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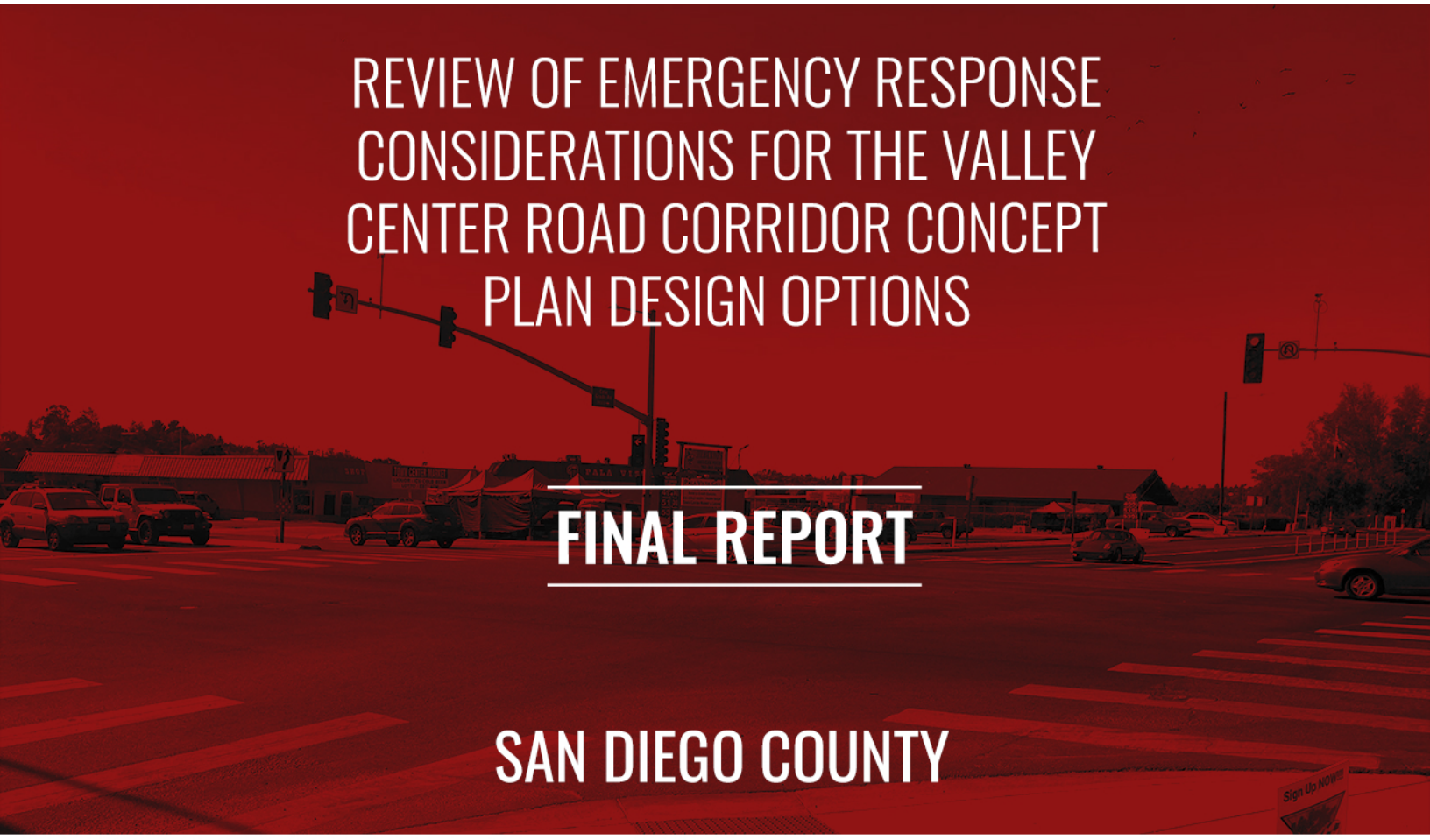
REVIEW OF EMERGENCY RESPONSE CONSIDERATIONS FOR THE VALLEY CENTER ROAD CORRIDOR CONCEPT PLAN DESIGN OPTIONS



FINAL REPORT

SAN DIEGO COUNTY

SEPTEMBER 26, 2023

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September 26, 2023

RE: REVIEW OF EMERGENCY RESPONSE CONSIDERATIONS FOR THE VALLEY CENTER ROAD CORRIDOR CONCEPT PLAN DESIGN OPTIONS

This report and companion technical exhibits identify the key elements of the requested review regarding the potential impacts of the proposed traffic control options on fire and EMS response times associated with Valley Center Road Corridor Concept Plan (CCP) options.

