TO: Jennifer Gates and Jack Lorbeer, City of Encinitas

FROM: Sherry Ryan, CR Associates

DATE: May 11, 2022

RE: AIM Metric & GHG Reduction Estimation – City of Encinitas MAP Project

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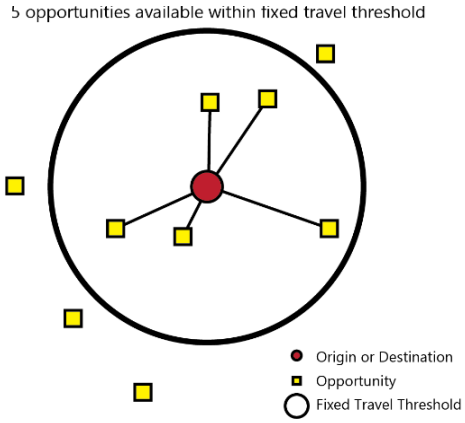
Purpose

The purpose of this memorandum is to describe the process used to estimate the GHG reduction attributable to individual Encinitas ATP projects. The Encinitas Climate Action Plan estimated that the implementation of all ATP projects would result in a reduction of GHG emissions by 254 tons citywide. The steps taken to estimate the contribution of individual ATP projects toward that total reduction involved the use of the Accessibility Improvement Measure (AIM), which measures how an active transportation project contributes to increased cycling or walking access between citywide origins and various active travel trip-attracting destinations. This measure was generated for all recommended bicycle and pedestrian projects identified in the Encinitas ATP. The remaining sections of the memorandum provide a background and overview of AIM, including how it is calculated for each project. The memorandum concludes by describing how AIM is applied to estimate GHG reduction.

Background

AIM is an *access measurement*, which includes a broad suite of methodologies for quantifying destinations or opportunities that are reachable from origins within a specified travel cost or distance (El-Geneidy and Levinson, 2006). Access measurements are useful because the outputs facilitate consistent comparisons across a study area by normalizing for inputs (population, destinations, and networks) that are otherwise distorted by irregular spatial distribution and scale. Access measurements are often used to help better understand travel behavior, make comparisons between modes, and analyze the nexus of transportation systems and land use. They have proliferated in the study of travel behavior as the processing capabilities of Geographic Information Systems (GIS) software has improved and a wider variety of spatial datasets are available.

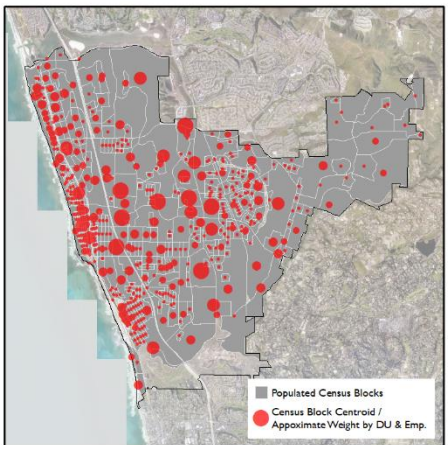


An abstract representation of an access measurement from one origin, showing a count of opportunities within a given travelshed.

