A Lot [of Parking]

Quantifying Parking at New Public High Schools in California

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Executive Summary

California's public school districts[1] own more than 150,000 acres of land. Where these properties are located has impacts on vehicle miles traveled (VMT) and greenhouse gas (GHG) emissions (Center for Cities + Schools and Terner Center for Housing Innovation 2021). However, with large enrollments and expectations that high schools have ample educational and recreational facilities, school districts tend to see parking as essential, especially for high schools. To accommodate these interests, school districts may build in areas where land is cheaper. These regions, however, also tend to have less access to high quality public transportation and active transportation facilities, leading to more reliance on single occupancy automobile travel. As California increases efforts to promote a more sustainable, multi-modal transportation ecosystem, it is important to understand how different parcel uses, especially those that benefit from public funding, such as schools, determine parking requirements.

Given California's evolving approach to off-street parking provisions and the state's funding of new school development projects, the amount of parking must be documented, and its implications understood. Currently, the California Department of Education (CDE)'s guidance on parking is based upon enrollment size and satisfying parking demand during *peak* periods – a common practice in parking planning and development. With an understanding of how much parking exists at new high schools, the state may be able to eliminate or modify the parking recommendations, taking a more holistic approach to recommending transportation planning strategies rather than parking planning strategies.

Methods

This research relied upon a geospatial analysis using Google Maps imagery to quantify the number of off-street parking spaces at 54 new high schools across the State of California, expanding on a research study conducted by the University of California, Berkeley's Center for Cities + Schools (Vincent, Maves, and Thomson 2022). This sample of 54 schools includes all high schools constructed between 2008 and 2018. For sites where parking was counted manually, a parking polygon was created in a GIS layer to identify acreage devoted to parking (see image). When parking counts could not be accurately obtained using satellite imagery, school districts provided estimates of the total number of spots at sites of interest. This parking data was then analyzed in relation to school enrollment and the size of the education workforce to create average driver to parking spot ratios across different locale designations (e.g., "city" vs. "rural"). Lastly, parking counts were compared to the CDE and municipality guidelines to determine the extent to which they adhere to established standards.

[1] School districts refer to public K-12 Local Education Agencies (LEA) (Unified School Districts, Elementary School Districts, and High School Districts). This study does not include information on County Offices of Education or Regional Occupational Centers & Programs (ROC-ROP).

Findings

How Does the Provision of Parking Vary Across Locale Designations (e.g., “city” vs. “rural”) and Accessibility to Alternative Forms of Transportation?

Schools in “city” localities had 2.7 drivers per parking spot, over twice as many as new high schools in both “town” and “rural” localities. This finding revealed a general trend that when aggregating the data by location typologies, the number of drivers per parking spot decreased as development density decreased. Further, new high school proximity to infrastructure that supports non-vehicular travel also decreased as development density and driver to parking spot ratios decreased. In other words, factors impacting the provision of parking at schools may include community development density, development patterns, and proximity to infrastructure that supports non-vehicular travel. To comply with SB 743 objectives and other goals meant to reduce community GHG from transportation, the CDE should recognize the positive role municipal infrastructure plays in promoting sustainable travel to school.

How Much Land is Devoted to Parking?

A total of 8.6% of the land area of school properties included in this study is devoted to off-street parking – a land use that does not directly impact educational outcomes other than through increased accessibility. The findings reveal that space devoted to cars at new high school properties equals approximately 92% of the land area devoted to buildings (225 acres). The remaining space (approximately 80%) is devoted to other land uses including athletic fields and courts, drop-off lanes, sidewalks, and courtyards.

How Do Parking Counts at New High Schools Compare to the Department of Education’s Recommendations?

The majority of high schools in this analysis (69%) provided less parking than the CDE recommends based on the school’s enrollment; however, 11% of schools in the analysis provided parking *above* the CDE’s recommendation. 4% of schools are providing the amount of parking the CDE recommends and 17% of schools are providing just under the CDE’s recommendation. With recommendations to provide a parking spot for every student of driving age, the CDE’s parking guidance is planning for *peak* demand, leading to the overprovision of parking for everyday use. If schools are not following these guidelines, questions arise as to their impact and enforceability. How can the State – which supports school site development through funding – enable a more context-specific approach to transportation planning at schools and provide clear parking guidelines that support the State’s sustainable transportation agenda? What measures can the CDE take, beyond tracking parking requirements, to reduce the demand for parking at schools and high schools, in particular?

Recommendations

The following recommendations are designed to track parking data at high school sites, reduce commuters' reliance on driving and, therefore, parking, and promote infrastructure that facilitates sustainable, multi-modal travel. Over the long run, these tactics could potentially enable school districts to locate schools on smaller parcels, adjacent to communities.

Additional Data Collection

1. Ensure maintenance personnel record parking counts at school campuses.
2. Utilize travel survey datasets to inform local school districts of how many students are driving to school today in the region.

Policy and Planning

3. Update the CDE guidance to school districts such that it strongly encourages school districts to consider proximity to measures known to reduce VMT.
    - Charge for parking at major school and athletic events.
4. Develop traffic impact analyses (TIA) and active transportation plans (ATPs) at new or expanded school development sites.
5. Develop lines of communication between stakeholders.

Infrastructure and Programs

6. Prioritize construction of active transportation networks to high schools from neighborhoods within the school's attendance area.
7. Encourage programmatic initiatives at the school or school district level to facilitate student travel by non-vehicular modes.
8. Expand California's Cash-Out law to the K-12 workforce.

1. Introduction

The way a parcel of land is designed and developed impacts travel behavior, travel modality, and vehicle miles traveled (VMT) (Harding et al. 2012). Each parcel contributes to local land use patterns, which impacts how accessible a place is and for whom. As the linkage between land use and transportation is increasingly better understood, urban planners and policymakers today are working to coordinate land use planning and transportation investments to reduce automobile dependence and support carpooling and non-vehicular travel. With this coordination, cities can improve accessibility of opportunities for all by taking a multi-modal approach to enhance pedestrian and bicyclist safety though improvements to public transportation and roadway connectivity. These changes are reflected in numerous bills that have recently moved through the California state legislature (e.g., SB 743).

