts.

Traffic Analysis

For roadway segments, the County uses a methodology based on service volume thresholds. If the project-added traffic causes the segment to exceed an acceptable operating threshold (typically level of service E), or causes a deficient segment to increase by more than .05 V/C, the roadway segment will be flagged as an impact requiring mitigation (see **Figure 3-3**). For intersections, the County uses methodologies consistent with the Highway Capacity Manual (HCM). The spreadsheet calculates turning movement forecasts and formats a .CSV file that can be directly imported into intersection analysis software. If the project-added traffic causes the intersection to exceed an acceptable operating threshold, or causes a deficient intersection to increase in average control delay by more than 5 seconds, mitigation will be required.

Update lanes as mitigations are assigned

Impacts Identified; Mitigations should be implemented as identified in TIS

Roadway Segment Levels of Service

	Segment					Existing						Lanes from Scenario:		Existing			
Number	Roadway	From	To	LOS Policy Criteria	Travel Lanes	Facility Type[2]	Daily Capacity	Daily Volume	Volume / Capacity Ratio	Level of Service	Travel Lanes	Facility Type[2]	Daily Capacity	Forecasted Volume	Volume/ Capacity Ratio	Level of Service
1	Bradshaw Road	Folsom Boulevard	US 50	D	6	Arterial M	54,000	20,592	0.38	A	6	Arterial M	54,000	21,180	0.39	A
2	Bradshaw Road	US 50	Lincoln Village Dr	D	6	Arterial M	54,000	52,590	0.97	E	6	Arterial M	54,000	54,564	1.01	F
3	Bradshaw Road	Lincoln Village Dr	Old Placerville Road	D	6	Arterial M	54,000	42,787	0.79	C	6	Arterial M	54,000	45,227	0.84	D
4	Bradshaw Road	Old Placerville Road	Goethe Rd	E	6	Arterial M	54,000	38,984	0.72	C	6	Arterial M	54,000	42,006	0.78	C
5	Bradshaw Road	Goethe Rd	Kiefer Boulevard	E	4	Arterial M	36,000	28,651	0.80	C	4	Arterial M	36,000	32,798	0.91	E
5.1	Bradshaw Road	Goethe Road	Collector WJ-8	E	4	Arterial M	36,000	28,651	0.80	C	4	Arterial M	36,000	32,103	0.89	D
5.2	Bradshaw Road	Collector WJ-8	Kiefer Boulevard	E	4	Arterial M	36,000	28,651	0.80	C	4	Arterial M	36,000	32,798	0.91	E
6	Bradshaw Road	Kiefer Boulevard	Jackson Road	E	4	Arterial M	36,000	30,726	0.85	D	4	Arterial M	36,000	37,954	1.05	F
6.1	Bradshaw Road	Kiefer Boulevard	Collector WJ-9	E	4	Arterial M	36,000	30,726	0.85	D	4	Arterial M	36,000	37,975	1.05	F
6.2	Bradshaw Road	Collector WJ-9	Mayhew Road	E	4	Arterial M	36,000	30,726	0.85	D	4	Arterial M	36,000	38,046	1.06	F
6.3	Bradshaw Road	Mayhew Road	Jackson Road	E	4	Arterial M	36,000	30,726	0.85	D	4	Arterial M	36,000	38,048	1.06	F
7	Bradshaw Road	Jackson Road	Elder Creek Road	E	4	Arterial M	36,000	22,871	0.64	B	4	Arterial M	36,000	22,962	0.64	B
7.1	Bradshaw Road	Jackson Road	Rock Creek Parkway	E	4	Arterial M	36,000	22,871	0.64	B	4	Arterial M	36,000	22,938	0.64	B
7.2	Bradshaw Road	Rock Creek Parkway	Collector WJ-10	E	4	Arterial M	36,000	22,871	0.64	B	4	Arterial M	36,000	22,933	0.64	B
7.3	Bradshaw Road	Collector WJ-10	Collector WJ-11	E	4	Arterial M	36,000	22,871	0.64	B	4	Arterial M	36,000	22,944	0.64	B
7.4	Bradshaw Road	Collector WJ-11	Elder Creek Road	E	4	Arterial M	36,000	22,871	0.64	B	4	Arterial M	36,000	22,962	0.64	B