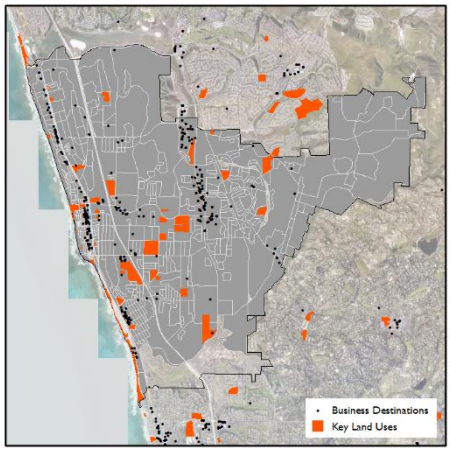
AIM Overview

In AIM, destinations accessible within a defined travelshed are quantified for each origin in the city under multiple network scenarios, including Ideal Conditions, Existing Conditions, and Project Conditions. A typical bicycle travelshed is 2-miles and at pedestrian travelshed is 1-mile. The destinations captured within each origin's travelshed in the different scenarios are quantified in a measure called the "Opportunity Score" (OS). The OSs are used to establish peak potential conditions, baseline conditions, and to determine the improvement in access generated by each project citywide. The AIM score is calculated by determining the increment of change between the OS with Project and the OS under Existing Conditions, across all citywide origins (typically defined as the centroid of a census geography). The sum of this change for all origins represents the collective improved access generated by a project citywide.

For the purposes of this study, origins are operationalized as the centroid of every populated census block in Encinitas. The census blocks are weighted by their combined dwelling units and employment. This weight factors into the calculation of the final AIM score, which measures the increment of change between OS with Project and OS under Existing Conditions.



*Census block centroids were used as **origins** in the analysis. For AIM scoring, each census block was weighted by its combined number of dwelling units and employment*

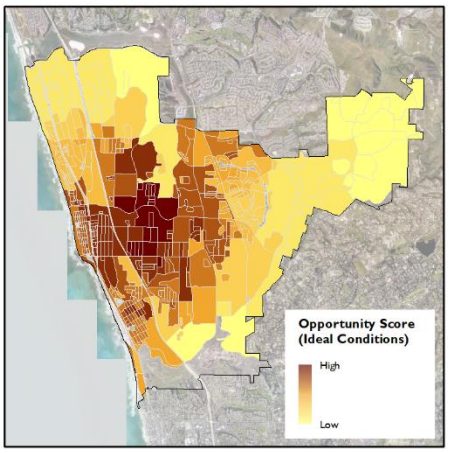


***Destinations** included key land uses (beaches, parks, schools, and libraries) and select business categories (grocery, drug, restaurants, drink/snack establishments, and retail)*

The OS is a composite index score, where the count of each destination type within the travelshed is transformed to a scale from 0 to 100. For example, if the OS analysis included consideration of 10 destination types, then the final OS would range from 0 to 1000. For land use destination types (parks, schools, beaches, etc), which are mostly community resources, we assigned a score of 100 if that use was present within the travelshed and 0 if it was not within the travelshed. For business destinations, we used the count of these establishments along with a multiplier to transform the count to 0 to 100.

The business types included in the AIM analysis are grocery stores, drug/health stores, restaurants, bar/snack/drink establishments, and retail. Business address locations were obtained from Data Axle, a marketing consultancy which maintains a comprehensive business location database.

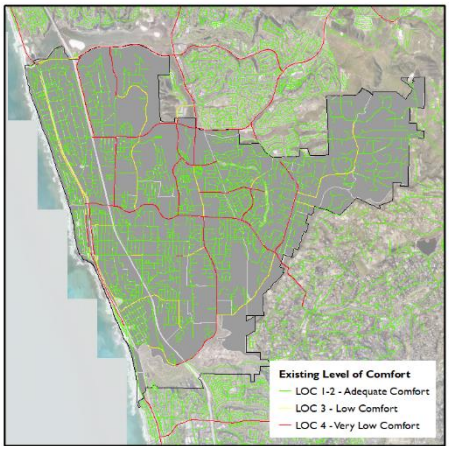
The network scenarios, briefly introduced earlier, include Ideal Conditions, Existing Conditions and Project Conditions. The assumptions associated with each network scenario, which generate variability in OS measurements, are described below.