These recent bills emphasize the need for urban density and accessibility via non-vehicular transportation to help the state meet its greenhouse gas (GHG) reduction goals. The regulations that guide school facility planning, however, have not kept up with these shifts in state policy and, in some ways, inadvertently still favor automobile travel over alternative modes. With school districts owning a significant amount of land throughout the state (over 150,000 acres) (Center for Cities and Schools and Terner Center for Housing Innovation 2021), decisions that dictate which parcels are developed for school use may significantly impact a region's VMT and GHG emissions. For example, school sites further from existing neighborhoods may generate more VMT and GHG than, for example, schools located within or adjacent to neighborhoods or near the center of town.

Schools are major trip generators. With about six million students enrolled in public schools across the state, trips to and from school can contribute significantly to a region's GHG emissions, depending on their location (California Department of Education 2020). In 2017, according to the National Household Travel Survey (NHTS) California Add-On, 71% of trips to school were taken via private automobile,[2] 18% of trips were walking or biking trips, 10% of trips were taken via a school bus, and 1% were taken via public transportation or another mode. A school's strategic placement – near high quality public transportation, bike facilities, and pedestrian-friendly infrastructure – can significantly reduce school-related vehicle trips and create lifelong sustainable transportation habits in California's youth.

A key component of a school district's ability to site a new school on a parcel amenable to such alternative forms of transportation is how much parking it provides. The parking recommendations and/or standards school districts follow can very quickly grow a school's footprint to a point where it may not be financially or logistically feasible to build near these mitigation measures. To remedy this, school districts may be drawn to land that is less expensive, generally farther from existing neighborhoods and infrastructure that supports alternative modes of transportation, which leaves students and staff little choice but to drive (McDonald 2010). Not only do these practices reduce commuter choice, but they may also contribute to the spatial mismatch problem wherein lower-income households – which typically have lower automobile ownership rates – have reduced access to job or educational opportunities from their place of residence (Hanson 2017).

1.1 California Policy Context

In recent years, the State of California has developed and enacted numerous policies to reduce vehicle miles traveled (VMT) and GHGs, recognizing that appropriate land use and transportation decisions play a critical role in reducing automobile dependency. The state's landmark Assembly Bill 32 (AB 32, 2006) required the reduction of GHG emissions to 1990 levels by 2020 and a further reduction of 40% below 1990 levels by 2030 (Nunez 2006). California's Air Resources Board (CARB) was responsible for developing policies to help achieve this goal. Building off this legislation, Senate Bill 375 (SB 375, 2008) allows CARB to set regional GHG emission reduction targets for

[2] In the United States as a whole, according to the 2017 NHTS survey, 58% of trips taken to school were in a private automobile.

passenger vehicles in order to, ultimately, meet the targets established by AB 32 (Steinberg 2008; Institute for Local Government 2015). Finally, Senate Bill 743 (SB 743) (Steinberg, 2013) requires agencies to evaluate and mitigate VMT impacts rather than traffic congestion from new development during the California Environmental Quality Act (CEQA) process. With the level of service (LOS) analysis, which mitigates traffic congestion and is conventionally used to assess the transportation impacts of new development, projects score higher if vehicles move more quickly through the built environment. With the changes outlined in SB 743, however, traditional measures known to (temporarily) reduce congestion (e.g., expanding road widths), "will be replaced with measures that mitigate additional driving, such as increasing transit options, facilitating biking and walking, changing development patterns, and charging for parking" (Steinberg 2013; SB743.org 2021).

Like cities and private development projects, public school districts must follow the CEQA process – and therefore comply with SB 743 – when siting a new school or making incremental building additions. It is now common for school districts to build a new building on an existing campus to replace an aging building or portable classrooms. This most often results in a minimal or zero environmental impact. This shift towards mitigating VMT has encouraged schools to build closer to neighborhoods to avoid unnecessary student travel and remain on smaller campuses. Additionally, it encourages school facility planning staff to prioritize building where the students are rather than where there is open land, in turn, bringing new amenities to existing communities. For other projects, a new school must be built. Modern expectations around sporting and educational facilities can quickly grow a school's footprint and require significant amounts of parking, impacting a school's ability to comply with new VMT policies.

While this research's scope is limited to newly constructed high schools, a site-specific analysis of parking capacity at all high schools across the state would provide insight into how existing planning policies and standards may be subtly encouraging automobile use and limiting more sustainable development patterns. Parking incentivizes vehicle use (resulting in more GHG) and may encourage cheaper greenfield development rather than infill development (Shoup 2011; McDonald 2010). Typically, an understudied area, the availability of parking may also provide valuable insight into the degree to which school siting and development processes align with these recent state policy goals.

1.2 Problem Statement & Research Questions

The California Department of Education (CDE) last updated its *Guide to School Site Analysis and Development* in 2000. This *guide* provides a set of guidelines local school districts may refer to when developing school sites that can accommodate their specific goals and educational programs. Detailed parking space guidelines are provided by the CDE, based upon school enrollment size, the number of classrooms, and the size of the largest congregation space (e.g., an auditorium). Because of this simplified approach to determining the number of parking spaces to provide, school site planning guidance is not necessarily encouraging school districts to provide parking based upon how many students (and faculty/staff) *actually* drive to school. They are, instead, providing parking based on *peak* demand – a common practice in parking planning and development. Although the CDE's guidelines are non-binding[3] and the amount of parking provided at an individual school is ultimately decided by the school district or local jurisdiction parking requirements, this approach may be inadequate in today's environment of planning and development. Additionally, the CDE does not keep a record of how much parking is provided on new school sites or what the parking utilization rates are, which inhibits an understanding of how new school sites are aligning with the state's new VMT-reduction priorities outlined above.

This research addresses the question: How much automobile parking (and land in acres) do new high school sites in California (constructed between 2008 and 2018) provide, and how do patterns of parking provision on school sites align with student travel patterns and changing on-site parking policies in California? The study focuses on high school

[3] These guidelines are *not* requirements in statute but allow a school district the flexibility needed given differing environmental and development barriers school districts face across the state. School districts may also be asked to articulate to CDE how their development plans do not compromise the functionality of the site and visitor safety if guidelines are not followed.

sites because high schools provide vastly more parking than other school types and because it ensures a more manageable sample size in the data collection process.

