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How Well Do New K-12 Public School Sites in California Incorporate Mitigation Measures Known to Reduce Vehicle Miles Traveled?

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How Well Do New K-12 Public School Sites in California Incorporate Mitigation Measures Known to Reduce Vehicle Miles Traveled?

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16. Abstract
California law (SB 743) requires school districts to measure the impact of school construction on the production of greenhouse gas emissions (GHG) and identify feasible mitigation measures that eliminate or substantially reduce the number of vehicle miles traveled (VMT) generated. This study analyzes 301 new schools constructed between 2008-2018 with respect to four VMT mitigation measures identified by the Governor's Office of Planning and Research (OPR) known to minimize VMT (proximity to high quality transit areas, proximity to roads with bicycle facilities, walkability scores, and proximity to electric vehicle charging stations). The analysis reveals mixed findings. Only about 16% of the new schools sited are located within ½ mile from high quality transit. About 65% of new school sites either connected or are close to (.06 miles or less) a bicycle network. Walkability scores varied greatly by location; approximately 60% of new school sites in "city" locales are considered walkable while sites in "rural" areas have low walkability scores. Nearly 60% (179) of new school sites are located within one mile of an EV charger, but only 19% are within one quarter mile.

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Executive Summary

Executive Summary

To support its policy goals of reducing greenhouse gas emissions (GHG), in recent years, California has enacted land use and transportation policies aimed at reducing vehicle miles traveled (VMT). One of these new policies, Senate Bill (SB) 743 (Steinberg, 2013), requires lead agencies to measure development impacts on VMT and identify feasible mitigation measures within the project that eliminate or substantially reduce VMT impact. Recommended mitigation measures have been developed by the California Governor's Office of Planning and Research (OPR) and focus on numerous built environment attributes that are known to minimize VMT, including disincentivizing private automobile reliance and promoting more "active" transportation modes (i.e., walking, bicycling, public transit, etc.). Where schools are located influences family travel patterns in the short run and spatial community development for decades. California's public school districts must adhere to this policy change and measure VMT impacts associated with proposed new school sites.

Scope of Paper

To establish an understanding of the state of new school siting in California prior to SB 743 implementation, this exploratory study analyzes recent years' new school siting outcomes in relation to numerous newly identified VMT mitigation measures. To this end, we developed a geo-spatial inventory of all land in the state under the ownership of California's K-12 school districts, selecting K-12 schools which had been constructed over the last decade (2008-2018) to use in our analysis. We then analyzed the spatial relationship between the 301 new school sites and four VMT mitigation measures (Proximity to High Quality Transit Area (HQTA), Proximity to Roads with Bicycle Facilities, Walkability Scores, and Proximity to Electric Vehicle (EV) charging stations), parsing the results by school- and locale-type.

Findings: Spatial Relationship between Newly Sited K-12 Public Schools and VMT Mitigation Measures in California

The 301 new school sites encompass 7,192 acres of land, with an average size of 23.9 acres. About two-thirds (67%) of the sites are less than 20 acres, while 12 percent of sites are larger than 50 acres. Overall, our analysis reveals mixed findings regarding how well newly sited K-12 public schools have incorporated these newly-recommended VMT mitigation measures, and these findings are described in Table 1 and Table 2.

Proximity to High Quality Transit Areas.

A high quality transit area (HQTA) is typically defined as an area within ½ mile of a bus, rail, or ferry stop that has a service frequency of 15 minutes or less during peak commute periods. Of the 301 new school sites, 16 percent are located within an HQTA, and 22 percent are located less than a third of a mile from an HQTA. Nearly half (47%) of newly sited schools, however, are located more than three miles from an HQTA. Lastly, newly sited high schools are most likely to be located in HQTAs (28%), while middle schools are least likely (0%). Schools located in “city” localities are also most likely to be in HQTAs (28%).

Proximity to Streets with Bicycle Facilities.

OPR recommends development projects that “orient toward bicycle facilities,” including connecting to or being near to streets with bicycle lanes. Nearly three-quarters (221) of the 301 new school sites are located within the five Metropolitan Planning Organizations that have bicycle network data available (covering 21 counties). These 221 sites are an average of .27 miles from a street with infrastructure for bicyclists, such as a buffered bike lane or a multi-use path. About 65 percent (143) of the 221 new school sites are either connected to or very close (.06 miles or less) to part of a bicycle network. When broken down by school type, three quarters or more of schools in each school type are within ¼ mile of bicycle facilities. Schools in “city” localities are also most often near bicycle facilities (89%), while only 50 percent of schools located in “town” and “rural” localities are near bicycle facilities.

Walkability Scores.

Walkability is a measure used to characterize the ease of pedestrian travel in an area. Higher walkability index scores (closer to 20), indicate a high level of walkability, while lower values (closer to 1) indicate less walkable areas. More than half (57%) of the newly sited schools in our analysis are not considered “walkable,” with walkability scores of less than 10.5. The average walkability score for the 301 new school sites is 10.14. Middle schools have the lowest average walkability scores (8.3), meaning they are less walkable than high schools, which are the most walkable with a walkability score of 11.5. Not surprisingly, “rural” localities have new school sites with lower walkability scores, averaging only 5.2.

Proximity to Electric Vehicle Charging Stations.

OPR recommends incorporating neighborhood EV networks into new developments to aid in lowering GHG emissions. The 301 new school sites have an average distance to an EV charger of 1.8 miles. Nearly 60 percent (179) of sites are located within one mile of an EV charger, while 11 percent are located over three miles from one. Overall, 19 percent of schools are located within ¼ mile of an EV charger, with 38 percent of K-12 schools and 30 percent of high schools within ¼ mile. Lastly, schools located in “city” localities are most frequently near EV charging infrastructure (26%).

Table 1. New School Proximity to Selected VMT Mitigation Infrastructure, by School Type

School Type	Number of New Schools	Percent of Schools Within an HQTA	Number of New Schools within ¼ Mile of Bike Infrastructure*	Average Walkability Score	Number of New Schools within ¼ Mile of an EV Charger
Elementary	131 (44%)	18 (14%)	75 (77%)	10.0	23 (18%)
Middle School	15 (5%)	0 (0%)	6 (75%)	8.3	4 (27%)
Middle/High School	13 (4%)	4 (31%)	10 (100%)	9.6	3 (23%)
High School	54 (18%)	15 (28%)	40 (93%)	11.5	16 (30%)
K-8	80 (27%)	9 (11%)	42 (76%)	10.0	8 (10%)
K-12	8 (3%)	1 (13%)	6 (75%)	9.6	3 (38%)
Total	**301 (100%)**	**47 (16%)**	**179 (81%)**	**-**	**57 (19%)**

*Only schools with available bicycle infrastructure data (n=221) were included in the analysis.

Table 2. New School Proximity to Selected VMT Mitigation Infrastructure, by School Type, by Locale Type

Locale Type	Number of New Schools	Percent of Schools Within an HQTA	Number of New Schools within ¼ Mile of Bike Infrastructure	Average Walkability Score	Number of New Schools within ¼ Mile of an EV Charger
City	155 (51%)	43 (28%)	109 (89%)	11.7	41 (26%)
Suburb	104 (35%)	4 (4%)	62 (76%)	9.0	14 (13%)
Town	23 (8%)	0 (0%)	4 (50%)	8.9	0 (0%)
Rural	19 (6%)	0 (0%)	4 (50%)	5.2	2 (11%)
Total	**301 (100%)**	**47 (16%)**	**179 (81%)**	**-**	**57 (19%)**

Recommendations

Overall, the study reveals mixed findings regarding how well newly sited K-12 public schools have incorporated VMT mitigation measures identified by OPR as aiding in SB 743 implementation. These findings suggest that local school siting practices may need to change to effectively adhere to SB 743 objectives and to better incorporate VMT mitigation measures. There are several steps that the California Department of Education (CDE) could take.

Improve the state's data collection on new school sites. The CDE should create a simple, user-friendly tracking system that records all sites obtaining The CDE approval each year, which would include basic information on the year approved, size, spatial boundaries/geographic coordinates, links to site approval documents, and a list of the school(s) that ended up being built on the sites.

Update site selection and development guidance to school districts to recommend incorporating known VMT mitigation measures as identified by the OPR. New school sites incorporating VMT mitigation measures should be given funding priority (and/or other incentives in the state's School Facility Program), which provides grants to school districts for purchasing school sites and constructing new schools.

Provide technical assistance to school districts on incorporating VMT mitigation measures into school siting decisions and site plans. This guidance should be developed in collaboration with OPR and could include workshops, case examples, and tools/templates. The CDE and the OPR should facilitate knowledge sharing among school districts, local governments, and Metropolitan Planning Organizations in the site design process to develop successful partnerships to incorporate VMT mitigation measures on or near school sites.

Support interventions that reduce VMT at existing school sites. As enrollment growth continues to slow statewide, construction of new schools will likely also slow. Thus, it is important to consider ways to reduce VMT associated with existing schools. This should include funding to expand Safe Routes to School programs, installation of EV chargers on school sites, installation of bicycle parking/storage infrastructure, and creating new bicycle path connecters.

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Introduction

To support its policy goals of reducing greenhouse gas emissions (GHG), in recent years California has enacted land use and transportation policies aimed at reducing vehicle miles traveled (VMT). One of these policies, established by the passage of Senate Bill (SB) 743,[1] introduces a new way to analyze transportation impacts of proposed development. Beginning July 1, 2020, a land use project developer (known as a "lead agency") must measure impacts on VMT and identify feasible mitigation measures within the project that eliminate or substantially reduce its VMT impact. Recommended mitigation measures have been developed by the California Governor's Office of Planning and Research (OPR) and focus on numerous built environment attributes that are known to minimize VMT, including disincentivizing private automobile reliance and promoting more "active" transportation modes (i.e., walking, bicycling, public transit, etc.).

When siting new schools, California's public school districts are considered "lead agencies" in development and, to comply with the new law, must now measure VMT impacts associated with proposed new school sites. To establish an understanding of the state of new school siting in California prior to SB 743 changes, this exploratory study analyzes recent years' new school siting outcomes in relation to the newly identified VMT mitigation measures. A better understanding of this will reveal to what degree school siting practices in California may have to shift in order to comply with SB 743 objectives.