The research work included:

- Review of the impacts of roundabouts on both emergency response times and disaster evacuation routes.
- Review of the 2022 Draft Corridor Concept Plan Report prepared by Michael Baker International (MBI).
- Comparison and contrast of the use of intersection controls on emergency response times and disaster evacuation routes, including traffic signals and roundabouts.
- Comparison of historical fire unit travel time records to CCP design traffic control models.
- Review of published practices regarding roundabouts and emergency responses.

CAPSTONE RECOMMENDATION

Based on the six findings included in this report and Citygate's research and professional experience in fire unit travel time planning, we find that fire and EMS unit response times will not be materially lengthened by either Option A or Option B CCP design concepts (Exhibits 1 and 2). Further, Citygate recommends the use of roundabouts as designed within CCP Options A and B, as they will slow response times the least compared to other design choices and will provide for smoother evacuation routing in comparison to traffic signals.

BACKGROUND AND BASELINE RESEARCH CONDUCTED

Citygate's review began with an understanding of the Draft Valley Center Road Corridor Concept Plan—the June 2022 Analysis Report; not the current, proposed project.[1] We took note that the CCP is intended to "create a sense of place within Valley Center and support a safer, more accessible roadway through the implementation of traffic calming measures and other multi-modal opportunities for all users, including pedestrians, cyclists, equestrians, and vehicles."

The Plan work begins with the as-is condition of the roadway between Cole Grade Road and Woods Valley Road. Current 85th percentile speeds along the corridor exceed the posted speed limit of 45 miles per hour,[1] and there were 300 collisions with three fatalities over an eight-year period, as noted in MBI Exhibit 3. The collision data indicated that most of the collisions were attributable to unsafe speeds, right-of-way violations, and improper turning. The deep planning effort also looked at growth in the area and the likely increase of traffic volumes on the corridor through the Forecast Year 2035. The planning documents reviewed by Citygate were consistent with what we commonly review from other agencies regarding vehicle and pedestrian safety planning.

Citygate also understands that, as is typical throughout California, current and future speed limits are determined in a rigorous process based on state laws outlined in the California Manual on Uniform Traffic Control Devices. The current posted speed limit of 45 mph along the subject roadway may change in the future. With the implementation of roadway safety treatments for vehicle and pedestrian safety considering the local driveways spaced along the corridor, the current 45 mph speed limit may be re-evaluated for a potential decrease.

The Valley Center Fire Protection District covers 84.5 square miles and serves a population of over 23,000 people by providing fire, emergency medical, and community risk reduction services along with responding to approximately 1,300 calls for service per year.[2] The District operates from two fire stations, with the primary station (Fire Station 1) location on Lilac Road, approximately 450 feet west of Valley Center Road. Citygate's analysis was to determine the impact of traffic control devices on fire and ambulance unit response times from Fire Station 1 along the CCP project's geographic scope—from the Woods Valley Road intersection to the Cole Grade Road intersection.

As of June 2023, the County was considering new options for traffic signals and roundabouts in addition to addressing other CCP components for road user safety. Both Option A and Option B—Exhibits 1 and 2 to this report—include the use of seven traffic signals (including two associated with private development requirements and two newly proposed), one pedestrian signal, and two

[1] https://www.sandiegocounty.gov/content/dam/sdc/pds/advance/VCRoadStudy/DCCP-report.pdf
[2] https://www.valleycenterfire.com/about-us/

dual-lane roundabouts. Both options feature roundabouts at Woods Valley Road. Option A has a roundabout at Miller Road and a signal at Cole Grade Road. Option B has a signal at Miller Road and a roundabout at Cole Grade Road.