To this end, this research provides quantitative insights on the following five sub-questions:

1. How do students of driving age (16-18 years old) commute to school?
2. How many driving age students are driving themselves to school?
3. How does the provision of parking vary across locale designation (e.g., "city" vs. "rural") and based on regional accessibility to alternative forms of transportation?
4. How much land is devoted to parking at new public high schools?
5. How do parking counts at new high schools compare to the CDE's recommendations?

The first two questions use National Household Travel Survey data to understand the relationship between student travel to school patterns and the state's broader policy goals aimed at reducing automobile dependency. Through exploration of the literature and policies that guide parking requirements and recommendations, the study then seeks to understand the degree to which on-site parking provision aligns with the state's approach to parking minimums in general. As cities and counties loosen and eliminate parking requirements to increase the feasibility of development, to what extent are school districts following suit? After quantifying the amount of parking at new high schools across the state, the research concludes with a series of policy and programmatic recommendations for reducing the *demand* for parking amongst these user groups.

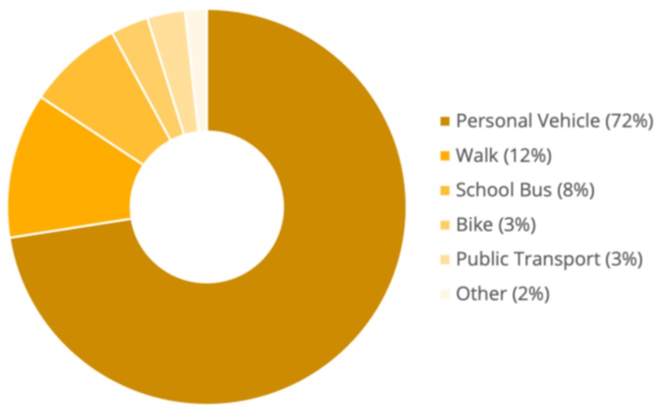
2. Existing Commute Patterns to School in California

2.1 How do Students of Driving Age (16-18 Years Old) Commute to School?

With approximately two million students enrolled in public high schools across the State of California, millions of trips are generated going to and from school each weekday. Nearly three-quarters (72%) of trips taken to school by driving age students (16-18 years old) across the state are taken via private automobile, 15% of trips are active transportation trips, 8% of trips are taken via a school bus, and 2% are taken via public transportation or another mode (Figure 2.1) (National Household Travel Survey (2017). A school's geographic location and its proximity to neighborhoods is an important factor influencing whether a student takes one form of transportation over another. The fact that approximately one-fifth (21%) of students take modes other than a private vehicle or school bus to school suggests that about one-fifth of schools currently have infrastructure nearby that supports safe use of alternative modes of transportation.

California, however, lags behind other states in the mode split of students who take non-vehicular forms of transportation to school. According to the nationwide NHTS, in the U.S., 58% of *all* students are traveling to school by private vehicle, while in California an additional 13% (71% in total) of all students are traveling to school in a private vehicle. This finding reveals that, as the state moves in a policy direction to try to reduce automobile dependency, as we will see in Section 3.1 below, many students are still traveling to school by car.

Figure 2.1: Mode of Travel to School for California Public School Students of Driving Age (NHTS 2017) (N = 815)

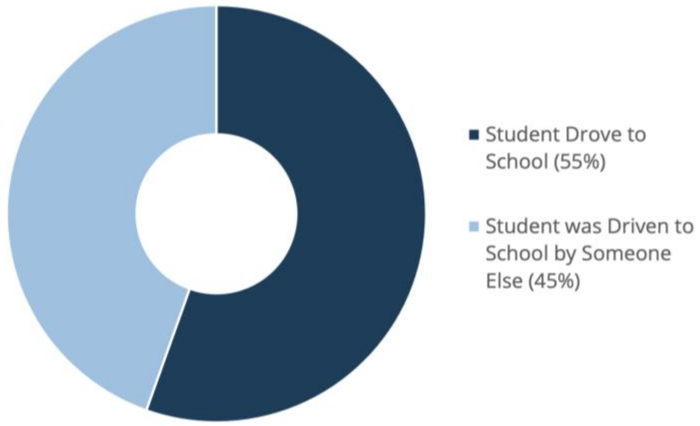


Source: Author's analysis using NHTS 2017 California Add-On survey data

2.2 How Many Driving Age Students are Driving Themselves to School?

An analysis of driving age students in California shows that 55% of students taking a private vehicle to school are driving themselves (and possibly other students) to school, while 45% are not driving themselves to school (Figure 2.2) (NHTS 2017 California Add-On). When compared to students taking any mode, 40% of all 16 to 18 year olds are driving themselves. Understanding how many students are driving themselves to school directly impacts the need for parking at a school site.

Figure 2.2: Percentage Students of Driving Age Who Are Driving Themselves to School (NHTS 2017) (N=617)



Source: Author's analysis using NHTS 2017 California Add-On survey data

3. Literature & Policy Review

3.1 Literature Review

3.1.1 School Siting Literature

Schools fulfill numerous roles in their communities and selecting the geographic location of a school is a critical component that impacts a school's ability to fulfill those roles. Over time, school campus footprints have grown with the expansion of educational programming, including reducing class sizes, requirements for recreational and athletic programming, and wider community use of school facilities. In the 1940s, schools took on a utopian vision amongst facility planners and were seen as centers for the entire community – children and adults alike (McDonald 2010). While not all school districts realized this vision, it remained an influential model in facility planning practice. On top of this, in the post-World War II years, school construction was needed quickly, and ample land (on the urban fringe) enabled quick construction. Compounding this trend further, with more and more families commuting by automobile, locating schools in the center of town became less of a priority (McDonald 2010).

Two influential reports have become the precedent when determining acreage requirements for various school types. In the 1960s, school site and facility planning largely became the responsibility of school districts. They were guided, however, by chapters in the *Urban Land Use Planning* textbook as well as by a report published by the Council of Educational Facility Planners, International (CEFPI), which created acreage *recommendations* for different school types. Many school districts across the country use these acreage recommendations as guidelines when determining where to construct a school. The *Urban Land Use Planning* textbook recommended 25 acres for high schools, and the CEFPI recommended 30 acres per high school (McDonald 2010). These school acreage recommendations were established in an era of higher birth rates and suburban expansion and sprawl. Changing development preferences and family development patterns mean these acreage requirements may be antiquated, too generous, and lack a connection to local context. These arbitrary historical school site planning standards, however, have persisted today and create unique challenges for school districts. The CDE's recommendations for acreage at high schools roughly follows the recommendations proposed in these guides, as we will discover in Section 3.2.1 below (Figure 3.1). Because areas with enough land to support these guidelines often sit in outlying areas – often distant from areas supported by transit, bike facilities, and strong walking scores – students and staff are left with little choice but to drive to school.