Some concerns about local school siting decisions in relation to land use and transportation outcomes have been raised in local California communities. For example, a 2017 letter from the Contra Costa County Board of Supervisors to Assemblymember Patrick O'Donnell of the Assembly Education Committee stated, "Currently, school siting practices are in direct conflict with numerous state policies and goals including safe routes to school, complete streets, Health in All Policies, greenhouse gas reduction efforts, etc. There is no debate on this point" (*1*). While it is unknown how widespread such conflicts may be statewide, it is clear that where a new school is sited has impacts on local land use and transportation.

For our analysis, we developed a geo-spatial inventory of all land in the state under the ownership of California's K-12 school districts (also known as local educational agencies, or LEAs). We then identified the locations of public K-12 schools newly sited over the last decade (2008-2018). Next, we gathered available statewide spatial data on four mitigation measures identified by OPR. Lastly, we conducted spatial proximity analysis to understand the relationship between the new school sites and the mitigation measures.

This report proceeds as follows. First, we describe the California policy context for SB 743. Next, we outline our analytic approach by describing the data and methods used. From there, we provide a brief review of relevant literature related to school siting and VMT. Then, we present our findings from the

[1] Chapter 386, Statutes of 2013.

analysis of new school sites and their incorporation of and proximity to selected VMT reduction mitigation measures. Finally, we conclude with a discussion of policy considerations and recommendations for future research.

Policy Context: Mitigating VMT and GHG in California

The transportation sector creates the largest share of U.S. GHG, accounting for one-third of total pollution, mainly caused by burning fossil fuels for vehicles and other transportation modes (*2*). The relationship between land use development patterns, transportation, and VMT is becoming increasingly clear to land use and transportation planners, public health officials, and policy makers (*3*). For example, in 2009, the *Federal Surface Transportation Policy and Planning Act* established multiple goals, including reducing VMT (and transportation-generated GHG emissions) and increasing public transit use (*4*). California is among the states taking the most aggressive policy steps to reduce GHG emissions, particularly those that are transportation-generated through bills, including Assembly Bill 32 (*California Global Warming Solutions Act of 2006*), Senate Bill 375 (*Sustainable Communities and Climate Protection Act of 2008*), and Senate Bill 743.

Senate Bill 743's Policy Framework

The California Air Resources Board (CARB) reports that California's vehicle emissions and VMT are rising (*5*). CARB notes that many factors explain this trend, including housing unaffordability near jobs, increases in leisure travel, and a growth in single-occupancy vehicle travel, among other factors. While increases in fuel efficiency and reductions in the carbon content of fuel have reduced emissions per mile, relying on technology alone to meet the state's emissions reduction goals is, CARB argues, not enough. CARB concludes that automobile pollution will be a major obstacle to meeting mandated emissions reduction goals by 2030 "without significant changes to how communities and transportation systems are planned, funded, and built" (*5*).

In line with this recommendation, California has enacted numerous policies to curb low-density land development and reduce GHG emissions associated with automobile travel. A key policy strategy has been to increase alignment between local land use decision-making and transportation planning in a way that reduces automobile dependency, which in turn will reduce VMT and automobile emissions. Assembly Bill (AB) 32 set the state's overarching policy framework for a low-carbon future by legally requiring a sharp reduction in GHG emissions (*6*). SB 375 advanced AB 32's goals by instructing CARB to establish GHG reduction targets for metropolitan planning organizations (MPOs) to achieve based on land use patterns and transportation systems planning.

In accordance with this framework, the legislature passed SB 743 in 2013, which changed the way transportation impacts of proposed land development projects are analyzed under the California Environmental Quality Act (CEQA). In doing so, SB 743 fundamentally shifts the conventional method of transportation analysis to better measure and mitigate vehicle miles traveled associated with land development proposals (referred to as "induced travel"). The new method, described below, was required statewide beginning July 1, 2020 (*7*).

SB 743 directed the OPR to establish a new, alternative method for evaluating the transportation impacts of local land development proposals. Conventionally, this is done through a Level of Service (LOS) analysis, which models the way in which existing and planned roadways can move vehicles more efficiently. In an LOS framework, proposed development projects score better if vehicles move through the built environment more quickly, which often increases VMT. SB 743 called for a novel methodology with criteria that "promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses" (*Public Resources Code* § 21099(b)(1)). Measurements of transportation impacts may include "vehicle miles traveled, vehicle miles traveled per capita, automobile trip generation rates, or automobile trips generated" (*Public Resources Code* § 21099(b)(1)).

The alternative developed by OPR focuses on assessing induced travel — the VMT per capita generation associated with a land development project. This method takes the opposite approach to LOS; projects that score low in VMT generation fare better. OPR developed technical recommendations for how to assess VMT and how lead agencies should develop their own threshold of significance, a measure triggering more extensive environmental review. Lead agencies are granted discretion to develop and adopt their own or rely on thresholds recommended by other agencies. Under this new method, when a significant transportation impact is determined, the lead agency must identify feasible mitigation measures that could eliminate or substantially reduce that impact on VMT through the development of multimodal transportation networks and land use diversity (*Public Resources Code*, § 21002.1, subd. (a)).

To support the implementation of SB 743, OPR identifies numerous mitigation measures intended to avoid or substantially reduce the VMT impact of a land development project (*Public Resources Code* § 21002.1, subd. (a)). In its 2018 technical guidance to local governments (i.e., "lead agencies"), OPR states,

> …the selection of particular mitigation measures and alternatives are left to the discretion of the lead agency, and mitigation measures may vary, depending on the proposed project and significant impacts, if any. Further, OPR expects that agencies will continue to innovate and find new ways to reduce vehicular travel. (*7*)

According to OPR, "[p]otential measures to reduce vehicle miles traveled include, but are not limited to:

- Improve or increase access to transit.
- Increase access to common goods and services, such as groceries, schools, and daycare.
- Incorporate affordable housing into the project.
- Incorporate neighborhood electric vehicle network.
- Orient the project toward transit, bicycle and pedestrian facilities.
- Improve pedestrian or bicycle networks, or transit service.
- Provide traffic calming.
- Provide bicycle parking.
- Limit or eliminate parking supply.

- Unbundle parking costs.
- Provide parking or roadway pricing or cash-out programs.
- Implement or provide access to a commute reduction program.
- Provide car-sharing, bike sharing, and ride-sharing programs.
- Provide transit passes.
- Shifting single occupancy vehicle trips to carpooling or vanpooling, for example providing ride-matching services.
- Providing telework options.
- Providing incentives or subsidies that increase the use of modes other than single-occupancy vehicle.
- Providing on-site amenities at places of work, such as priority parking for carpools and vanpools, secure bike parking, and showers and locker rooms.
- Providing employee transportation coordinators at employment sites.
- Providing a guaranteed ride home service to users of non-auto modes." (*7*)

In general, OPR's recommendations focus on built environment attributes of the development (and other programmatic incentives) that reduce automobile reliance and promote more "active" transportation options to and from the site, such as walking, bicycling, and using public transit. The recommendations also encourage promoting electric vehicles (EV), which do not necessarily reduce VMT but do generate fewer GHG emissions.

California's public school districts are lead agencies when they choose locations to site new schools or other district-owned buildings. They are now required to conduct LOS analyses on proposed new school sites, and so, as of July 1, 2020, they must also adhere to the new SB 743 transportation analysis requirements and conduct VMT analyses. Complying with these regulations could play a significant role in helping the state reach its GHG emission reductions goal due to the number of students and teachers commuting to public schools daily.

Analytic Approach: Data and Methods

Our analytic approach involved identifying the locations of newly sited public K-12 schools in California from 2008-2018 and gathering available data on VMT mitigation measures on or near these sites, as outlined below.

To identify newly sited public K-12 schools, we created a robust geo-spatial inventory of all land in the state under the ownership of California's K-12 local educational agencies (LEAs). The spatial inventory was created in partnership with GreenInfo Network (GIN) and is an expansion of GIN's existing California School Campus Database (CSCD). CSCD is a curated database that uses the California Department of Education (CDE) school list, county assessor parcel ownership data from all 58 of California's counties, and geographic imagery (aerial and street view) to accurately identify all of California's public K-12 school campuses. We then geocoded individual school locations and spatially linked them to the parcel ownership data. Because no agency in California keeps a spatial record of new school sites that can be readily matched to the school(s) currently operating on the site, we manually matched the CDE school-level data to the school site spatial data. Last, we assembled relevant characteristic data on each school operating on these lands (e.g., enrollment and grade levels served). Characteristics for each school were then joined to the geo-spatial representation of each LEA property. K-12 LEAs consist of 522 elementary school districts, 76 high school districts, and 344 unified school districts.

Using this spatial inventory, we identified newly opened schools by filtering the CDE's administrative data, selecting only schools opened between the years 2008 and 2018. The most recent decade was selected to generate a larger dataset of new school sites for analysis. The resulting dataset includes 301 new school sites. All findings reported are for the 301 new sites, unless otherwise indicated.

Next, we collected available spatial data for the VMT mitigation measures recommended by the OPR in their SB 743 technical guidance document. We were able to assemble spatial data on four mitigation measures, as listed in Table 3 (*7*). For one of the mitigation measures (proximity to roads with bicycle lanes), we were only able to obtain spatial data covering the 21 counties of five of California's largest metropolitan planning organizations (MPOs): the Metropolitan Transportation Commission (MTC) in the Bay Area, the Southern California Association of Governments (SCAG), the Sacramento Council of Governments (SACOG), the Fresno Council of Governments (FCOG), and the San Joaquin Council of Governments (SJCOG).

With the data assembled, we then analyzed the spatial relationship between the 301 new school sites and the available VMT reduction mitigation measures to understand the spatial proximity between the two, parsing data by school type and locale type. School types were generated by grouping schools serving grades kindergarten to 6th as elementary, grades 7th and 8th as middle school, grades 7th to 12th as middle/high school, grades 9th to 12th as high school, a combo of grades K to 6 and 7th to 9th as K-8, and, finally, a combination of grades K to 6 plus 7th to 12th as K-12.

Last, we used National Center for Educational Statistics (NCES) locale code classifications to identify sites as being located in a “city,” “suburb,” “town,” or “rural” locality (*8*). The NCES locale code is a general geographic indicator that classifies the type of area where a school is located and is based on a twelve-category framework that includes four primary classifications (city, suburban, town, and rural) that each have three sub-types. Locale classifications are derived from urban and rural definitions used by the U.S. Census Bureau.

The appendix contains summary tables of findings by locale type, grade level, and county.