To understand the affect the traffic control devices would have on emergency response time, Citygate first needed to establish a baseline understanding of current fire unit travel times. The measures were from Fire Station 1 on Lilac Road to both the north and south ends of the CCP's geographic scope from Cole Grade Road to Woods Valley Road. Citygate, the Valley Center Fire Protection District, and their dispatch center identified incidents where a fire unit responded from Station 1 to an emergency occurring past the end of the CCP project's limits. The fire units have a GPS transponder, so the dispatch center knows to send the closest unit. This technology can also measure response travel time at intervals along a given route. Citygate / Fire District-provided Exhibits 10 and 11 are the result of these incident measures.

The incident data was used to compare to the modeling of intersection performance delay per CCP Options A and B (Exhibits 7 through 9 to this report). The fire unit travel time data was representative of other incidents the Fire District provided to Citygate between 2021 and 2023.

- The northern fire unit response travel time inside the CCP's geographic scope—from Fire Station 1 to the fire unit GPS waypoint just onto Cole Grade Road (approximately 1.5 miles)—was 3:32 minutes/seconds.

- The southern fire unit response travel time inside the CCP's geographic scope—from Fire Station 1 to the fire unit GPS waypoint just off Valley Center Road on Woods Valley Road (approximately 1.4 miles)—was 2:27 minutes/seconds.

The MBI model shows the present baseline travel times[3] to Cole Grade Road are 4:31 minutes/seconds and to Woods Valley, 2:49 minutes/seconds. Both times are close to the fire unit times, but not the same, being reflective of civilian traffic patterns. In Citygate's experience, these fire unit times are typical in an urban/suburban road network given the distances involved and a minimum number of controls such as stop signs and traffic lights. These fire unit speeds within the corridor are currently ranging from 17–60 mph.

Finding #1:	In Citygate's experience, the existing emergency response travel times for fire units are typical for suburban business districts as found within the corridor. The fire unit speeds reflect the existing four-lane boulevard design with intermittent medians and controls.

[3] See footnotes in Exhibit 9 for additional information regarding the baseline travel time calibration process, which was needed to isolate differences based on intersection controls.

In the United States, there are no staffing or response time requirements in federal or state law. It is a local policy choice made by cities, counties, and fire districts to fund the fire unit response coverage to match the risks to be protected within available funding. Many communities cannot fund the services necessary to guarantee optimum response times. Within nationally published best practice advice, and in Citygate's experience, fire/EMS travel time for the first-due unit in an urban environment is ideally planned for 4:00 to 5:00 minutes. In suburban areas, an 8:00-minute travel time for fire and/or paramedics to arrive is common. For rural communities, travel time can range up to 12:00 minutes or more.

In the Fire Department's data related to existing travel times on the unmodified roadway within the corridor, fire unit speeds are materially faster than a controlled roadway in an urban/suburban setting. Normally, fire units do not drive 5–10 mph faster than the posted speed limits on surface (not freeway) streets.

ROUNDABOUT AND TRAFFIC SIGNAL RESEARCH

The Valley Center Road Corridor Concept Plan utilizes several traffic safety improvements, two of which are a combination of traffic signals and roundabouts. The conceptual design by MBI for the roundabouts uses typical engineered "turn templates." The CCP's layout of the roundabouts includes two circulating lanes, wide entry lanes, a truck apron on the innermost lane, and other features that will ensure large vehicles—including fire aerial ladder trucks, pumper trucks, and large commercial vehicles including tractor trailers or smaller, towed trailers—can easily and safely navigate the roundabouts mixed with the passenger vehicles. In reviewing the proposed roundabout design (MBI Exhibits 1 and 2), Citygate observes three key features of the roundabouts that provide easy access for large vehicles:

1. Wider entry lanes

2. An inside apron that can be driven over by rear wheels (as opposed to a high-sided curb with a planter bed)

3. Two wide lanes fully encircling each roundabout.

Turn templates have been provided (Exhibits 4, 5, and 6 to this report) to show how large vehicles will be able to navigate the roundabouts, including addressing the dimensions of the largest VCFPD vehicle (aerial ladder truck) and a Cal Fire truck with bulldozer trailer. In reviewing the current literature on roundabouts, Citygate determined the proposed roundabout design to represent best practice for both larger vehicles and higher-volume traffic throughput. Roundabouts may not be as common in the United States as they are abroad, but they are also not rare. Along with our legacy experience with traffic safety design impacts on emergency services, Citygate researched the most recent findings related to roundabouts both in the United States and abroad.

The articles and data reviewed by Citygate found that roundabouts moved higher volumes of traffic more efficiently than a standard signalized intersection. We did not find any research or professional journal articles stating that roundabouts slowed or hampered emergency unit travel. In fact, we did find relevant positive articles/media about the use of roundabouts for emergency evacuations. Two of them are provided by Citygate as Exhibits 12 and 13 to this report.

Further, in Citygate's review of relevant research, roundabout design was, in fact, perceived as safer, given that it eliminates "T-bone" intersection accidents with emergency vehicles. In a signalized intersection, even with traffic light preemption in the emergency unit's direction of travel, it can occur (and has occurred) that a driver does not notice their green light changing to red sooner than expected, or the driver is otherwise impaired or distracted and runs a red light, hitting the side of a fire or ambulance unit. Because of this, all fire and ambulance drivers are trained to *decrease* speed when traveling through intersections—even with a green light—until they can ensure that cross traffic has seen them and will stop. Thus, the basic premise of the California Vehicle Code for use of red lights / sirens is that these devices allow the emergency unit to "request the right-of-way" safely as to not endanger members of the public, who may not see or hear the red lights and sirens when the public otherwise has the right-of-way.

By comparison, where roundabouts are utilized, traffic is continually flowing and, as an emergency vehicle approaches a roundabout, cars that have not yet entered can normally pull over to the right. Vehicles inside the roundabout can exit and then also pull over to the right. The emergency unit flows through without coming to a complete stop, as could occur when requesting access through a stop sign or red light. While vehicles should clear the intersection when an emergency vehicle is approaching, it is possible that a car in the two-lane roundabout could stop in the outermost (right) lane and the emergency unit would still have the inside lane to use.

In traffic engineering flow models, data does exist which measures the lag time delay of a signalized intersection versus a roundabout. MBI Exhibits 7 and 8 of this report summarize the average delay per vehicle during AM and PM peak hours for all approaches at each of the studied intersections. These tables compare the existing traffic control to design Options A and B at high-demand traffic during AM and PM peak hours. As the table shows, the safety improvements' impact on travel times for non-emergency traffic—in order from what causes the most delay to what causes the least delay—are stop signs, traffic signals, and roundabouts. An option without roundabouts creates the greatest intersection delay of the options to consider.

The intersection performance tables shown in Exhibits 7 and 8 factored into the modeling of VCFPD travel times per Options A and B and a "no roundabout" option. MBI Exhibit 9 provides this modeling of VCFPD travel times. Citygate then compared the traffic safety control measure time delays to the overall impact on fire and ambulance response times.

Citygate observes that, northbound from the fire station on Lilac Road to Cole Grade Road, Option A, with a single roundabout in addition to the other proposed safety controls, is 0:24 seconds slower. Option B is 0:36 seconds slower. A "no roundabout" option is 1:00 minute slower.

As for fire unit travel southbound from the fire station, at Woods Valley Road and Valley Center Road, a traffic signal already exists. Under either design (Option A or Option B), a single roundabout delay in addition to the other proposed safety controls is just 0:14 seconds slower by comparison. A "no roundabout" option is 0:17 seconds slower.

Finding #2: The two roundabouts proposed in Option A and Option B are consistent with best practices and will impact fire unit travel times less than traffic signals while being safer for the motoring public and firefighters requesting emergency right-of-way. For both Options A and B, there are only two roundabouts proposed for the CCP—one north of Lilac Road, and one south of Lilac Road. Based on the location of Station 1 (Lilac Road), a Valley Center Fire unit would typically only encounter one roundabout during a response. The lag factor for multiple added traffic signals will be far greater than it will be for the one roundabout.