Figure 3-3: Roadway Segment Analysis Results

4. Assigning Improvements

After the needed improvements are identified, the last step in the adopted strategy[4] is checking that the cost is roughly equal to the development's financial obligation:

Financial Obligation = Number of DUEs in development X transportation fee rate per DUE in fee program

This is to ensure that the financial burden on the individual developer is proportionate to the size of the development. If the tool assigns an improvement costing less than the developer's financial obligation, the County will collect the difference and build a surplus. If the assigned improvement is greater than the developer's financial obligation, surplus funds will be provided to cover the cost of the improvement in excess.

For example, a developer comes in with residential units, retail, and office space totaling 400 DUEs. Each DUE must pay $14,000 in plan area roadway fees in order to satisfy their financial obligation. So, we calculate 400 DUEs X $14,000 = $5.6 million. The tool identifies mitigation needs totaling $4.0 million, which are assigned to the developer. The developer is required to begin to construct and complete their improvements at specified stages of their development. A surplus of $1.6 million is deposited into the County's roadway fee account, which may be given to the next small development that trips a large improvement.

5. Limitations

Double Counting of Trips between Project Districts

In the select zone calculation, any project district generating or attracting a trip was allocated both trip ends. Typically for fair share calculations, both trip ends are only allocated to the

4 http://www.agendanet.saccounty.net/sirepub/cache/2/wxn0d0ebpjjaei2xe5dzpix3/89974650317202004291250 9.PDF

project if one end is external to the project; if a trip goes between two project zones, one trip end is usually allocated to each zone. The methodology used may thus result in double counting of trips between two project districts. This was a necessary assumption for phasing analysis, as the actual sequence of development is unknown. Consider a trip that occurs between a residential unit in district 3 and retail in district 7 at project buildout. If district 3 develops before district 7, those residents would still generate shopping trips that would have to be satisfied elsewhere in the network. Thus, it is necessary to assign both trip ends to that district to avoid underestimating roadway usage before district 7 develops. A schematic representation of the select zone assignment is shown in **Figure 5-1**.