Table 3. Vehicle Miles Traveled (VMT) Mitigation Measures Used in Analysis

Mitigation Measure Identified by Office of Planning and Research	Data Layer	Geography of Data Layer	Source of Data Layer	Year of Data Layer	Definition of Data Layer
Locate the project near transit.	Proximity to High Quality Transit Area (HQTA)	Statewide	Othering & Belonging Institute at the University of California, Berkeley (https://mappingopportunityca.org)	2019	High Quality Transit Areas (HQTAs) are those within ¼ mile of a high quality bus stop and/or ½ mile of a major transit stop. Criteria for "high quality" derived from Senate Bill 827, Weiner available at https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB827. Geographic buffers around transit stops were created in a Geographic Information System (GIS).

Mitigation Measure Identified by Office of Planning and Research	Data Layer	Geography of Data Layer	Source of Data Layer	Year of Data Layer	Definition of Data Layer
Orient the project toward bicycle facilities.	Proximity to Roads with Bicycle Facilities	Counties in the following Metropolitan Planning Organizations (MPOs): Fresno Council of Governments (FCOG), Metropolitan Transportation Commission (MTC), Sacramento Area Council of Governments (SACOG), Southern California Association of Governments (SCAG), and San Joaquin Council of Governments (SJCOG)	Bike facilities shapefiles shared by Metropolitan Planning Organization (MPO) staff	2020 - 2021	Geolocation of bike facilities was shared by Metropolitan Planning Organization (MPO) staff. Only new school sites within the five MPO jurisdictions listed at left were used in bike facility analysis.
Orient the project toward pedestrian facilities.	Walkability Scores	Statewide	(https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=%7B251AFDD9-23A7-4068-9B27-A3048A7E6012%7D)	2019	The National Walkability Index is based on measures of the built environment that affect the probability of whether people walk as a mode of transportation: street intersection density, proximity to transit stops, and diversity of land uses. This metric is calculated by the US EPA for each Census block group.

Mitigation Measure Identified by Office of Planning and Research	Data Layer	Geography of Data Layer	Source of Data Layer	Year of Data Layer	Definition of Data Layer
Incorporate neighborhood electric vehicle network.	Proximity to EV charging stations	Statewide	(https://afdc.energy.gov/stations/#/analyze)	2020	The data in the Alternative Fueling Station Locator are gathered and verified through a variety of methods. The National Renewable Energy Laboratory (NREL) obtains information about new stations from trade media, Clean Cities coordinators, the Submit New Station form on the Station Locator website, and through collaborating with infrastructure equipment and fuel providers, original equipment manufacturers (OEMs), and industry groups. Existing stations in the database are contacted at least once a year on an established schedule to verify they are still operational and providing the fuel specified.

Travel to School, School Siting, and VMT

In this section, we provide a summary of the "travel to school" literature, with a focus on how our four selected mitigation measures situate within it. In general, the "travel to school" literature focuses on understanding mode split to school and the factors that affect mode choice by children and families in their travel to and from school. Much of this focus has been from a public health perspective, whereby more "active" transportation modes encourage more physical activity for school children. Concerns about the decline in active travel to school have been raised by childhood health proponents who argue that children's lack of physical activity is contributing to rising childhood obesity. Increased sedentary time in cars increases the risk of being overweight and reduces time for leisure physical activity, social relationships, civic engagement, and other health promoting behaviors (*9*). In addition to physical activity, active transportation to school has been found to help children better know their neighborhoods and become independent travelers, spurring cognitive development, knowledge acquisition, and a sense of community (*10*).

With more than 50 million children enrolled in U.S. public schools, travel to and from school each weekday accounts for a substantial amount of travel for children and families. According to the 2017 National Household Travel Survey, 54.2 percent of trips to school were taken in a private vehicle, 33.2 percent were taken in a yellow school bus, 10.4 percent were walking or bike trips, and 2.2 percent were taken on transit or some other form of transportation (*11*). In general, "active" modes to school, including walking and bicycling, have been losing mode share for decades across the country; in 1969, 41 percent of students were walking or bicycling to school (*12*, *13*). "Yellow school bus" use has also declined in recent decades as states and local districts reduce student transportation funding (*14*, *15*).

With more than 6.1 million students enrolled in public schools in California during the 2019-2020 academic year, it is important to understand how students are traveling to and from school within the state. According to the 2017 National Household Travel Survey – California Add-On dataset, 71 percent of trips taken to school were made by private vehicle (car, SUV, van, or pickup truck), 18 percent were walking or biking trips, 10 percent were taken in a yellow school bus, and 2 percent were taken via public transit or another mode.

To counter the declining use of active transportation modes, planners and policymakers have increasingly focused on the built environment, land use, and design changes that may promote more active, non-automobile travel modes to school (*16*). Studies have found that aspects of the urban form influence the likelihood that students will walk and/or bicycling to school (*1*, *17*, *18*). Street connectivity, sidewalk networks, and access to public transportation are the top three factors contributing to pedestrian-friendly school neighborhoods (*19*). Parent perceptions of safety and built environment characteristics also play strong roles in influencing student travel to school (*17*). When schools are located in automobile dominated neighborhoods, walking may be perceived as dangerous or unhealthy due to pollution levels and the lack of bike- and pedestrian-friendly infrastructure (*9*). Infrastructure improvements such as increasing intersection density and sidewalk connectivity, implementing traffic calming measures, and constructing sidewalks and bicycle facilities have shown promise for active travel to school (*20–22*).

School Siting, Site Size, and Land Use

New school locations influence family travel patterns in the short run and spatial community development for decades (*23*). U.S. Environmental Protection Agency (EPA) researchers found that building schools close to neighborhoods where students live, can reduce traffic, increase walking and biking by 13 percent, and could create a 15 percent emissions reduction as a result of decreased automobile travel to and from the school site (*24*). Outside of travel behavior, school siting decisions have multiple impacts on communities. Schools offer both a physical and social infrastructure for students, parents, and the neighborhood residents and can play a role in creating more sustainable lifelong travel habits.

An important factor in school siting is state minimum school site acreage policies. In the early 20th century, schools were often built on less than ten acres of land. Nationally, the past few decades have seen a trend toward building larger new schools (*1*). Now, schools are often built on 20 to 50 acres or more. Recommended acreage for schools can be very high, in part, due to state guidelines for athletic fields as well as policies aimed at reducing the number of students per classroom, which can mean more classrooms are needed on a campus (*25*). These changes have shaped school siting decisions by local school districts in favor of suburban and ex-urban areas with more available land to accommodate larger site and facility recommendations (*26*). The result is often increased local VMT and fewer opportunities for active commutes. Factoring VMT reduction strategies into school siting policy may prioritize low-carbon or carbon-free modes such as public transit, walking, or biking and empower school-aged children and their parents to utilize non-vehicular modes of transportation (*13*, *27*).

Public Transit Use

Public transit use has numerous economic, environmental, social equity, and personal health benefits. According to the American Public Transit Association, switching from private vehicles to transit can eliminate thousands of pounds of GHG emissions each year (*28*). Adequate transit also increases social, educational, and economic opportunities for physically or economically disadvantaged people and is, therefore, important to ensuring equal access to educational opportunity (*29*). Not only does public transit use reduce VMT and traffic congestion levels, it is also associated with increases in physical activity because transit is usually paired with walking at either or both ends of the trip (*27*, *30*).

A 2010 meta-analysis of the built environment travel literature found that transit use is strongly associated with transit access and that car commuters might switch to transit if a convenient transit route becomes available near their homes (*31*). In a panel study analyzing 87 U.S. urban areas, increasing transit ridership has been shown to significantly lower VMT per capita (*32*).

Public transit options, however, are often not convenient or feasible for school trips (*15*, *33*). While some cities across the U.S. have established programs for the use of public transit for school trips, this mode remains low nationally (*14*, *15*). Transit systems are often designed to transport workers to jobs in employment centers, while schools are often located in neighborhoods with poor transit access to local schools (*14*). Siting new schools near public transit stops may increase students' use of transit and decrease automobile trips to school.

Bicycle Facilities

While the largest social benefits from bicycling are health-related, bicycle commuting also helps reduce congestion levels as well as noise and air pollution. "Active" travel (bicycling and walking) also contributes to increases in productivity, community vitality, and social cohesion (*34*, *35*). Bicycling infrastructure such as bike lanes, lane protections for riders, and bicycle parking/storage has been shown to increase bicycle use for commute trips that would have otherwise been taken by car (*36*, *37*). Appropriate infrastructure such as protected bike lanes, which are physically separated from vehicular traffic, significantly increases bike safety and highlights the importance of a safe systems approach that prioritizes all road users' safety when designing roadway infrastructure (*38*). Promoting bicycling for school-aged children can enhance mental and emotional health, create healthy, active lifestyles, and is positively associated with cardiovascular fitness (*39*). There are, however, numerous barriers that prevent students from bicycling to school such as the distance from home to school and parental safety concerns. These findings stress the importance of highly connected streets and low traffic volumes in school catchment areas (*39*). Equally important to promoting safe bicycling are educational programs which develop children's motor skills (e.g., balancing, pedaling, and steering) and cognitive abilities (e.g., concentration and judgment) (*39*).

Walkability

People who live in walkable neighborhoods — neighborhoods with high population density, high frequency of neighborhood amenities, and small block sizes — are more likely to walk for many of their trips (*40*). Replacing half of all car trips in the U.S. that are less than one mile (totaling five billion miles) with walking could save hundreds of millions in fuel costs and approximately two million metric tons of CO_2 emissions per year (*41*). One's ability to safely walk around their neighborhood promotes regular physical activity, can help one manage obesity, boost one's mood, and reduce one's risk of heart disease, certain cancers, and diabetes (*42*). Improving walkability can "provide a variety of benefits, including accessibility, transport cost savings, improved public health, external cost reductions, more efficient land use, community livability, economic development, and support equity objectives" (*43*).

Distance from home to school also strongly impacts decisions to walk or drive (*27*, *44*). Children are most likely to walk to school when they live less than two miles away from their school (*13*). Children are also more likely to walk to school when their household does not have access to a vehicle, highlighting the equity implications of ensuring adequate infrastructure to support safely walking to school. When other modes are available, convenience is also frequently identified as a contributing factor to whether a child walks to school. As a result, school programs may be needed to create behavioral changes which could result in VMT reductions (*45*).