While many schools in urban areas can waive out of these land requirements due to a lack undeveloped land,[4] "small and mid-sized communities often struggle with them because acquiring more land is not considered a big problem" (Beaumont 2000). It thus becomes difficult for areas urbanizing today to keep schools centrally located in commercial centers or in neighborhoods. These requirements, therefore, have significant potential to shape or alter a community's urban form, growth pattern, and, as Beaumont notes, they "establish beachheads for residential sprawl" (Beaumont 2000).

Another issue raised in the literature is that many states also have a capital funding formula which favors new construction over the renovation of older schools. If the cost to reconstruct a school exceeds a certain threshold, the district must build a new school to get state funding instead (Beaumont 2000; Hoskens et al. 2004). As Bierbaum et al. note, "environmentalists, public health advocates, and historic preservationists have advocated for the preservation of older school buildings, infill development of new schools, and shared use strategies" to counteract these funding and development patterns (Bierbaum, Vincent, and Katz 2022). In California, generally speaking, if repair becomes higher than approximately two-thirds of the cost of new construction, then a school district must provide a compelling

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[4] The California Department of Education acknowledges the difficulty of acquiring land to meet the guidelines in urban areas, and according to the '*School Site Selection and Approval Guide*,' is currently in the process of developing policies catered towards facility planning in urban areas.

reason to retain the original school that makes economic sense and can meet future education needs. Bringing old buildings into compliance with modern accessibility, environmental, and seismic codes can be an expensive endeavor, but this bias towards new school construction has the potential to push schools to locations where acreage recommendations may be met. School districts also "retain the authority to overrule local zoning and general plan land-use designations for schools if specified procedures are followed" (California Department of Education 2021).[5] In conversations with the CDE personnel, I have learned that this ability gives school districts a bargaining chip as they negotiate school facility planning decisions with city and county personnel but can come into conflict with the municipality's development goals.

Smart growth advocates have also discussed the implications of the physical layout of public education facilities for years. New school locations impact development and travel patterns, school facility quality, student achievement, and a school's ability to be a space for social and political mobilization (Bierbaum, Vincent, and Katz 2022). These aforementioned acreage requirements have been scrutinized by smart growth advocates for their history of making it challenging to develop new school sites in existing neighborhoods (Ewing, Schroeer, and Greene 2004). On top of this, school siting choices are critical to ensuring the development of sustainable transportation patterns because school siting choices impact what transportation options are available to students and staff (Hoskens et al. 2004). Although the CDE has a vision for "promot[ing] sustainable practices that conserve natural resources, limit greenhouse gas emissions, optimize construction and life cycle costs, and encourage walking and bicycling," this study suggests that some of the CDE's guiding documents for school siting may be outdated and may counteract this vision (California Department of Education 2015). The provision of parking is a key component that leads to more unsustainable travel habits and pushes schools away from other modes of transportation and densely developed areas.

3.1.2 Parking Literature

Typically, across the United States and in California, municipalities have established parking requirements for disparate land uses to ensure that there is enough parking available to satisfy peak demand.[6] This assumes that parking is a public good, but many scholars argue that planners and decision-makers take the wrong approach when creating minimum parking requirements. Many scholars argue that this 'need' for parking requirements on private property (off-street parking) stems from the inefficient and insufficient management of on-street parking (Manville 2014). The overwhelming majority of the time, valuable curbside parking is available for free use, and when metered, it is often priced inadequately, leading to parking shortages (Chatman and Manville 2018). Cities have responded to this shortage by forcing developers to provide parking on private property through minimum parking requirements.

According to Donald Shoup, "no one knows" where minimum parking requirements came from (Shoup 1999). Planning literature has not historically included minimum parking requirements as a subject matter. Historically, across the United States, parking minimums – nebulous calculations that prescribe a certain amount of parking for each type of development – have led to an abundance of parking, which works to induce additional automobile travel (Shoup 1999). In other words, when ample parking is provided, people will be encouraged to drive to their destination instead of seek other travel modes. Other side effects of requiring minimum parking include that the cost of providing parking becomes hidden in the price of all other goods and services, constrains developers, leads to inefficient land use, creates an automobile dominant and dependent environment, and inflates the prices of all other goods (e.g., housing or food) (Shoup 1999; Gabbe, Pierce, and Clowers 2020). Eliminating minimum parking requirements, scholars argue, would allow the market to establish the parking supply, reduce unnecessary supply, and permit development that may otherwise have been impossible due to minimum parking requirements (Willson 2013; Hess and Rehler 2021). To this end, many cities and counties across the State of California are now revisiting their parking

[5] Please see as reference California *Public Resources Code* Section 21151.2 and *Government Code* sections 53094, 65402(a), and 65403 to learn more about when school districts may override local zoning and general land-use designations.
[6] This preference for satisfying peak demand is also the approach used to create the CDE's recommendations for parking provision, as will be explored later in this section.

policies to increase development feasibility and density and to help them reach the goals described in numerous progressive climate and transportation policies, like SB 375.

While there are numerous rationales for off-street parking requirements, including that they reduce parking spillover effects, subsidize automobile travel for low-income commuters, and encourage shopping at local businesses, parking minimums are not based on hard science, and they have significant shortcomings. Municipalities typically develop these requirements based upon what other nearby cities have done or by consulting the Institute of Transportation Engineers' (ITE) Parking Generation handbook (Shoup 1999). Both methods are problematic, but when considering the ITS handbook, it is important to note that recommendations are developed by (1) surveying just one or a few of sites for each land use, (2) surveying the site(s) during peak periods, (3) surveying sites that include predominantly free parking, and (4) paying no attention to local context and availability of alternative forms of transportation. Each of these contributing factors leads to an overestimation of the demand for free parking. When there is ample 'free' parking, it reduces the marginal cost of automobile ownership to effectively subsidize automobile travel. Those who take public transport are still subsidizing off-street parking through the price of other goods they purchase. With this, it encourages the development of an auto-oriented society, rising car ownership rates, higher VMT and GHG, induced demand, lower urban density, and, subsequently, more urban sprawl (Shoup 2011).