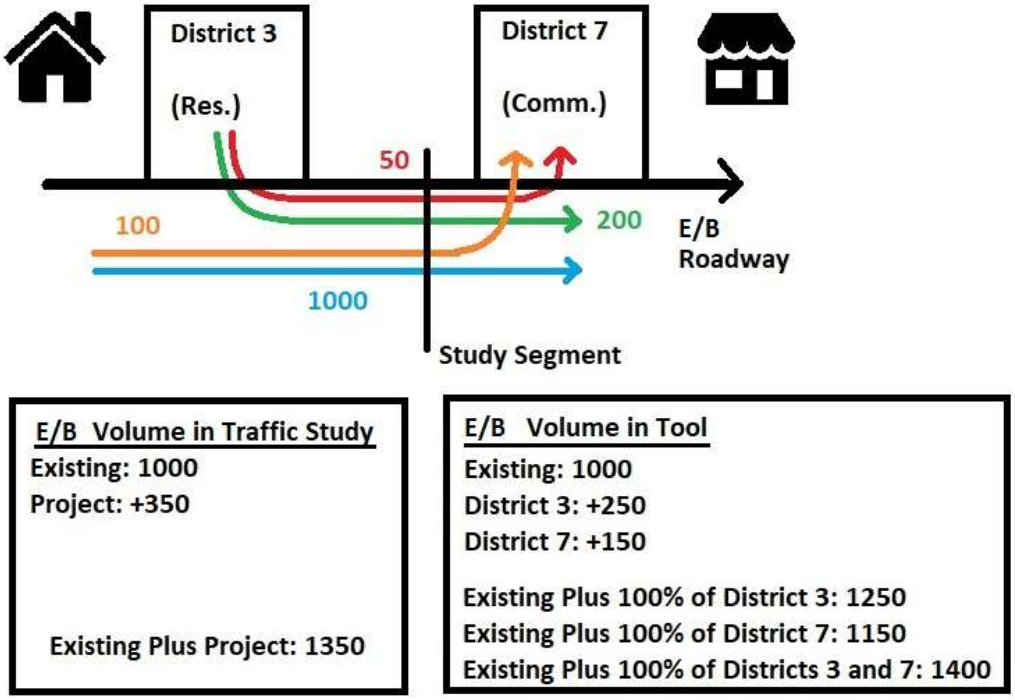

Figure 5-1: Representation of Double Counting Effect in Select Zone Assignment

It should be remembered that impacts are based on traffic forecasts which assume full buildout of the project. The tool is simply a select zone assignment used to determine when previously-identified mitigations are needed. A double count only occurs when (1) trips go between two project districts; and (2) the tool assumes development in both of those districts. Even then, while it is possible that mitigation may be built slightly sooner than needed, the project would not be responsible for any impacts that were not identified in the original traffic impact study.

Shelf Life

The tool produces forecasts based on traffic counts consistent with the baseline of the model. Over time, background growth will fill in excess capacity of roadways and intersections. As growth occurs in multiple districts of the project, the double counting effect may also go from being negligible to perceptible in the results. Thus, it is anticipated that the tool may have a "shelf life" of 5± years, at which point it will need to be refreshed. Resetting the baseline would involve collecting new traffic counts and updating the model to ensure that the "Existing No Project" scenario includes growth to date in the project and periphery.

Trip Distribution
The aggregation of TAZs to districts creates a traffic shed that is inherently assumed to have the same trip distribution. In reality, individual components (especially different land use types, e.g. residential and retail) would have different distributions. However, this granularity cannot be achieved without an unreasonably large number of TAZs or re-running the model as each development increment comes in. These run contrary to the goal of the tool, which is to provide simplified, "good enough" information for phasing analysis.

Trips between Adjacent Projects
The tool tracks trips for four ongoing, adjacent development projects: the West Jackson Highway Master Plan, the Jackson Township Specific Plan, the NewBridge Specific Plan, and the Mather South Community Master Plan. Each plan area has a separate traffic impact study and separate "Existing Plus Project" analysis excluding the other plan areas. While all four plan areas were assumed in the cumulative analyses, no trips are assumed to occur between plan areas in the "Existing Plus Project" scenarios used in the tool. This assumption was intentional, as large employment and retail centers in the West Jackson Highway Master Plan would skew the trip distribution from the adjacent, more residential-focused projects. In reality, retail and office typically lag residential development, so most of these trips will head north to existing centers in Rancho Cordova in the early stages of development. Over time, the tool will be updated to reset the baseline, and growth to date in other plan areas will be incorporated.

6. Transferability, Outreach, and Final Thoughts
While the strategy described in this document was developed using the Sacramento region's SACSIM travel demand model, the concept can be applied to any travel demand model capable of select zone analysis. The spreadsheet tool is simply an interface containing model assumptions and outputs, and allowing users to make interpolations based on an assumed relationship between the two.

The County first tested a variety of scenarios to check that mitigation results were logical, and all previously identified impacts would be triggered at 100% development. After feeling comfortable with the results, the County reached out to the development community to explain the strategy and conduct a live demonstration. While the audience was primarily non-technical, they understood the concept at a high level and become familiar with how the process worked. The feedback received was positive, as they appreciated the benefits of being able to quickly and cheaply test different phasing scenarios and effects on their cash flow. With the support of the development community, the tool-based mitigation strategy was presented to the Board of Supervisors and formally adopted.

The strategy has not yet been applied on a project, as three of the four plan areas have not yet been approved by the Board of Supervisors. However, the benefits are anticipated to be (1) additional control to ensure that improvements are built when and where they are needed; and (2) flexibility to ensure that our customers do not face unreasonable barriers to development. The County does anticipate this strategy requiring more resources than traditional approaches. Staff will need to serve as a "gatekeeper" for the tool to track all development applications to date and the mitigation assigned to each applicant.