Electric Vehicles

While EVs do not reduce VMT, they do reduce emissions associated with travel, a core goal of VMT reduction. Proximity and access to a charging station is an important factor for consumers' adoption decisions (*46*). A 2021 study of California EV owners found that in recent years one in five switched back to owning a gas-powered car in large part because they felt that charging their plug-in EV was a hassle. About 70 percent of these owners reported not having a Level 2 charging station at home or at their workplace (*47*). Increasing public access to charging stations shows promise to promote electric car travel and reduce GHG. In 2020, Governor Newsom signed an executive order requiring that, by 2035, all new cars and passenger trucks sold in California be zero-emission vehicles (*48*). With a significant portion of the population traveling to public schools for employment or educational purposes, EV charging infrastructure on or near public school campuses may reduce GHG associated with travel to school sites.

Findings: Spatial Relationship between Newly Sited K-12 Public Schools and VMT Mitigation Measures in California

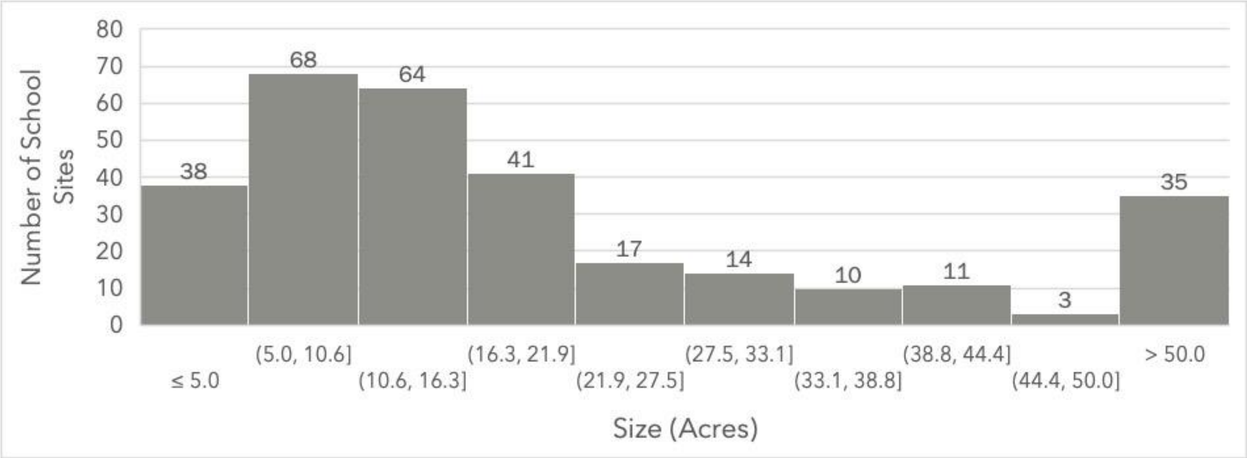
Guided by the preceding literature review, we now turn to reporting our findings analyzing the new schools sited between 2008 and 2018 in relation to VMT mitigation measures.

Of the 301 new public school sites, 44 percent are elementary schools, nine percent are either middle school or middle school and high school combined, and 18 percent are high schools, while 27 percent are K-8 schools, and three percent are K-12 schools, as shown in Table 4. In total, these sites encompass 7,192 acres of land.

Table 4. New Public K-12 Schools Sited in California 2008-2018, by Grade Level

School Type	Number of New Schools	Total Acres	Average Acres
Elementary	131 (44%)	1,615 (22%)	12.3
Middle School	15 (5%)	478 (7%)	31.9
Middle/High School	13 (4%)	631 (9%)	48.5
High School	54 (18%)	2,415 (34%)	44.7
K-8	80 (27%)	1,507 (21%)	18.8
K-12	8 (3%)	546 (8%)	68.2
Total	**301 (100%)**	**7,192 (100%)**	**-**

The average size of the 301 new school sites is 23.9 acres, but site size varies by grades served. About two-thirds (67%) of new school sites are on sites less than 20 acres, while about 12 percent are on sites larger than 50 acres, as shown in Figure 1.



Note: For histogram bin ranges: "(" excludes the value; "]" includes the value.

Figure 1. New Public K-12 Schools Sited in California 2008-2018, by Site Size

Generally, high schools require more land than middle schools and elementary schools to accommodate more athletic fields and parking — a trend that is confirmed in the analysis, as Table 4 shows. While 44 percent of new sites are elementary schools, they only amount to 22 percent of the total acreage of new school sites and are, on average, 12.3 acres per site. High schools, however, average approximately three times as many acres (44.7 acres) and consist of approximately 18 percent of all new sites and approximately 34 percent of the total acreage of new sites.

Interestingly, when broken down by locale type, we found that the average size of new school sites hovers between 21.3 and 24.1 acres for all sites in "city," "suburb," and "town" geographies, as shown in Table 5. On the other hand, average acreage of sites in "rural" localities nearly doubles to 42.2 acres. New schools are also sited in "city" geographies 51 percent of the time and account for 46 percent of the total size of new school sites.

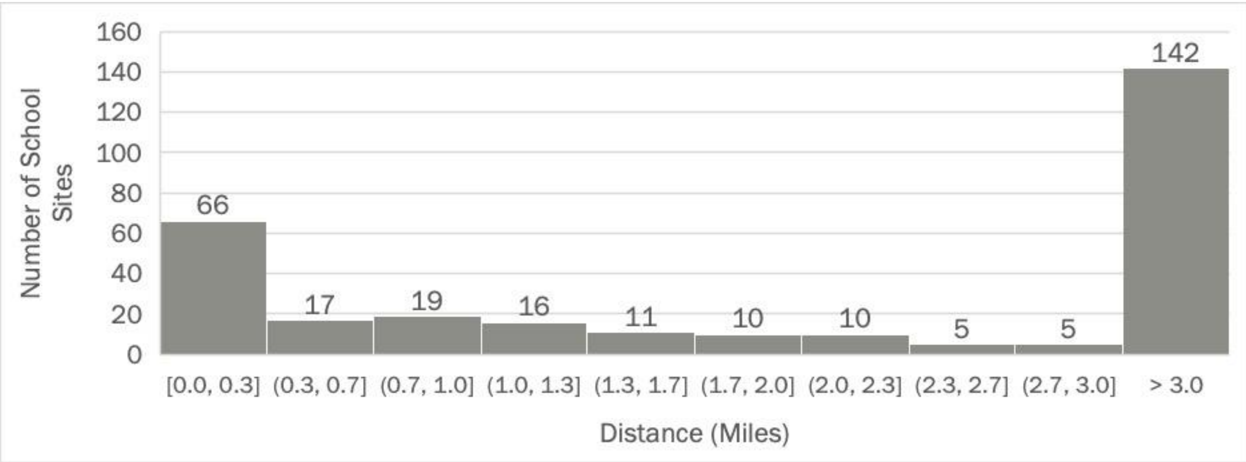
Table 5. New Public K-12 Schools Sited in California 2008-2018, by Locale Type

Locale Type	Number of New Schools	Total Acres	Average Acres
City	155 (51%)	3,302 (46%)	21.3
Suburb	104 (35%)	2,535 (35%)	24.4
Town	23 (8%)	554 (8%)	24.1
Rural	19 (6%)	802 (11%)	42.2
Total	**301 (100%)**	**7,192 (100%)**	-

Proximity to High Quality Transit Areas

Access to transit is a key factor known to help reduce reliance on private automobiles. A high quality transit area (HQTA) is typically defined as an area within ½ mile of a bus, rail, or ferry transit stop that has a service frequency (e.g., "headways") of 15 minutes or less during peak commute periods. In practical terms, this means that a person would never wait more than 15 minutes for a bus, train, or ferry during peak morning and evening commute hours.

Of the 301 new school sites, 22 percent are located less than a third of a mile from an HQTA. However, nearly half (47%) of newly sited schools are located more than three miles from an HQTA, as shown in Figure 2.



Note: For histogram bin ranges: "(" excludes the value; "]" includes the value.

Figure 2. New Public K-12 Schools Sited in California 2008-2018, by Distance to a High Quality Transit Area

Of all newly sited schools from 2008-2018, 16 percent are located in an HQTA, less than ½ mile from transit, as shown in Table 6. High schools are most likely to be located in HQTAs (28%), while middle schools are least likely (0%). Middle schools also are, on average, located farthest from an HQTA (10 miles).

Table 6. New Public K-12 Schools Sited in California 2008-2018, by Grade Level and Distance to a High Quality Transit Area

School Type	Number of New Schools	Schools in HQTA	Average Distance to HQTA (Miles)
Elementary	131 (44%)	18 (14%)	5.0
Middle School	15 (5%)	0 (0%)	10.0
Middle/High School	13 (4%)	4 (31%)	2.6
High School	54 (18%)	15 (28%)	3.7
K-8	80 (27%)	9 (11%)	9.6
K-12	8 (3%)	1 (13%)	4.4
Total	**301 (100%)**	**47 (16%)**	**-**

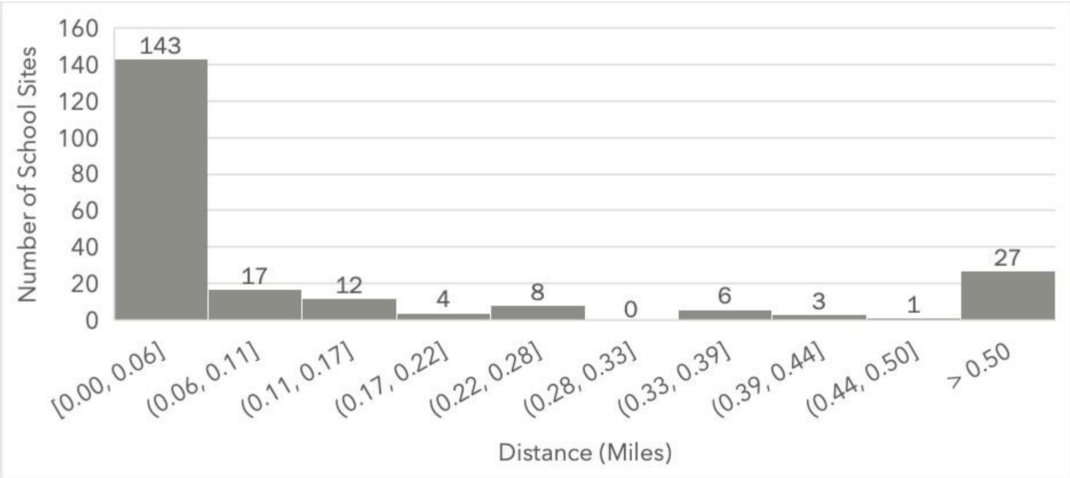
School sites in "city" locales are more likely to be in HQTAs, as shown in Table 7. Given that most HQTAs in California are located in more dense urban areas of the state, this finding is not surprising.