With California aiming to decrease GHG and VMT associated with personal travel, recording the quantity of parking at school sites and developing strategies to reduce the demand for parking on school land is a critical next step. With mechanisms in place to reduce the *demand* for parking by both students and the education workforce, schools may also be able to be sited on smaller parcels near to existing development. Not only would this approach reduce VMT associated with travel in the present, but it could shift development patterns and commuter mode choice in the decades to come. As will be discussed in the next section, while the CDE does not have parking *requirements,* it does have unmonitored *recommendations,*[7] or rules of thumb, which may *encourage* school districts to provide a certain amount of parking. Because the Department currently does not have binding requirements, how much parking is provided at a site is likely dependent on cultural norms or expectations communities have for parking.

3.2 School Site Development Policy in California

3.2.1 Overarching State Guidance on School Siting

School site planning is guided by numerous state-level rules and regulations. To receive state funding, schools must comply with California's *Education Code Section 17251* and *Title 5* from the California Code of Regulations. California's *Education Code (Section 17251)* stipulates that parcels considered for school site development must consider the "reduction of traffic hazards" to reduce the potential of child-car injuries and conform to the "land use element in the general plan of the city" and/or county. It also assigns the CDE the responsibility of developing standards for site selection, design, and construction to ensure spaces are appropriate for desired educational programming. Additionally, Title 5 establishes a set of minimum requirements of school sites planned by school districts, as follows (California Department of Education 2022, 5):

A. Evolved from a statement of educational program requirements which reflects the school district's educational goals and objectives.
B. Master-planned to provide for maximum site enrollment.
C. Located on a site which meets California Department of Education standards as specified in Section 14010.
D. Designed for the environmental comfort and work efficiency of the occupants.
E. Designed to require a practical minimum of maintenance.
F. Designed to meet federal, state, and local statutory requirements for structure, fire, and public safety.

[7] Recommendations for parking are provided by the CDE in the form of total recommended acres for roads and parking. Section 3.2.2 will go into more detail on converting this recommendation from acres to parking spots.

G. Designed and engineered with flexibility to accommodate future needs.

For the purposes of this research, item 'C' is most critical for understanding how historical factors, educational reforms, and aspects of site design (e.g., parking) contribute to determining the geographic location of a school within a community. Interestingly, no mention of ensuring compliance with state regulations on emissions or sustainability standards is mentioned here. Sites that meet the standards specified in *Section 14010* (Standards for School Site Selection), must have a net usable acreage specified in Figure 3.1 below for each range of enrollment *unless* sufficient land is not available due to, for example, density of existing development, environmental hazards on nearby undeveloped land, undeveloped land is outside of the attendance area, or due to geographic barriers between the proposed site and neighborhoods (California Department of Education 2022, 5).

In less densely urbanized areas of the state, where the above criteria cannot be met to enable the school district to waive out of the requirement and build on smaller parcels, these acreage recommendations (Figure 3.1) may encourage school districts to build where land is cheaper, contributing to urban expansion. With recommendations for total acreage between 19.7 and 55.7 acres, depending on enrollment, a school district may have difficulty siting a new school adjacent to neighborhoods in need. Rather than mandating certain acreage requirements, perhaps the CDE should recommend a school of a certain size have certain amenities or features that can more precisely be geared towards helping the school meet its educational and programmatic needs while also ensuring more sustainable development. Context-specific siting is critical to ensuring a school can meet its educational goals and positively contribute to the state's environmental goals.

Figure 3.1: The CDE's Recommendations for High School Site Total Acreage

Enrollment	Total Site Acreage
Up to 400	19.7
401-600	24
601-800	28.1
801-1,000	32.3
1,001-1,200	35
1,201-1,400	38.2
1,401-1,600	40.8
1,601-1,800	46.8
1,801-2,000	49.7
2,001-2,200	52.8
2,201-2,400	55.7

Source: CDE's *Guide to School Site Analysis and Development* (2000 Edition)

3.2.2 California Department of Education's *Guide to School Site Analysis and Development*

The CDE has developed a set of guidelines, in compliance with *California Code of Regulations, Title 5, Section 14010*, to which school districts must comply, and they are published in the CDE's *Guide to School Site Analysis and Development*. Originally created in 1966, the CDE last updated its *Guide to School Site Analysis and Development* in 2000. While this document is non-binding, it provides school districts with a *guide* that is intended to help them 'right size' their development based upon the education programs made available at a site. The last revision, in 2000, was created due to changes in legislation that required improvements to gender equity and classroom size reduction (CSR). Within gender equity, Title IX ensured equal access to recreational space for female athletes, which required schools, in some instances, to provide additional recreational fields. Site size also increased with CSR because it required the school district to reduce the student to classroom ratio, therefore requiring additional classrooms and teachers (School Facilities Planning Division, California Department of Education, and California Department of Education 2000). While multi-story facilities could reduce the need for larger site sizes resulting from CSR, both of these changes have contributed to growing school footprints. With more athletic fields, more classrooms, and more teachers, more parking seems natural to provide. The tendency to have larger school properties can encourage school districts to develop on the urban fringe or alongside agricultural land to take advantage of lower land costs, which can then spur additional development and make it difficult to commute to school by non-vehicular modes (McDonald 2010).

In terms of parking suggestions, the guide provides recommendations on how much off-street parking to provide based upon the number of teaching stations (i.e., classrooms). It recommends 2.25 parking spaces per teaching station, and at high schools, the guide also recommends additional parking for 50% of its enrollment. "A high school of 2,000 students would provide parking for 1,000 cars at 380 square feet per car – an area of 380,000 square feet or about 8.7 acres of land – in addition to the space needed for staff and visitor parking" (School Facilities Planning Division, California Department of Education, and California Department of Education 2000). Schools are meant to provide enough parking areas for students on the school site so as to not occupy a neighborhood's street parking. The NHTS survey (Figure 3.1 and 3.2), which found that 55% of students of driving age are driving themselves to school, indicates that the CDE's recommendations to provide parking for 50% of enrollment may create an overprovision of parking for daily needs. Approximately half of *all* high school students are of driving age, and these NHTS survey results indicate that just over *half of students of driving age* are driving to school. Lastly, if a school site will be used for community or athletic events, "more land than is needed for student parking must be provided as determined by the capacity of the gymnasium, stadium or auditorium," highlighting a common practice in parking planning – planning to meet peak parking demand (School Facilities Planning Division, California Department of Education, and California Department of Education 2000). It is not uncommon for school districts to allocate enough parking for, for example, occasional high-traffic sport events.