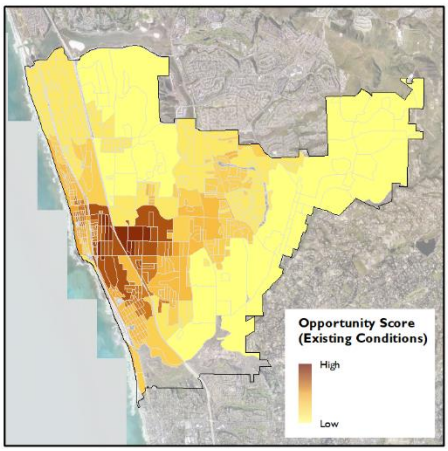
Opportunity Score under Ideal Conditions at bicycle travel threshold (2-miles)

Ideal Conditions – This scenario measures an origin's proximity to the selected categories of destinations within the travelshed, assuming conditions are 'ideal' for walking or bicycling, or put another way, without accounting and adjusting for deterrence that may be caused by high stress roadway conditions. High OSs in this scenario are indicative of areas with the most potential for bicycling or walking, based on where destinations within the city are geographically distributed, if the city's entire roadway network were improved to be comfortable for all users. The highest count of destinations in each business category captured by any one origin in this scenario are used to determine the multipliers for business categories in the subsequent scenarios.

Existing Conditions – This scenario measures an origin's proximity to the selected categories of destinations within the travelshed assuming low comfort roadway environments deter bicycling or walking trips of longer length. It is operationalized by assigning travel time penalties to low comfort roadways within the network[1], which thereby reduces an origin's accessibility to surrounding destinations. High OSs are less likely to be achieved in this scenario because of the prevalence of low comfort roadway environments. The Existing Conditions OS shows locations in the city where there are relatively better conditions for making bicycling or walking trips under actual roadway conditions. Locations where differences between Ideal and Existing Conditions OSs are the highest represents locations



Bicycle Existing Level of Comfort Conditions. Travel time penalties were assessed to Low and Very Low Comfort segments

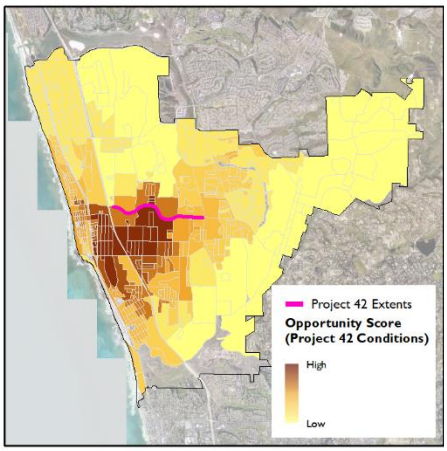


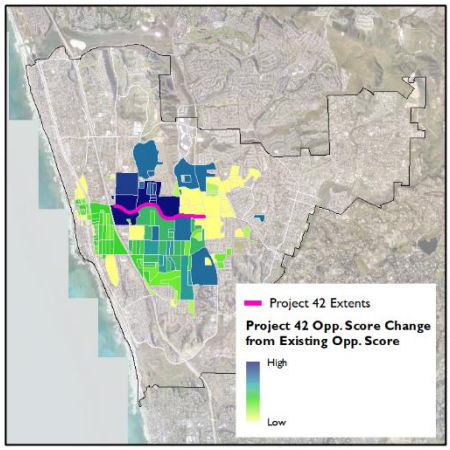
Opportunity Score under Existing Conditions at bicycle travel threshold (2-miles)

[1] High stress/low comfort conditions were based on Level of Comfort from the Encinitas ATP. LOC 3 Low Comfort roadways were assigned a travel time penalty multiplier of 2 (1 foot = 2 feet), LOC 4 Very Low Comfort roadways were assigned a travel time penalty multiplier of 3 (1 foot = 3 feet)

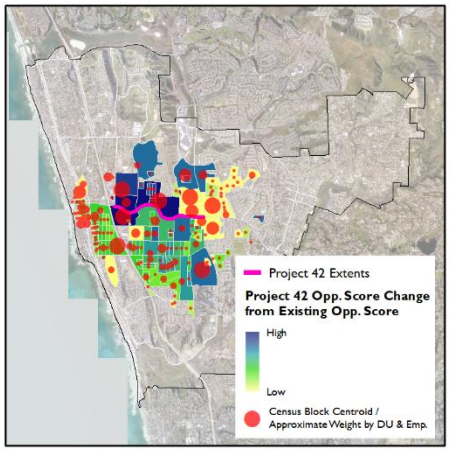
where improvements can have the most benefit. Projects targeted in these locations will have higher AIM scores, especially if they are well populated.