Given (1) the expected increase in traffic volume due to future development, and (2) the understanding that implementing any CCP safety design options will result in the addition of intersection controls, it is Citygate's experience that, after all envisioned safety improvements are made, the roadway will no longer facilitate emergency vehicles traveling materially faster (regularly and for long distances) above the posted speed limits. The question, then, is how much of a delay will be caused *in total* to either end of the corridor (CCP's geographic scope, extending from the Woods Valley Road intersection to the Cole Grade Road intersection) from Valley Center Fire Station 1, and will the resulting lag be significant enough to materially matter?

CCP Changes Modeled on Fire/EMS Response Times

Citygate used the historical Fire Department travel time data for comparison to the CCP traffic control modeling software outputs from MBI. Their computer software (Synchro v11) utilizes the Highway Capacity Manual (6th Edition) methodology, which is a widely accepted approach and is consistent with the County's requirements for intersection analysis as outlined in the County of San Diego Transportation Study Guidelines (September 2022). The software calculations consider many factors such as volume, speed, and intersection control designs. As of this writing, there are three options being analyzed in this modeling for the Valley Center Road Corridor Concept Plan—Option A, Option B, and a "no roundabout" option.

Fire/EMS unit travel time is a combination of the travel speeds along a given roadway segment and the delay at an intersection (i.e., red light at a traffic signal). The following travel time summary table from MBI is a "baseline (calibrated)" output. This is needed as prior uncontrolled, open road Fire/EMS travel times cannot be compared to the effort of just one CCP option change, be it a change in speed limit or intersection design. There must be an "apples to apples" model that accounts for what all the *collective* CCP changes will create, including different intersection types such as signals or roundabouts.

The baseline model uses a "ceiling cap" on all travel speeds of the (posted) 45 mph speed limit in all sections. Everything less than 45 mph remained the same as the raw data received from the historical fire Automatic Vehicle Location (AVL) maps. In practical terms, this means that the emergency vehicle is travelling with the flow of traffic, but no more than the posted speed limit. Added to this, the baseline traffic safety improvements are the primary delay variable from the intersection control modifications for both Option A, Option B, and the "no roundabout" option. Therefore, the comparisons for this emergency unit travel time study are the delay associated with the three intersection control design choices. The following comparison table (and in the attached MBI Exhibit 9) also forecast 2035 traffic as an additional variable contributing to future travel time delay.

Table 1—MBI Exhibit 9 – Valley Center Road Modeled VCFPD Travel Time Comparison

Scenario		Northbound / Eastbound	Southbound
		Lilac Road to Cole Grade Road	Lilac Road to Woods Valley Road
Based on Existing Traffic Volumes			
Baseline (Calibrated)	Travel Time	4:31	2:49
Option A	Travel Time	4:55	3:03
	Difference	+0:24	+0:14
Option B	Travel Time	5:07	3:03
	Difference	+0:36	+0:14
No Roundabouts	Travel Time	5:31	3:06
	Difference	+1:00	+0:17
Based on Future Year 2035 Traffic Volumes			
Baseline (Calibrated)	Travel Time	4:55	2:51
Option A	Travel Time	5:23	3:07
	Difference	+0:28	+0:16
Option B	Travel Time	5:40	3:07
	Difference	+0:45	+0:16
No Roundabouts	Travel Time	6:17	3:11
	Difference	+1:22	+0:20
Difference between Existing and Future Year 2035			
Baseline (Calibrated)		+0:24	+0:02
Option A		+0:28	+0:04
Option B		+0:33	+0:04
No Roundabouts		+0:46	+0:05

All times are shown in minutes : seconds

Notes:

- Baseline (Calibrated) scenario utilizes actual speeds provided by automatic vehicle location (AVL) data. For segments that were greater than the posted speed limit (45 mph), a ceiling cap of 45 mph was applied. For speeds lower than 45 mph, actual speeds were used.
- Options A and B assume the same segment speeds as the Baseline condition and only consider the change in delay associated with the intersection control modifications.
- South of Lilac Road, Option A and Option B have the same intersection controls and geometry. Therefore, the estimated travel times in the southbound direction are assumed to be identical.
- All travel time estimates utilize PM Peak-Hour intersection delays as this scenario is shown to be the worst-case study scenario.
- All travel time estimates utilize the approach delay for the direction of travel (i.e., northbound/eastbound or southbound approaches to the intersection).