Table 7. New Public K-12 Schools Sited in California 2008-2018, by Locale Type and Distance to a High Quality Transit Area

Locale Type	Number of New Schools	Schools in HQTA	Average Distance to HQTA (Miles)
City	155 (51%)	43 (28%)	2.3
Suburb	104 (35%)	4 (4%)	4.9
Town	23 (8%)	0 (0%)	19.7
Rural	19 (6%)	0 (0%)	27.8
Total	**301 (100%)**	**47 (16%)**	**-**

Proximity to Streets with Bicycle Facilities

OPR recommends development projects that "orient toward bicycle facilities," including connecting to or being near to streets with bicycle lanes (*7*). Nearly three-quarters (221) of the 301 new school sites are located within the five metropolitan planning organizations (MPOs) that have bicycle network data available (covering a total of 21 counties), as shown in Table 8. These 221 sites are located an average of .27 miles from a street with infrastructure for bicyclists such as a protected lane or bike route. Additionally, about 65 percent (143) of the 221 new school sites are either connected to or very close (.06 miles or less) to a bike network, as shown in Figure 3. These findings indicate there is likely a high degree of bikeability for new school sites in the major metropolitan areas. Not surprisingly, school sites in less urbanized town and rural areas are much less likely to be proximal to streets with bicycle facilities.



Note: For histogram bin ranges: "(" excludes the value; "]" includes the value.

Figure 3. New Public K-12 Schools Sited in California MPOs 2008-2018, by Distance to Bike Infrastructure

One-hundred seventy nine (81%) of all new school sites are within ¼ mile of bicycle infrastructure, while 194 (88%) are within ½ mile of bicycle infrastructure, as shown in Table 8. Combined middle/high schools and high schools have the smallest average distances to bicycle infrastructure (.03 and .05 miles, respectively). New school sites serving younger students, are on average farther from bicycle infrastructure.

Table 8. New Public K-12 Schools Sited in Selected California MPOs 2008-2018, by Grade Level and Distance to Bike Infrastructure (N=221)

School Type	Number of Schools in Regions with Bike Infrastructure Data	Average Distance to Bike Infrastructure (Miles)	Schools within ¼ Mile of Bike Infrastructure	Schools within ½ Mile of Bike Infrastructure
Elementary	97 (43%)	0.36	75 (77%)	83 (86%)
Middle School	8 (4%)	0.45	6 (75%)	7 (88%)
Middle/High School	10 (5%)	0.03	10 (100%)	10 (100%)
High School	43 (19%)	0.05	40 (93%)	42 (98%)
K-8	55 (25%)	0.21	42 (76%)	46 (84%)
K-12	8 (4%)	0.85	6 (75%)	6 (75%)
Total	**221 (100%)**	**-**	**179 (81%)**	**194 (88%)**

Looking at proximity to bicycle infrastructure by locale type, we find that the distance from new school sites to bicycle infrastructure in the five MPO jurisdictions increases as the density of the locality decreases, as shown in Table 9. "City" localities are closest to bicycle infrastructure (.08 miles, on average), while sites in "town" and "rural" localities are farther on average (2.06 miles and 1.63 miles, respectively).

Table 9. New Public K-12 Schools Sited in Selected California MPOs 2008-2018, by Locale Type and Distance to Bike Infrastructure (N=221)

Locale Type	Number of Schools in Regions with Bike Infrastructure Data	Average Distance to Bike Infrastructure (Miles)	Schools within ¼ Mile of Bike Infrastructure	Schools within ½ Mile of Bike Infrastructure
City	123 (56%)	0.08	109 (89%)	117 (95%)
Suburb	82 (37%)	0.24	62 (76%)	68 (83%)
Town	8 (4%)	2.06	4 (50%)	5 (63%)
Rural	8 (4%)	1.63	4 (50%)	4 (50%)
Total	**221 (100%)**	**-**	**179 (81%)**	**194 (88%)**

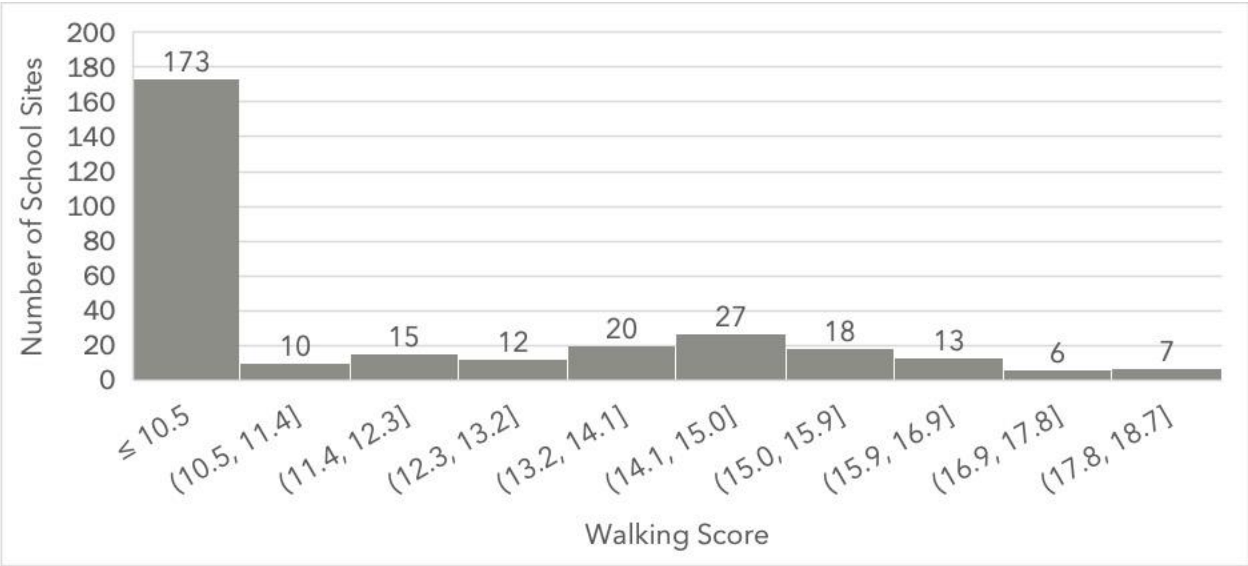
The majority of all new schools sited in each of the five MPO jurisdictions were within ¼ mile of bicycle infrastructure, showing promise for students' ability to safely bike to school (Table 10). The new school sites in SACOG's jurisdiction are most likely to be in close proximity to bicycle infrastructure, with 88 percent within ¼ of a mile from bicycle infrastructure and 100 percent within ½ mile of bicycle infrastructure. FCOG had the lowest percentage of its new schools sited in proximity to bicycle infrastructure (58% within ¼ mile of bicycle infrastructure and 67% within ½ mile of bike infrastructure).

Table 10. New Public K-12 Schools Sited in Selected California MPOs 2008-2018, by MPO and Distance to Bike Infrastructure (N=221)

MPO	Number of Schools in Regions with Bike Infrastructure Data	Average Distance to Bike Infrastructure (Miles)	Schools within ¼ Mile of Bike Infrastructure	Schools within ½ Mile of Bike Infrastructure
FCOG	12 (5%)	0.49	7 (58%)	8 (67%)
MTC	37 (17%)	0.60	22 (59%)	25 (68%)
SACOG	17 (8%)	0.05	15 (88%)	17 (100%)
SCAG	147 (67%)	0.20	129 (88%)	137 (93%)
SJCOG	8 (4%)	0.16	6 (75%)	7 (88%)
Total	**221 (100%)**	**-**	**179 (81%)**	**194 (88%)**

Walkability Scores

Walkability is a measure used to characterize the ease of pedestrian travel in an area. As such, OPR recommends that projects orient toward pedestrian facilities. The EPA National Walkability Index characterizes each geography in terms of relative walkability on a 1-20 point scale. The index considers intersection density (higher intersection density is correlated with more walking trips), proximity to transit stops (shorter distances correlate with more walking trips), and diversity of land uses (including mix of employment types and household types in a block group; higher values correlate with more walking trips). Higher walkability index scores (closer to 20), indicate a high level of walkability, while lower values (closer to 1) indicate less walkable areas. Scores of 1-5.75 are considered "least walkable," scores of 5.76-10.5 are considered "below average walkable," scores of 10.51-15.25 are considered "above average walkable," and scores of 15.26 are considered "most walkable." The EPA considers a place "walkable" if it has a score of at least 10.5; conversely a place with a score below 10.5 is not "walkable." More than half (57%) of the newly sited schools in our analysis are not considered "walkable," with walkability scores less than 10.5, as shown in Figure 4.



Note: For histogram bin ranges: "(" excludes the value; "]" includes the value.

Figure 4. New Public K-12 Schools Sited in California 2008-2018, by Walkability Score

The average walkability score for the 301 new school sites is 10.14. Middle schools have the lowest average walkability scores (8.3), meaning they are less walkable than high schools, which are the most walkable with a walkability score of 11.5, as shown in Table 11.

Table 11. New Public K-12 Schools Sited in California 2008-2018, by Grade Level and Walkability Score

School Type	Number of Schools	Average Walkability Score	Number of Walkable Schools
Elementary	131 (44%)	10.0	51 (39%)
Middle School	15 (5%)	8.3	4 (27%)
Middle/High School	13 (4%)	9.6	5 (38%)
High School	54 (18%)	11.5	32 (59%)
K-8	80 (27%)	10.0	31 (39%)
K-12	8 (3%)	9.6	5 (63%)
Total	**301 (100%)**	**-**	**128 (43%)**

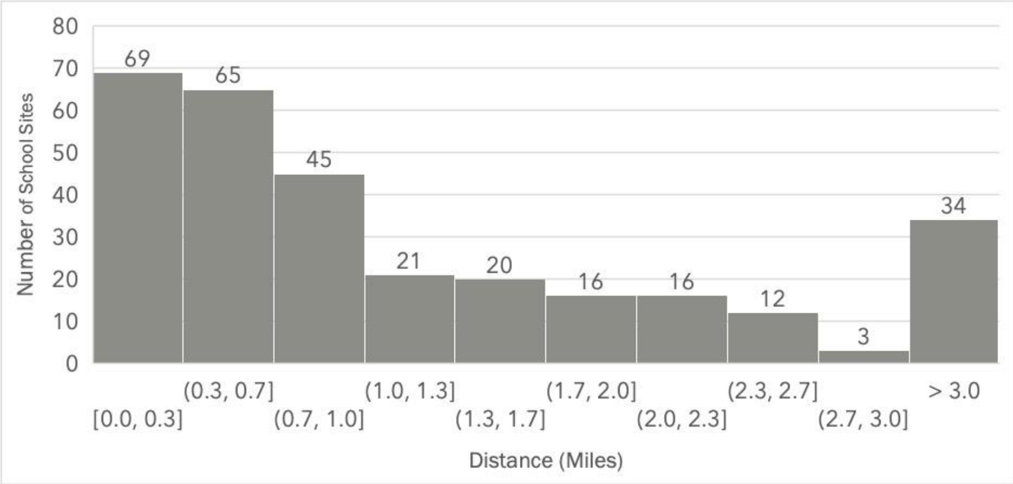
Not surprisingly, “rural” localities have new school sites with lower walkability scores, averaging only 5.2, as shown in Table 12. This is likely due to sprawl development which creates longer distances less suitable to walking between residential locations and school sites. Within “city” localities, 59 percent of new school sites are walkable with an average walkability score of 11.7.