Project Conditions – This scenario measures an origin's proximity to the selected categories of destinations within the travelshed with the implementation of an ATP project. This scenario is calculated for each ATP project individually. It applies the same assumptions and network conditions as Existing Conditions, where travel time penalties are assigned to all high stress roadways within the network, except for the analyzed project extents – where the travel time penalty is eliminated or reduced because the infrastructure treatment has hypothetically improved the roadway's conditions. Differences in OSs between Existing Conditions and Project Conditions (shown in the images) reveal locations that benefit from the project in the form of increased access to surrounding destinations. This benefit is most pronounced closer to the project extents, though projects can also improve accessibility to destinations from origins not in the immediate vicinity.





As mentioned, the AIM score is calculated by subtracting the OS under Existing Conditions for all census blocks from the OS under Project Conditions. The differences in OS for each census block are multiplied by the dwelling unit and employment weighted percentage of each census block. The sum of differences from each census block citywide represents the AIM score.



The preceding sequence of images demonstrate the AIM calculation for bike project #42, which improved the conditions along Encinitas Boulevard between Interstate 5 and El Camino Real from Level of Comfort 4 to Level of Comfort 1.

This bicycle project received 80.5 points, the highest AIM score of all recommended projects. The project scored the highest because this part of the city (New Encinitas, centered around Encinitas Boulevard) has the highest potential for supporting bicycling trip-making, as evidenced by the map showing OS under Ideal Conditions. This project is situated between two major destination areas (coastal Encinitas and the El Camino Real corridor) at bikeable distances. Encinitas Boulevard is one of

the few roadways which links these two parts of the city. Improvements to that roadway would better link many populated areas.

In summary, the AIM score is related to proximity to destinations, population and employment levels nearby, and the project's ability to improve the conditions a roadway from very low/low comfort to adequate comfort for a significant stretch. Projects which do not score high are missing one or more of these components. Either those projects did not change the level of comfort significantly (or at all) or were in remote locations of the city that did not serve many trips.

Using AIM to Calculate GHG Reduction

The AIM measure provides an excellent approximation of mode shift potential for many non-commute trip types. Access measurements are often used to help better understand travel behavior, make comparisons between modes, and analyze the nexus of transportation systems and land use. The AIM measure builds on this by recognizing that despite proximity, pedestrians and bicyclists are also sensitive to the roadway environment and may still not elect to use those modes if they do not feel safe or comfortable. This is where the Existing Conditions and Project Conditions OS measurements come in play. If there is confidence in environmental measures such as Level of Comfort (used in the Encinitas ATP), Bicycle Level of Traffic Stress or various other inputs that exist to define the network quality, then AIM's series of OS measures may effectively capture the potential for walking and bicycling trip making (Ideal Conditions), the actual potential based on the environment (Existing Conditions), and a project's contribution to maximizing that potential (Project Conditions).

The AIM scores were subsequently converted to estimates of GHG reduction based on the proportion of each project's score to the sum of all project AIM scores. The Encinitas Climate Action Plan estimated that the implementation of all ATP projects would result in a reduction of GHG emissions by 254 tons citywide. Taking this research at face value, the AIM measure was then used to proportion this estimated GHG reduction to each project. The sum of all project AIM scores was 366, therefore, it was estimated that an AIM score point was worth 0.69 tons of GHG. Each ATP project's AIM score was multiplied by 0.69 tons and the resulting product was assumed to reflect that particular project contributed to the total estimate of GHG reduction.