To meet the off-street parking space guidelines, the CDE provides acreage recommendations for parking and access roads, based on student enrollment and size of the education workforce, as listed in Figure 3.2. Using these guidelines provided from the 'Parking & Road Acreage' column, I converted the total acreage for parking and roads to square feet. Using the assumption that 380 square feet[8] of pavement is required for each parking space, I calculated how many parking spots would be recommended based on the parking and access road acreage recommendations. Because this simple calculation devotes all space to parking, recommendations displayed below may be slightly higher than the CDE's intention because it does not consider road space devoted to other uses.

Figure 3.2: The Department of Education's Guideline for Land Devoted to Parking by Enrollment

Enrollment	Parking & Road Acreage	Parking & Road Square Footage	Recommended Parking Spots
Up to 400	2.2	95,832	252
401-600	3.8	165,528	436
601-800	4.6	200,376	527
801-1,000	5.5	239,580	630
1,001-1,200	6.4	278,784	734
1,201-1,400	7.5	326,700	860
1,401-1,600	8.7	378,972	997
1,601-1,800	9.7	422,532	1,112
1,801-2,000	10.8	470,448	1,238
2,001-2,200	11.8	514,008	1,353
2,201-2,400	12.9	561,924	1,479

Source: Author's Analysis using the CDE's *Guide to School Site Analysis and Development* (2000 Edition)

3.2.3 Additional Factors Driving School Site and Parking Planning

[8] This square footage assumption is based on CDE's *Guide to School Site Analysis and Development*.

In addition to this state-level foundation for the school facility planning process, there are many other factors involved in school facility planning that may complicate the process. Conversations with staff members at the CDE and Safe Routes Partnership have highlighted numerous factors that play a role in school facility planning and may impact decision-making at the local school district level.

A. Local school district policies for school site planning

While some school districts do not have additional requirements or policies which drive the facility planning process, others may have detailed planning processes and could also have certain requirements for parking.

B. City & county standards for parking

Some cities and counties may have their own standards for parking. School districts may or may not follow these guidelines for development.

C. Neighborhood groups opposing limited on-site parking

Neighbors may oppose *low levels* of on-site parking out of concern that vehicles will park in their neighborhood all day during school. While districts are meant to address off-site impacts, such as traffic congestion, during the planning process, they are not required to do traffic control plans. This neighborhood tension, however, could result in using more space for parking. It could also lead a school to construct additional parking after initial construction.

D. Unique circumstances, needs, and identities of school campuses

Schools fill different roles in different communities. Recommendations for parking have been built off of standards which consider peak demand, while putting less emphasis on community needs and local context. In practice, this means schools may be encouraged to, for example, construct enough parking to satisfy the need based on the capacity of the stadium or auditorium even though, on a daily basis, the school may not need quite so much parking. Additionally, some schools support students from many linguistic backgrounds. The need for translators or staff to support students with other special needs should be considered in the site planning process and can impact building, parking lot, and site size. Policies which better capture this complexity rather than recommend uncontextualized amounts of parking may be more appropriate.

E. School catchment areas

Some schools, for example, magnet schools, draw students from a larger than normal catchment area. This results in more students either being driven or driving to school and parking.

F. Relationships between school districts & cities

Cities and school districts oftentimes have complex relationships which may impact what city-provided supportive services are available in close proximity to schools (e.g., collaboration with the Streets Department may be necessary to get bike lanes adjacent to campuses). Some school districts have strong relationships with the city and county staff, however others do not. Inadequate lines of communication between, for example between the Department of Public Works and the school district can be detrimental to ensuring there's infrastructure in place to support alternative modes of transportation to school.

G. Pick-up/drop-off lanes

Rather than providing drop-off/pick-up lanes, some schools may subtly be encouraging students to drive or may be providing more parking for parents. While driving to drop-off or pick students up from school in a car may not reduce VMT associated with school travel, it may encourage schools to be located more centrally if they do not need as much land for parking.

H. Role of a parking lot

Parking lots sometimes play a role in a school's emergency response plan. A school district may be hesitant to reduce the size of the parking lot if the parking facility serves a purpose in emergency situations.

3.3 Municipality & State Parking Policy in California

3.3.1 A Glance at Municipal Parking Policies

As mentioned previously, cities have a long history of creating parking requirements for different land uses. Figure 3.3 provides a brief snapshot of the parking requirements in municipalities which had a significant number of high schools used in this analysis. As one might see in glancing at Figure 3.3, parking requirements are not homogenous between municipalities and there are different approaches to creating driver to parking spot ratios (e.g., number of spaces for a fixed number of seats versus number of spaces based on the capacity of the auditorium). Assuming an average class size of 30 students per classroom, the standards below tend to hover between 5 to 6 parking spots per classroom. While some cities and counties across the state and country are loosening or eliminating parking requirements and minimums to enable more dense development (e.g., The City of Berkeley has removed minimum requirements on residential uses and San Diego has eliminated them in high quality transit areas), they are still common, and their legacy has and will continue to impact development patterns in the years to come (Siegman 2022). In the case of parking, school districts are not bound to comply with local minimum requirements, but they may *choose* to align with the minimum parking requirements listed in the municipal or county code because it may allow the school district to comply with the region's standards or expectations for development.

Figure 3.3: Minimum Parking Requirements for High Schools from Select Cities & Counties

City / County	Minimum Parking Requirement	Code
Los Angeles County	1 space per classroom and 1 space per 5 persons based on the occupant load of the auditorium or largest assembly room.	URL
City of Los Angeles	1 per 35 square feet or 1 per 5 fixed seats	URL
Riverside County	1 space/employee, PLUS 1 space/faculty member, AND 1 space/8 students	URL
City of Riverside	7 spaces/classroom plus 3 bus loading spaces	URL
City of San Diego (County data unavailable)	1 per 5 students at maximum occupancy "In November, the San Diego City Council voted unanimously to remove minimum parking mandates for businesses in transit-priority areas and commercial neighborhoods" (Siegman 2022).	URL

Source: Author generated from municipal codes listed at right.

