

Interstate 880 (I-880) is 47 miles long. It runs north and south from the I-880/I-280 interchange in San Jose to the West Grand Avenue/I-880 interchange in Oakland and connects major cities and airports in the San Francisco Bay Area. This corridor is essential to the state and country's economy, defense, and mobility. It is also one of the most congested freeways in the Bay Area and is in the top 100 most congested freeways in the US. Ramp metering is a proven traffic management strategy. It is to maintain an efficient freeway system by keeping it operating at or near capacity otherwise it would have been congested.



Figure 1 Ramp meters on I-880

Ramp meters (Figure 1) have been in operation on I-880 in Santa Clara County since 1977 and in Alameda County since 1996. There are a total of 134 on-ramps and connectors along this I-880 corridor. There are 64 ramp meters in the northbound (NB) direction and 70 in the southbound (SB) direction.

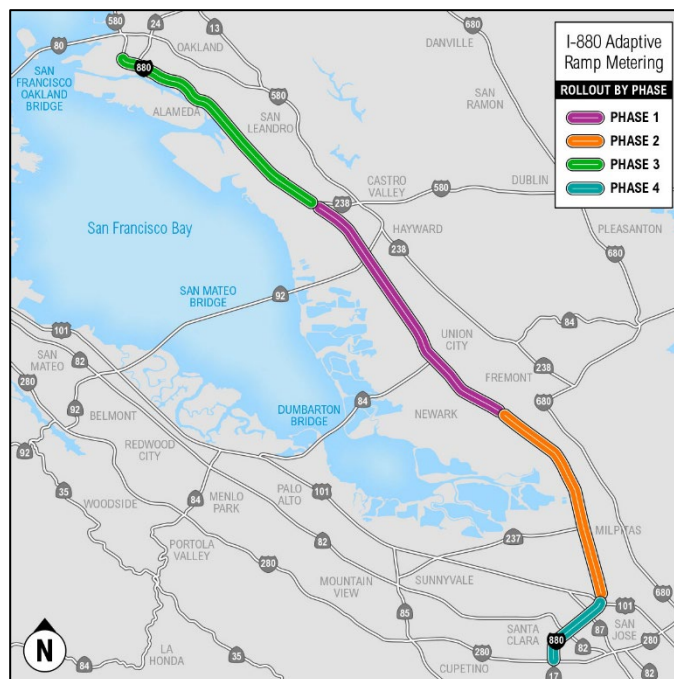


Figure 2 Phase 1 through Phase 4 segments on I-880

Local traffic responsive metering had been used on this corridor since 1977. The metering rates at each freeway entrance ramp were determined by the historical traffic data of the freeway near that metered on-ramps. Under the local responsive metering approach, the ramp metering hours of operation on I-880 were limited to fixed and pre-determined AM and/or PM peak periods. With funding from the Metropolitan Transportation Commission (MTC), Caltrans in cooperation with the local agencies along the I-880 corridor and Parsons have implemented a new ramp metering approach on the I-880, called I-880 Adaptive Ramp Metering or I-880 ARM. The project limits cover the whole I-880 corridor.

The goal of I-880 ARM is to optimize traffic flow along the whole I-880 corridor, rather than at a local segment on the freeway as used in the local traffic responsive metering approach. The uniqueness about I-880 ARM is that its metering rates are determined by Fuzzy-Logic algorithms, which are used to analyze real-time traffic conditions. The metering rates of the I-880 ARM are dynamic and interactive depending on the downstream mainline traffic conditions and the queues on local streets. This ARM approach can respond to non-recurring congestion and events. It can adapt to the changes in traffic condition or travel patterns; including seasonal, weekday, and weekend traffic variations, and the traffic growth over time. Thus, the I-880 ARM provides additional benefits compared to the previous traditional local traffic responsive ramp metering approach. The new ramp metering operational hours are from 5 AM to 8 PM on weekdays. The metering lights can be cycled or rest-in-green to manage traffic on the freeway and respond to the current downstream traffic conditions and the entrance ramp queue lengths as needed. With I-880 ARM, ramp metering controllers and detectors have been upgraded to new life cycles resulting in a change of the ramp metering system asset conditions for the I-880 corridor from poor to good.

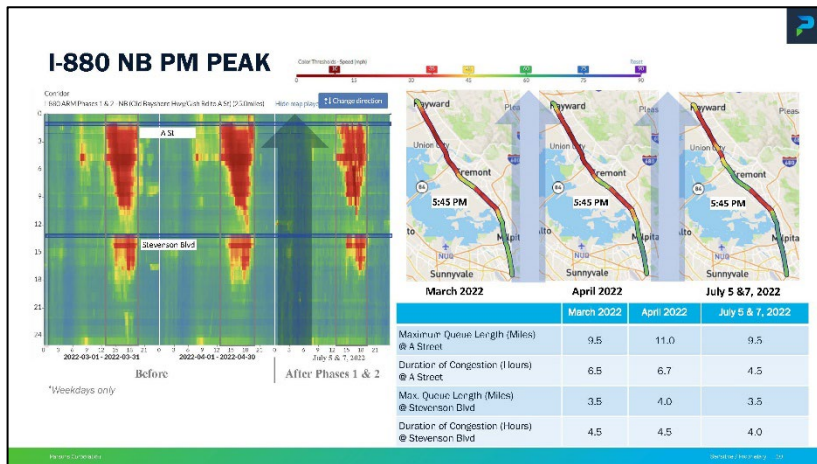


Figure 3 The queue & the congestion conditions on NB I-880 during the peak periods