Table 12. New Public K-12 Schools Sited in California 2008-2018, by Locale Type and Walkability Score

Locale Type	Number of Schools	Average Walkability Score	Number of Walkable Schools
City	155 (51%)	11.7	92 (59%)
Suburb	104 (35%)	9.0	30 (29%)
Town	23 (8%)	8.9	6 (26%)
Rural	19 (6%)	5.2	0 (0%)
Total	**301 (100%)**	**-**	**128 (43%)**

Proximity to Electric Vehicle Charging Stations

OPR recommends incorporating neighborhood electric vehicle (EV) networks (e.g., EV chargers) into new developments to aid in lowering GHG emissions (*7*). Looking at the 301 new school sites, the average distance to an EV charger is 1.8 miles. Nearly 60 percent (179) of new school sites are located within one mile of an EV charger, as shown in Figure 5. Eleven percent (34) new school sites are located far (over three miles) from an EV charger.



Note: For histogram bin ranges: "(" excludes the value; "]" includes the value.

Figure 5. New Public K-12 Schools Sited in California 2008-2018, by Distance to Electric Vehicle Charging Stations

Overall, 19 percent of new school sites are located within ¼ mile of an EV charger, while 34 percent are located within ½ mile of an EV charger, as shown in Table 13. While the average distance to an EV charger ranges considerably among the various school types, K-12 new school sites have the shortest average distance to EV chargers at 0.5 miles.

Table 13. New Public K-12 Schools Sited in California 2008-2018, by Grade Level and Distance to Electric Vehicle Charging Stations

School Type	Number of New Sites	Average Distance to EV Charger (Miles)	Schools within 1/4 Mile of EV Charger	Schools within 1/2 Mile of EV Charger
Elementary	131 (44%)	1.6	23 (18%)	46 (35%)
Middle School	15 (5%)	2.5	4 (27%)	8 (53%)
Middle/High School	13 (4%)	1.2	3 (23%)	3 (23%)
High School	54 (18%)	1.0	16 (30%)	24 (44%)
K-8	80 (27%)	3.0	8 (10%)	18 (23%)
K-12	8 (3%)	0.5	3 (38%)	3 (28%)
Total	**301 (100%)**	**-**	**57 (19%)**	**102 (34%)**

By locality, new school sites in "city" localities are the most likely to be near an EV charger, as shown in Table 14. About half (48%) of new school sites in "city" localities have EV charging infrastructure within ½ mile, significantly higher than all new schools (34%). New schools sited in "rural" localities are only within a half mile of EV charging infrastructure 11 percent of the time.

Table 14. New Public K-12 Schools Sited in California 2008-2018, by Locale Type and Distance to Electric Vehicle Charging Stations

Locale Type	Number of New Sites	Average Distance to EV Charger (Miles)	Schools within 1/4 Mile of EV Charger	Schools within 1/2 Mile of EV Charger
City	155 (51%)	1.0	41 (26%)	74 (48%)
Suburb	104 (35%)	1.5	14 (13%)	21 (20%)
Town	23 (8%)	3.5	0 (0%)	5 (22%)
Rural	19 (6%)	8.6	2 (11%)	2 (11%)
Total	**301 (100%)**	**-**	**57 (19%)**	**102 (34%)**

Findings and Considerations for Policy and Future Research

Overall, our analysis reveals mixed findings regarding how well newly sited K-12 public schools over the past decade (2008-2018) reflect VMT mitigation measures identified by OPR as aiding in SB 743 implementation. Only about 16 percent of the new schools sited in our dataset are located within ½ mile from high quality transit (an HQTA). Thus, transit access to most schools appears fairly minimal. Conversely, combined middle/high schools and high schools had the lowest average distances to bicycle infrastructure (.03 and .05 miles, respectively), which may be encouraging students of driving age (i.e., high school students) to bicycle to school. However, new school sites serving younger students (elementary and middle school ages) are on average farther from bicycle infrastructure, which highlights both the challenge of getting these students to adopt more active transportation modes as well as the possible road safety vulnerability of these young bicyclists. Middle school students are a key age group for setting travel behaviors, because students are often beginning independent travel without their parents, and they are not yet old enough to drive themselves. Unsurprisingly, "rural" localities have new school sites with lower walkability scores, averaging only 5.2 (which is considered by the EPA as "least walkable"). However, approximately 60 percent of new school sites in "city" locales are considered walkable, based on the EPA index. Especially for more suburban and rural districts, a mechanism for reducing GHG emissions associated with travel to and from school (particularly for school staff) may be building EV charging infrastructure on or near schools. While on the one hand, it may seem unfair to judge past development decisions based on new criteria, the findings shed light on the degree to which school siting practices in California may have to shift in order to comply with SB 743 objectives going forward. See Appendix for more detailed findings for each mitigation measure by locale and grade level combined as well as by county.

Because schools are trip generators, important questions for land development across California — and especially the siting of new schools — arise from SB 743's policy shift. How will public school districts utilize the new methodology when selecting sites for new schools? Will the new requirements reduce VMT associated with travel to school and help a region meet its greenhouse gas emissions reduction targets prescribed by SB 375? Will travel modes to school change in newer communities as a result? Will any travel mode shifts be ones that reduce VMT and GHG emissions?

The answers to these questions have real implications for land use and climate change on the ground in communities across California. Given our findings on school siting from the decade prior to SB 743 implementation, there appears to be opportunity in the future to potentially reduce GHG as well as potentially help promote healthier travel-to-school habits for children and youth through well-planned school siting decisions.

Considerations for Policy

Data Collection on New School Sites

Identifying new school campuses sited proved to be a challenging task in this research because the CDE does not keep a database of approved sites that links them to the schools which ended up operating on the sites. When sites are approved, they rarely have a specific address or school name associated with them because neither tends to exist at the time of CDE site approval. The CDE should create a simple, user-friendly tracking system that keeps a record of all sites obtaining CDE approval each year, which also includes basic information on the site (e.g., year approved, size, spatial boundaries/geographic coordinates, links to site approval documents, and a list of the school(s) that ended up opening on the site). Having these data will enable future analysis; for example, schools on entirely new school sites can be analyzed differently than new schools on sites which replace older schools.

Amplify Importance of VMT Mitigation Measures in CDE Guidance to School Districts

Currently, the CDE's site selection and development guidance to school districts says very little about specific VMT measures. Some examples of existing language related to these topics is found in Title 5 of the California Code of Regulations:

> k. The site shall be easily accessible from arterial roads and shall allow minimum peripheral visibility from the planned driveways in accordance with the Sight Distance Standards established in the "Highway Design Manual" Table 201.1, published by the Department of Transportation, July 1, 1990 edition, and incorporated into this section by reference, in toto.
>
> l. The site shall not be on major arterial streets with a heavy traffic pattern as determined by site-related traffic studies including those that require student crossings unless mitigation of traffic hazards and a plan for the safe arrival and departure of students appropriate to the grade level has been provided by city, county or other public agency in accordance with the "School Area Pedestrian Safety" manual published by the California Department of Transportation, 1987 edition, incorporated into this section by reference, in toto.
>
> m. Existing or proposed zoning of the surrounding properties shall be compatible with schools in that it would not pose a potential health or safety risk to students or staff in accordance with Education Code Section 17213 and Government Code Section 65402 and available studies of traffic surrounding the site.
>
> n. The site shall be located within the proposed attendance area to encourage student walking and avoid extensive bussing unless bussing is used to promote ethnic diversity.

o. The site shall be selected to promote joint use of parks, libraries, museums and other public services, the acreage of which may be included as part of the recommended acreage as stated in subsection (a) of this section. (5 CCR § 14010. Standards for School Site Selection)

The guidance should be updated to recommend incorporation of known VMT mitigation measures, pointing to those identified by OPR in their technical guidance. In particular, the CDE guidance should promote local implementation of "Complete Streets" planning to ensure all different types of road users can safely get to school. "Complete Streets" guidance provides approaches to creating built environments that are welcoming to public transportation, bicyclists, and pedestrians, subsequently reducing a community's VMT output (*49–51*). Additionally, new school sites incorporating VMT mitigation measures could be given funding priority (and/or other incentives in the state's School Facility Program), which provides grants to school districts for purchasing school sites and constructing new schools.

Provide Technical Assistance to School Districts on Incorporating VMT Mitigation Measures into School Siting Decisions and Site Plans

The CDE should provide technical assistance to school districts (and the transportation consultants they contract with) when conducting VMT analysis during the new school site selection process. Ideally, this guidance would be developed in collaboration with OPR and could include workshops, case examples, and tools/templates. The CDE and the OPR could facilitate knowledge sharing among school districts, local governments, and MPOs to develop successful partnerships that site schools and incorporate VMT mitigation measures on or near school sites in the site design process. The OPR SB 743 technical guidance contains many more suggested mitigation measures than the four analyzed in this study, including reducing onsite parking, providing bicycle parking/storage infrastructure, co-location with parks and shopping areas, and others. Additionally, site design can accommodate EV charging facilities on campus, ensure building entrances are pedestrian oriented rather than parking lot oriented, and provide bicycle path connectors from schools to other bicycle facilities.

Support Interventions that Reduce VMT at Existing School Sites

As enrollment growth continues to slow statewide, it is likely that the siting of new schools will also slow. Thus, focusing on ways to reduce VMT associated with existing schools is important. These interventions include funding to expand Safe Routes to School programs, installation of EV chargers on school sites, installation of bicycle parking/storage infrastructure, and creating new bicycle path connecters.