3.3.2 A Glance at Innovative State Parking Policies

California's Parking Cash-Out program, which went into law in 1992, requires employers (public and private) with work sites in "any air basin designated as a nonattainment area" to provide a parking cash-out program if they provide a parking subsidy (i.e., free parking) at the workplace. This means that the cash-out program effectively gives commuters a choice to benefit from *free* parking at work or be *paid* the parking spot's cash equivalent. As Donald Shoup writes, "The cash option converts employer-paid parking from a matching grant for driving to work into a cash grant for commuting" (Shoup 2005). The Cash-Out program treats commuters equally: Car commuters can continue to park at no additional cost to them and those who choose not to commute by car are provided monetary assistance (typically monthly) to help and reward them for walking, biking, or riding public transportation to work.

The benefits of the Cash-Out program are widespread. A 1997 study found that the program led to a 17% decrease in solo car commuting, while leading to a 64% increase in carpooling, a 50% increase in public transportation, and a 39% increase in active transportation use (Shoup 1997). The employee Cash-Out program has also been shown to increase tax revenue. In California, federal income and state income tax revenues rose by $48 and $17 per year, respectively, for employees who chose the cash-out option (Shoup 2005). This monetary impact is significant when multiplied by a region's qualified workforce. Parking Cash-Out programs allow for reduced traffic congestion and increases in active and public transportation. Unfortunately, this powerful law is not well-known and is not typically enforced, according to Donald Shoup in a recent SPUR webinar on the topic. On top of this, schools and school districts are likely exempt from the Cash-Out law because they own their parking facilities. With more state-wide enforcement and possible expansion of this law to affect schools, school districts could benefit from new opportunities to develop schools on smaller parcels that are more walkable and bikeable.

While parking requirements and recent reforms to eliminate or change parking requirements at development sites are largely dictated by decisions at the local level, there is one key bill moving through the legislature now, Assembly Bill (AB) 2097 *(Residential and commercial development: remodeling, renovations, and additions: parking requirements)* (formerly AB 1401), which seeks to "prohibit a public agency from imposing a minimum automobile parking requirement, or enforcing a minimum automobile parking requirement, on residential, commercial, or other development if the development is located on a parcel that is within one-half mile of public transit" (Friedman 2022). The bill has not been enacted, but it has passed the Assembly, the Senate Committee, and is awaiting a vote from the Senate Appropriations Committee (Newton 2021). While it is unclear if the passage of this bill would affect school districts and schools, this bill signals a strong shift in development requirements which prioritizes affordable, dense development over parking.

4. Data Collection & Research Methods

The analytic foundation and approach for this project is based off a forthcoming report produced by researchers at the University of California, Berkeley's Center for Cities + Schools (CC+S), *Reducing Vehicle Miles Traveled (VMT) Associated with K-12 Public Schools: How Well Do New School Sites in California Incorporate Mitigation Measures Known to Reduce VMT?* (Vincent, Maves, and Thomson 2022). The study provides an analysis of new school siting outcomes in California prior to SB 743, analyzing the spatial relationship between schools built from (2008-2018) and four VMT mitigation measures identified by California's Office of Planning & Research (Governor's Office of Planning and Research 2018):

(1) Proximity to high quality transit areas
(2) Proximity to streets with bike facilities
(3) Walkability scores
(4) Proximity to electric vehicle (EV) charging infrastructure

The study did not analyze off-street parking on new school sites. OPR identifies "limiting or eliminating parking supply" as a mitigation measure that may help a development project reduce VMT (Governor's Office of Planning and Research 2018). Before determining how to limit or eliminate the parking supply, the CDE must have a record of the existing parking supply. An overview of the methodology in the CC+S report and this off-street parking supply follow-on study is detailed below.[9]

4.1 Identifying New School Sites

To identify newly sited public high schools across the state, I utilized a robust geo-spatial inventory of land and buildings owned by LEAs across the state, developed by the Center for Cities + Schools (Vincent, Maves, and Thomson 2022; Center for Cities and Schools and Terner Center for Housing Innovation 2021). The spatial inventory was built using county assessor parcel ownership data from California's 58 counties and Microsoft's building footprint data. Spatial polygon shapefiles were created for each school site and for the buildings on each site. The CDE school-level data was then matched to the school site spatial data to identify the individual schools operating on each of the campus parcels. National Center for Education Statistics (NCES) locale code classifications were also used to identify sites as being in "city," "suburb," "town," or "rural" geographies (National Center for Education Statistics n.d.).

To identify the new school sites constructed between 2008 and 2018, the CDE's administrative data was filtered by "year opened." The resulting dataset included 301 "new" schools. After limiting this dataset to high schools (grades 9-12) only, the resulting dataset included 54 schools throughout the state. Figure 4.1 shows that most schools analyzed in this study are located in "city" and "suburb" localities, with a cluster of new schools located in the Greater Los Angeles area.