The result from the integrated travel time model intersection controls on the *north* section of the corridor ranges from a 0:24-second to 0:36-second travel time *increase* from all intersection controls (one of which is a roundabout). The "no roundabout" option increases travel time by 1:00

minute. In the *south* section of the corridor, there is a 0:14-second increase (again, one control is a roundabout) and a "no roundabout" increase of 0:17 seconds. The Fire District's travel times from Fire Station 1 to incidents well past the corridor are typical of longer travel times to edge suburban and rural areas. The traffic safety plan control small increases of less than a maximum of 0:36 seconds is not long enough to materially change current Fire District customer service delivery.

Finding #3: In Citygate's experience, increased traffic and added development along the corridor will result in the need for additional intersection control requirements at some point in the near term—even without a Corridor Concept Plan. Therefore, response times will be affected by congestion, an increased number and use of side streets/driveways, and controls such as traffic signals.

Finding #4: Increasing traffic and resultant required traffic controls will lengthen emergency unit travel time. The current CCP strategies only lengthen travel times by 0:14 to 0:36 seconds compared to longer anticipated delays with other options.

Finding #5: The least traffic safety impact to response times will be the options with roundabouts proposed as part the CCP. The small roadway design impact on fire or ambulance unit travel time must be contrasted with the overall improvements in traffic and pedestrian safety.

ROUNDABOUTS AND EVACUATION ROUTE USE

Citygate reviewed the available professional publications in the United States and abroad and found *nothing* professionally published in fire service or traffic engineering literature citing that roundabouts would harm evacuation routing and thus should be banned where formal evacuation routes are planned. Valley Center Road is a formal evacuation route in either direction depending on the emergency. Should an evacuation or emergency event occur, Valley Center will need to evacuate while allowing mutual aid emergency responders into the community. Thus, corridor evacuation planning must include two options: (1) using standard road design to allow movement both in and out, or (2) "contra-flow" design where all lanes are used for outbound traffic only. The CCP roundabout design in Options A and B, with two lanes, provides for either flow option. In the event of any evacuation, human traffic control guidance is required at both traffic signals and roundabouts. In the event of a power failure, an officer may be required to direct traffic at signalized intersections. In the power failure situation, roundabouts still work and do not require

signal controls while also maintaining a smoother flow than a four-way stop without a traffic control officer.

Citygate found two sources regarding roundabouts in evacuation scenarios, and they also require human control with a handheld sign and traffic cones to restrict movement inside the roundabout to only one in to one out. There is an excellent video from Australia of a working roundabout during an evacuation (see the video web link in the footnote and screenshot image in Exhibit 12) and it shows that a roundabout has the capacity to move a large volume of traffic smoothly.[4]

Citygate also found one published article (Exhibit 13) from the Traffic Operations Manager of Clearwater Beach, Florida entitled "Round is Resilient."[5] As a result of Hurricane Charlie, the city had to contraflow and double the capacity of the main roundabout entering the City. The resultant plan worked, increasing capacity and only requiring minor oversight from a traffic officer.

Finding #6:	The proposed roundabouts in the CCP Options A and B will not slow or hamper evacuation route use and, in fact, would provide a smoother flow and higher capacity than a four-way intersection.

[4] https://commons.wikimedia.org/wiki/File:Contraflow_traffic_through_roundabout_on_North_Beach_Road.ogv

[5] https://www.naplesgov.com/sites/default/files/fileattachments/streets_amp_stormwater/project/3361/fes_round_is_resilient.pdf