Recommendations for Research

As California school districts begin incorporating VMT analysis into their school siting decision-making process, it will be important to assess what impacts this has on siting outcomes and transportation. How will public school districts utilize the new methodology when selecting sites for new schools? Will the new requirements reduce VMT associated with travel to school and help a region meet its greenhouse gas emissions reduction targets prescribed by SB 375? Will travel modes to school change in newer communities as a result? Will any travel mode shifts be ones that reduce VMT and GHG emissions? Our findings in this study begin to provide a baseline of trends “before” SB 743 implementation.

Comparative research should investigate how California compares to other states. Are there policies or practices in other states that contribute to improved VMT reduction with regards to school siting decisions?

Research should also seek to identify long-term effects on students going to schools using non-vehicular modes of transportation — do these students utilize more active transportation modes? If so, are there measurable health impacts from this modal shift?

More fine-grained analysis of built environment features that affect travel behavior should be conducted. For example, because we find a high degree of school sites in close proximity to streets with bicycle infrastructure, this indicates there is likely a high degree of bikeability for the majority of new school sites. However, just because bicycle infrastructure exists nearby does not mean it was designed in a way that encourages bicycle activity or was placed on an appropriate street to alleviate parent safety concerns and ultimately increase bicycle travel by students.

Researchers should aim to take an explicit equity lens to future new school siting analysis. For example, Cal EnviroScreen data could be used to investigate VMT-related outcomes at school sites, such as traffic density, pollution (i.e., particulate matter), and other environmental justice concerns. OPR recommends locating development in areas with a low pollution burden and low traffic due to the health effects from pollutants released in traffic exhaust (*7*). Similarly, researchers should look more closely at new school sites and issues of local climate resilience, particularly as they relate to different types of communities and structural disadvantage.

Lastly, research should aim to understand what nearby developments and other physical structures are planned (but not yet built) at the time a new school site is chosen by an LEA. Such analysis should explore the development and decision-making timeline across different land uses and types of land, such as greenfield or urban infill sites, and lead agency developers to shed light on current levels of land use and transportation planning integration and help identify policy opportunities to encourage greater integration in the future.

Conclusion

Where new schools get sited shapes local built environments and affects neighborhood character and travel behavior (*1*, *52*). Integrated land use planning that focuses on siting and built environment decisions that support multimodal transportation gives residents transportation options, which can help reduce VMT and GHG. Our analysis is a point-in-time analysis of spatial relationships between school sites and these specified mitigation measures. As such, our findings do not shed light on whether these mitigation measures were planned as part of the school siting process, were happy coincidences, or occurred after-the-fact.

Appendix

Size of New School Sites by Locale Type, Grade Level, and County

Table 15. New Public K-12 Schools Sited in California 2008-2018, by Locale Type and Grade Level

Locale & School Type	Number of New Schools	Total Acres	Average Acres
City	155 (51%)	3,302 (46%)	21.3
Elementary	72 (24%)	775 (11%)	10.8
Middle School	6 (2%)	126 (2%)	21.0
Middle/High School	9 (3%)	448 (6%)	49.8
High School	33 (11%)	1,058 (15%)	32.1
K-8	30 (10%)	414 (6%)	13.8
K-12	5 (2%)	481 (7%)	96.1
Suburb	104 (35%)	2,535 (35%)	24.4
Elementary	46 (15%)	578 (8%)	12.6
Middle School	6 (2%)	234 (3%)	38.9
Middle/High School	4 (1%)	182 (3%)	45.6
High School	16 (5%)	781 (11%)	48.8
K-8	30 (10%)	726 (10%)	24.2
K-12	2 (1%)	34 (0%)	16.9
Town	23 (8%)	554 (8%)	24.1
Elementary	10 (3%)	189 (3%)	18.9
Middle School	1 (0%)	18 (0%)	17.5
Middle/High School	-	- (-)	-
High School	2 (1%)	113 (2%)	56.6
K-8	10 (3%)	234 (3%)	23.4
K-12	- (-)	- (-)	-
Rural	19 (6%)	802 (11%)	42.2
Elementary	3 (1%)	73 (1%)	24.2
Middle School	2 (1%)	101 (1%)	50.7
Middle/High School	-	- (-)	-
High School	3 (1%)	463 (6%)	154.2
K-8	10 (3%)	134 (2%)	13.4
K-12	1 (0%)	31 (0%)	31.5
Total	**301 (100%)**	**7,192 (100%)**	**-**

Table 16. New Public K-12 Schools Sited in California 2008-2018, by County

County	Number of New Schools	Total Acres	Average Acres
Alameda	6 (2%)	95 (1%)	15.9
Alpine	1 (0%)	3 (0%)	3.0
Colusa	2 (1%)	36 (0%)	18.0
Contra Costa	9 (3%)	110 (2%)	12.3
Fresno	12 (4%)	422 (6%)	35.2
Humboldt	2 (1%)	46 (1%)	22.8
Kern	11 (4%)	460 (6%)	41.8
Kings	1 (0%)	150 (2%)	150.5
Los Angeles	82 (27%)	1,113 (15%)	13.6
Madera	4 (1%)	351 (5%)	87.7
Marin	2 (1%)	20 (0%)	10.0
Mariposa	1 (0%)	6 (0%)	5.6
Merced	6 (2%)	273 (4%)	45.4
Monterey	4 (1%)	67 (1%)	16.7
Napa	1 (0%)	393 (5%)	392.6
Nevada	2 (1%)	19 (0%)	9.7
Orange	10 (3%)	234 (3%)	23.4
Placer	5 (2%)	88 (1%)	17.5
Riverside	27 (9%)	793 (11%)	29.4
Sacramento	9 (3%)	247 (3%)	27.4
San Benito	2 (1%)	15 (0%)	7.4
San Bernardino	26 (9%)	592 (8%)	22.8
San Diego	24 (8%)	432 (6%)	18.0
San Francisco	3 (1%)	7 (0%)	2.3
San Joaquin	8 (3%)	305 (4%)	38.1
San Luis Obispo	1 (0%)	53 (1%)	53.2
San Mateo	3 (1%)	27 (0%)	8.9
Santa Barbara	1 (0%)	10 (0%)	9.9
Santa Clara	5 (2%)	121 (2%)	24.2
Santa Cruz	1 (0%)	10 (0%)	9.6
Siskiyou	1 (0%)	16 (0%)	16.3
Solano	1 (0%)	12 (0%)	12.0
Sonoma	7 (2%)	99 (1%)	14.1
Stanislaus	8 (3%)	212 (3%)	26.5
Tulare	8 (3%)	246 (3%)	30.7
Ventura	2 (1%)	38 (1%)	19.0
Yolo	2 (1%)	64 (1%)	31.8
Yuba	1 (0%)	10 (0%)	9.8
Total	**301 (100%)**	**7,192 (100%)**	**-**

Distance to High Quality Transit Areas by Locale Type, Grade Level, and County

Table 17. New Public K-12 Schools Sited in California 2008-2018, by Locale Type, Grade Level, and Distance to a High Quality Transit Area

Locale & School Type	Number of Schools	Schools in HQTA	Average Distance to an HQTA (Miles)
City	155 (51%)	43 (28%)	2.3
Elementary	72 (24%)	16 (22%)	2.4
Middle School	6 (2%)	0 (0%)	2.3
Middle/High School	9 (3%)	4 (44%)	3.2
High School	33 (11%)	13 (39%)	1.0
K-8	30 (10%)	9 (30%)	2.8
K-12	5 (2%)	1 (20%)	3.7
Suburb	104 (35%)	4 (4%)	4.9
Elementary	46 (15%)	2 (4%)	4.9
Middle School	6 (2%)	0 (0%)	3.8
Middle/High School	4 (1%)	0 (0%)	1.5
High School	16 (5%)	2 (13%)	5.8
K-8	30 (10%)	0 (0%)	5.1
K-12	2 (1%)	0 (0%)	1.1
Town	23 (8%)	0 (0%)	19.7
Elementary	10 (3%)	0 (0%)	16.2
Middle School	1 (0%)	0 (0%)	8.0
Middle/High School	-	-	-
High School	2 (1%)	0 (0%)	17.1
K-8	10 (3%)	0 (0%)	24.9
K-12	-	-	-
Rural	19 (6%)	0 (0%)	27.8
Elementary	3 (1%)	0 (0%)	30.8
Middle School	2 (1%)	0 (0%)	52.6
Middle/High School	-	-	-
High School	3 (1%)	0 (0%)	12.8
K-8	10 (3%)	0 (0%)	27.8
K-12	1 (0%)	0 (0%)	14.9
Total	**301 (0%)**	**47 (16%)**	**-**

Table 18. New Public K-12 Schools Sited in California 2008-2018, by County and Distance to a High Quality Transit Area

County	Number of Schools	Schools in HQTA	Average Distance to HQTA (Miles)
Alameda	6 (2%)	2 (33%)	1.0
Alpine	1 (0%)	0 (0%)	59.3
Colusa	2 (1%)	0 (0%)	38.6
Contra Costa	9 (3%)	0 (0%)	4.4
Fresno	12 (4%)	0 (0%)	11.5
Humboldt	2 (1%)	0 (0%)	85.2
Kern	11 (4%)	0 (0%)	11.6
Kings	1 (0%)	0 (0%)	1.3
Los Angeles	82 (27%)	37 (45%)	0.6
Madera	4 (1%)	0 (0%)	10.1
Marin	2 (1%)	0 (0%)	1.3
Mariposa	1 (0%)	0 (0%)	35.2
Merced	6 (2%)	0 (0%)	11.2
Monterey	4 (1%)	0 (0%)	5.5
Napa	1 (0%)	0 (0%)	4.1
Nevada	2 (1%)	0 (0%)	8.8
Orange	10 (3%)	0 (0%)	1.7
Placer	5 (2%)	0 (0%)	3.6
Riverside	27 (9%)	0 (0%)	7.2
Sacramento	9 (3%)	0 (0%)	3.7
San Benito	2 (1%)	0 (0%)	28.3
San Bernardino	26 (9%)	0 (0%)	5.6
San Diego	24 (8%)	2 (8%)	5.7
San Francisco	3 (1%)	3 (100%)	0.0
San Joaquin	8 (3%)	1 (13%)	4.6
San Luis Obispo	1 (0%)	0 (0%)	7.0
San Mateo	3 (1%)	0 (0%)	1.0
Santa Barbara	1 (0%)	0 (0%)	6.8
Santa Clara	5 (2%)	1 (20%)	0.7
Santa Cruz	1 (0%)	0 (0%)	3.2
Siskiyou	1 (0%)	0 (0%)	7.1
Solano	1 (0%)	0 (0%)	1.8
Sonoma	7 (2%)	1 (14%)	3.5
Stanislaus	8 (3%)	0 (0%)	8.9
Tulare	8 (3%)	0 (0%)	20.5
Ventura	2 (1%)	0 (0%)	1.5
Yolo	2 (1%)	0 (0%)	9.7
Yuba	1 (0%)	0 (0%)	27.7
Total	**301 (100%)**	**47 (16%)**	**-**