The implementation of I-880 ARM covers different I-880 segments from Phase 1 through Phase 4 (Figure 2). Metering lights are rest in green from 5 AM to 8 PM on the weekends to alert the public that weekend metering will begin soon. After the completion of Phase 4, ARM will start cycling during the weekend for the whole I-880 corridor. The I-880 ARM implementation is expected to be completed in the Fall of 2022. So far, Phases 1 through 3 have been completed. Phase 1 covers the NB I-880 between Thornton Avenue and West A Street and on the SB I-880 between SR 238 and Mowry Avenue. Phase 2 includes the NB I-880 from Old Bayshore Highway to Mowry Avenue and the SB I-880 from Mowry Avenue to Montague Expressway.. Phase 3 spans from Lewelling Boulevard to W Grand Avenue in the NB direction and from 7th Street to Washington Avenue in the SB direction. Field observations and performance

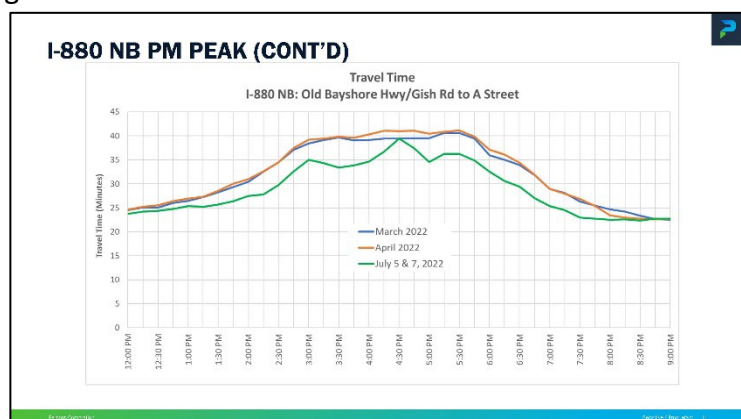


Figure 2 The travel times along NB I-880 in Phase 1 and 2 during 12 PM to 9 PM

before (March-April 2022) and after (July 2022) activation of ARM were conducted and summarized by Caltrans and Parsons.

The results from the INRIX roadway analytics during the peak periods before and after the implementation are displayed and compared in Figure 5. Along the NB I-880 in Phases 1 and 2

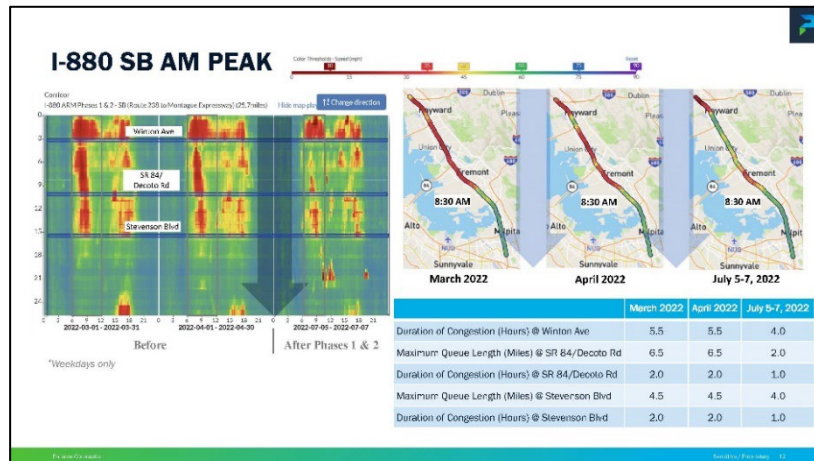


Figure 5 The queue & the congestion conditions on SB I-880 during the peak periods

segments in Phases 1 and 2, during 12 PM to 9 PM and after ARM implementation can also be seen (Figure 4). Along the SB I-880 in Phases 1 and 2, there are at least three bottlenecks; at the Winton Avenue interchange, at the SR 84/Decoto Road interchange, and at the Stevenson

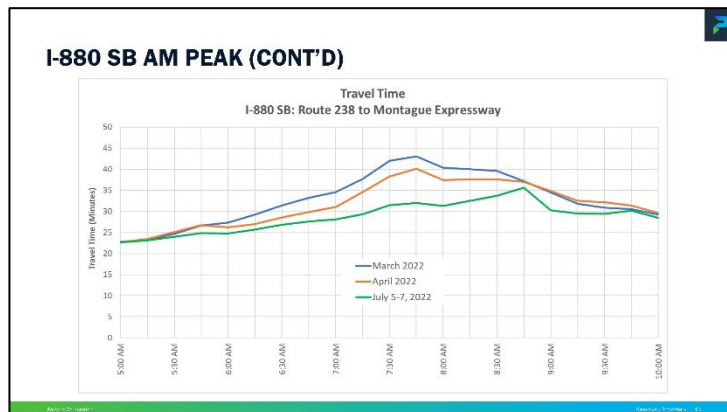


Figure 6 The travel times along SB I-880 in Phase 1 and 2 during 5 AM to 10 AM

operations and minimize traffic impact.

The I-880 ARM is also part of the I-880 Integrated Corridor Management (ICM) plan that includes installation of Closed-Circuit Television cameras (CCTVs) and traffic Monitoring Stations (TMSs); Vehicle Detection Systems (VDSs), Changeable Message Signs (CMSs), and electronic toll collection systems (FasTrak); and the trunk lines of fiber optics cables. The complete I-880 ICM plan is expected to reduce the congestion and further improve freeway travel time reliability along I-880.

during the peak period between around 1 PM to 8 PM, we identified two bottlenecks at Stevenson Boulevard interchange and at the West A Street interchange (Figure 3). After the I-880 ARM implementation, the decrease of the queue lengths and the congestion durations at both bottlenecks has been observed. The decline in the travel times (the green solid line) through the I-880 segments in Phases 1 and 2, between 5 AM to 10 AM after the implementation can also be found in the green line of Figure 6. Caltrans continues working and adjusting the ARM system and detector settings to optimize freeway