Walkability Scores by Locale Type, Grade Level, and County

Table 19. New Public K-12 Schools Sited in California 2008-2018, by Locale Type, Grade Level, and Walkability Score

Locale & School Type	Number of Schools	Average Walkability Score	Number of Walkable Schools
City	155 (51%)	11.7	92 (59%)
Elementary	72 (24%)	11.4	39 (54%)
Middle School	6 (2%)	9.9	3 (60%)
Middle/High School	9 (3%)	9.9	4 (44%)
High School	33 (11%)	13.2	26 (79%)
K-8	30 (10%)	12.1	17 (57%)
K-12	5 (2%)	8.9	3 (60%)
Suburb	104 (35%)	9.0	30 (29%)
Elementary	46 (15%)	8.4	9 (20%)
Middle School	6 (2%)	7.9	1 (17%)
Middle/High School	4 (1%)	9.1	1 (17%)
High School	16 (5%)	9.8	6 (38%)
K-8	30 (10%)	9.4	11 (37%)
K-12	2 (1%)	14.1	2 (100%)
Town	23 (8%)	8.9	6 (26%)
Elementary	10 (3%)	8.1	3 (30%)
Middle School	1 (0%)	8.5	0 (0%)
Middle/High School	-	-	- (-)
High School	2 (1%)	7.1	0 (0%)
K-8	10 (3%)	10.0	3 (30%)
K-12	-	-	- (-)
Rural	19 (6%)	5.2	0 (0%)
Elementary	3 (1%)	5.3	0 (0%)
Middle School	2 (1%)	4.4	0 (0%)
Middle/High School	-	-	- (-)
High School	3 (1%)	5.3	0 (0%)
K-8	10 (3%)	5.3	0 (0%)
K-12	1 (0%)	4.3	0 (0%)
Total	**301 (100%)**	-	**128 (43%)**

Table 20. New Public K-12 Schools Sited in California 2008-2018, by County and Walkability Score

County	Number of New Schools	Average Walkability Score	Number of Walkable Schools
Alameda	6 (2%)	11.1	3 (50%)
Alpine	1 (0%)	6.5	0 (0%)
Colusa	2 (1%)	6.4	0 (0%)
Contra Costa	9 (3%)	8.9	2 (22%)
Fresno	12 (4%)	6.4	1 (8%)
Humboldt	2 (1%)	9.0	1 (50%)
Kern	11 (4%)	7.2	1 (9%)
Kings	1 (0%)	8.2	0 (0%)
Los Angeles	82 (27%)	13.8	68 (83%)
Madera	4 (1%)	5.8	0 (0%)
Marin	2 (1%)	6.8	0 (0%)
Mariposa	1 (0%)	4.8	0 (0%)
Merced	6 (2%)	7.6	0 (0%)
Monterey	4 (1%)	7.5	0 (0%)
Napa	1 (0%)	4.0	0 (0%)
Nevada	2 (1%)	10.4	1 (50%)
Orange	10 (3%)	11.7	8 (80%)
Placer	5 (2%)	6.8	1 (20%)
Riverside	27 (9%)	10.1	12 (44%)
Sacramento	9 (3%)	10.3	5 (56%)
San Benito	2 (1%)	11.2	1 (50%)
San Bernardino	26 (9%)	7.6	1 (4%)
San Diego	24 (8%)	9.1	10 (42%)
San Francisco	3 (1%)	17.6	3 (100%)
San Joaquin	8 (3%)	9.3	3 (38%)
San Luis Obispo	1 (0%)	14.2	1 (100%)
San Mateo	3 (1%)	6.9	0 (0%)
Santa Barbara	1 (0%)	6.3	0 (0%)
Santa Clara	5 (2%)	7.7	0 (0%)
Santa Cruz	1 (0%)	18.7	1 (100%)
Siskiyou	1 (0%)	13.7	1 (100%)
Solano	1 (0%)	14.2	1 (100%)
Sonoma	7 (2%)	7.1	0 (0%)
Stanislaus	8 (3%)	9.1	3 (38%)
Tulare	8 (3%)	7.2	0 (0%)
Ventura	2 (1%)	7.6	0 (0%)
Yolo	2 (1%)	8.3	0 (0%)
Yuba	1 (0%)	6.8	0 (0%)
Total	**301 (100%)**	**-**	**128 (43%)**

Distance to Electric Vehicle Charging Stations by Locale Type, Grade Level, and County

Table 21. New Public K-12 Schools Sited in California 2008-2018, by Locale Type, Grade Level and Distance to Electric Vehicle Charging Stations

Locale & School Type	Number of Schools	Average Distance to EV Charger (Miles)	Schools within 1/4 Mile of EV Charger	Schools within 1/2 Mile of EV Charger
City	155 (51%)	1.0	41 (26%)	74 (48%)
Elementary	72 (24%)	0.8	16 (22%)	33 (46%)
Middle School	6 (2%)	0.7	2 (33%)	4 (67%)
Middle/High School	9 (3%)	1.2	3 (33%)	3 (33%)
High School	33 (11%)	0.4	14 (42%)	22 (67%)
K-8	30 (10%)	2.0	5 (17%)	11 (37%)
K-12	5 (2%)	0.7	1 (20%)	1 (20%)
Suburb	104 (35%)	1.5	14 (13%)	21 (20%)
Elementary	46 (15%)	1.5	7 (15%)	10 (22%)
Middle School	6 (2%)	0.7	2 (33%)	2 (33%)
Middle/High School	4 (1%)	1.0	0 (0%)	0 (0%)
High School	16 (5%)	1.5	2 (13%)	2 (13%)
K-8	30 (10%)	1.8	2 (7%)	2 (7%)
K-12	2 (1%)	0.4	1 (50%)	1 (50%)
Town	23 (8%)	3.5	0 (0%)	5 (22%)
Elementary	10 (3%)	4.9	0 (0%)	5 (50%)
Middle School	1 (0%)	1.7	0 (0%)	5 (500%)
Middle/High School	-	-	- (0%)	- (0%)
High School	2 (1%)	1.0	0 (0%)	5 (250%)
K-8	10 (3%)	2.8	0 (0%)	5 (50%)
K-12	-	-	- (0%)	- (0%)
Rural	19 (6%)	8.6	2 (11%)	2 (11%)
Elementary	3 (1%)	9.7	0 (0%)	0 (0%)
Middle School	2 (1%)	13.5	0 (0%)	0 (0%)
Middle/High School	-	-	- (0%)	- (0%)
High School	3 (1%)	4.0	0 (0%)	0 (0%)
K-8	10 (3%)	9.5	1 (10%)	1 (10%)
K-12	1 (0%)	0.2	1 (100%)	1 (100%)
Total	**301 (100%)**	**-**	**57 (0%)**	**102 (0%)**

Table 22. New Public K-12 Schools Sited in California 2008-2018, by County and Distance to Electric Vehicle Charging Stations

County	Number of New Schools	Average Distance to EV Charger (Miles)	Schools within 1/4 Mile of EV Charger	Schools within 1/2 Mile of EV Charger
Alameda	6 (2%)	0.8	1 (17%)	1 (17%)
Alpine	1 (0%)	15.0	0 (0%)	0 (0%)
Colusa	2 (1%)	4.6	0 (0%)	1 (50%)
Contra Costa	9 (3%)	0.9	2 (22%)	4 (44%)
Fresno	12 (4%)	3.5	1 (8%)	3 (25%)
Humboldt	2 (1%)	5.3	0 (0%)	0 (0%)
Kern	11 (4%)	4.9	0 (0%)	1 (9%)
Kings	1 (0%)	0.0	1 (100%)	1 (100%)
Los Angeles	82 (27%)	0.5	29 (35%)	47 (57%)
Madera	4 (1%)	3.5	1 (25%)	1 (25%)
Marin	2 (1%)	0.8	0 (0%)	0 (0%)
Mariposa	1 (0%)	8.3	0 (0%)	0 (0%)
Merced	6 (2%)	0.7	1 (17%)	3 (50%)
Monterey	4 (1%)	0.6	0 (0%)	2 (50%)
Napa	1 (0%)	0.6	0 (0%)	0 (0%)
Nevada	2 (1%)	1.0	0 (0%)	1 (50%)
Orange	10 (3%)	0.7	2 (20%)	6 (60%)
Placer	5 (2%)	2.0	0 (0%)	0 (0%)
Riverside	27 (9%)	1.8	1 (4%)	3 (11%)
Sacramento	9 (3%)	1.0	1 (11%)	2 (22%)
San Benito	2 (1%)	6.8	0 (0%)	0 (0%)
San Bernardino	26 (9%)	3.3	2 (8%)	2 (8%)
San Diego	24 (8%)	2.7	6 (25%)	8 (33%)
San Francisco	3 (1%)	0.5	1 (33%)	2 (67%)
San Joaquin	8 (3%)	0.9	1 (13%)	2 (25%)
San Luis Obispo	1 (0%)	5.4	0 (0%)	0 (0%)
San Mateo	3 (1%)	0.9	0 (0%)	0 (0%)
Santa Barbara	1 (0%)	0.6	0 (0%)	0 (0%)
Santa Clara	5 (2%)	0.6	1 (20%)	3 (60%)
Santa Cruz	1 (0%)	0.2	1 (100%)	1 (100%)
Siskiyou	1 (0%)	0.4	0 (0%)	1 (100%)
Solano	1 (0%)	0.1	1 (100%)	1 (100%)
Sonoma	7 (2%)	1.0	3 (43%)	4 (57%)
Stanislaus	8 (3%)	3.0	0 (0%)	0 (0%)
Tulare	8 (3%)	4.2	0 (0%)	1 (13%)
Ventura	2 (1%)	0.6	1 (50%)	1 (50%)
Yolo	2 (1%)	2.6	0 (0%)	0 (0%)
Yuba	1 (0%)	2.4	0 (0%)	0 (0%)
Totals	**301 (100%)**	**-**	**57 (19%)**	**102 (34%)**

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