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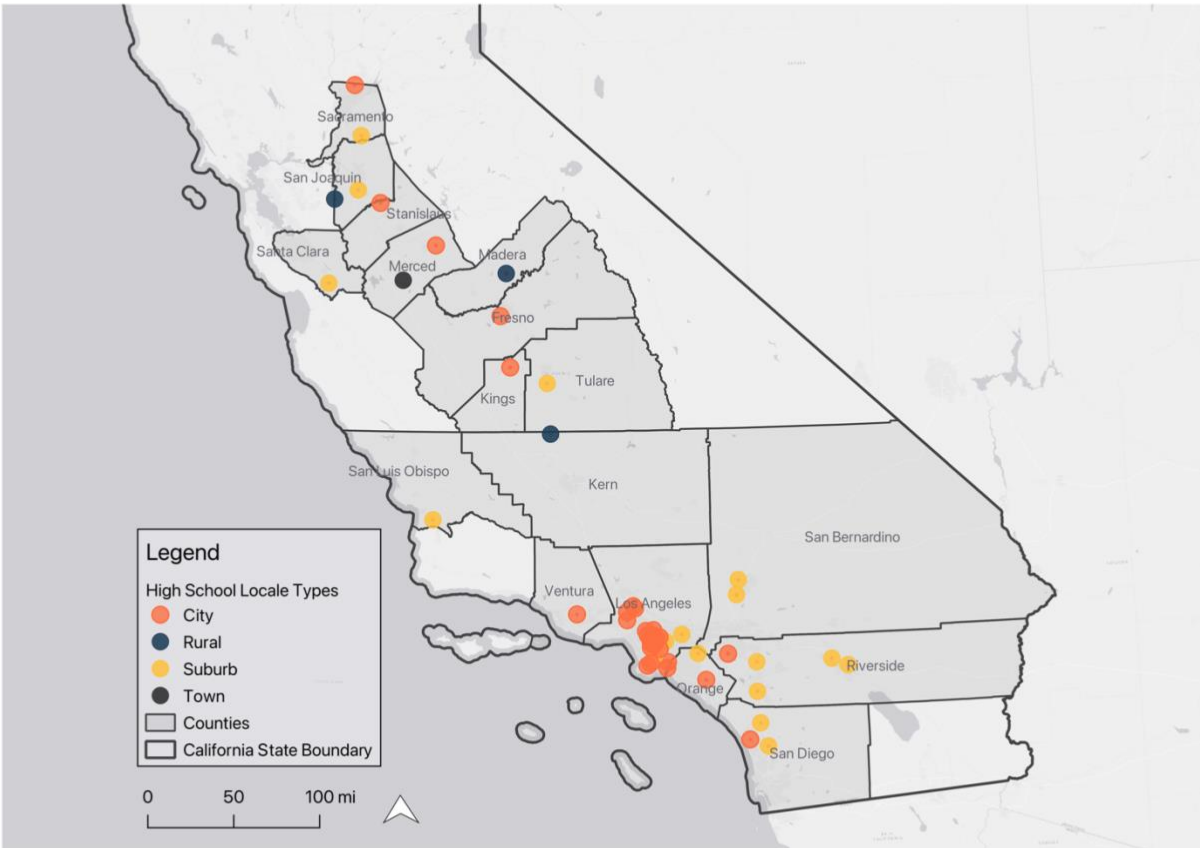
[9] For more information on the forthcoming CC+S study, please search for it by title: Reducing Vehicle Miles Traveled (VMT) Associated with K-12 Public Schools: How Well Do New School Sites in California Incorporate Mitigation Measures Known to Reduce VMT?

Figure 4.1: Map of All New High Schools Included in Study by Locale Type



Source: Author generated.

The research focuses on high schools because they devote much more space to parking to accommodate student drivers. In addition, high school students may have enough independence to enable them to become adopters of alternative modes of travel. In other words, the demand for parking is more elastic than the other main group of commuters to school – the education workforce (teachers, faculty, and supportive and administrative staff). Students, for example, may be more able to carpool, be dropped off at school by caretakers, or take active transportation to school if they live in the public high school's catchment area. It is important to note that the parking demand by teachers, faculty, and staff may be less elastic due to longer commute distances,[10] their need to carry supplies to and from school, and their potential need to pick their children up or run errands after work. For this reason, strategies to reduce the demand for students and the education workforce may be different.

4.2 Collecting School-Site Parking Data

As noted earlier, the CDE does not currently collect data on off-street parking provided at school sites. Without this information, it is difficult for the Department to assess the status of parking provided (and utilized) at schools. Information on parking *and* its utilization are also needed to ensure appropriate policies are in place to effectively reduce VMT and improve multimodal access at new school sites. To quantify parking provided at each new high school, I reviewed satellite aerial imagery of each site using Google Maps. I manually counted parking spaces at

[10] A 2021 study by Center for Cities + Schools, 'Education Workforce Housing in California: Developing the 21st Century Campus,' found that many teachers struggle to live in the communities they work (Center for Cities and Schools and Terner Center for Housing Innovation 2021).

each of the school properties. To identify the parking facilities associated with a school, I used our geospatial inventory to identify which facilities sat within the high school's parcel polygon, as shown in the orange polygon in Figure 4.2. An iPad was used to assist in the manual counts of parking spots. Screenshots of each property would be marked up and counts for each individual parking facility within a school were obtained and recorded on the property screenshot.

Figure 4.2: School District-Owned Parcel and Building Footprint Polygons used to Identify Location of Parking Facilities (In Yellow)

Note: The map above is of Pacheco High School in Los Banos Unified School District. In the large yellow parking facility polygon, one can see the lot is partially covered with solar arrays.
Source: Author's analysis from data analysis and data collected in ITS VMT Study (Vincent, Maves, and Thomson 2022)

To ensure consistency and accuracy across school sites, this study utilized a set of selection criteria for identifying which parking spaces to count. Areas included in parking counts were paved parking areas where parking spot lines were visible, paved areas where solar panels covered the rows of parking (it is common, especially in Southern California to see parking lots covered by solar arrays), and in underground or multi-story parking facilities (common to the Los Angeles metropolitan area). When solar arrays covered a row of parking, parking was counted by measuring the length of a solar array, dividing this length by 9 feet which is the typical width of a parking spot.[11] Lastly, areas not included in the parking counts were those clearly reserved for school bus parking, areas where cars were parked informally on fields or athletic courts, and areas where cars were parallel parked on streets within the parcel polygon (unless parking spots lines were clearly visible). At campuses counted manually (34 properties), I created a shapefile in GIS which identified land devoted to parking at each school site, indicated in yellow in Figure 4.2. Using GIS' polygon area calculator, I aggregated and calculated the areas of each polygon on the 34 high school properties to determine how much acreage was devoted to parking. It is important to note, however, that polygons were created primarily around parking areas and do not include all acreage devoted to access roads and pick-up/drop-off areas.

When parking spot counts could not be reliably counted using aerial imagery – which occurred at selected properties in Los Angeles Unified School District (LAUSD) due to the presence of multi-story parking garages – the school district was contacted. Parking counts were provided by school district personnel for the remaining 20 properties (38% of properties).[12] The parking counts provided by school district personnel should be considered estimates. Actual parking amounts may vary as schools add parking in an ad-hoc manner after initial construction. Because the state is moving in a policy direction to reduce parking requirements at different land uses and because the state funds 50% a new

[11] The length and widths of parking spots vary slightly from one municipality to another. While the average dimensions of parking spaces in California is 9 feet by 18 feet, some municipalities may have parking spaces with widths as small as 8 feet 6 inches or as wide as 10 feet.
[12] 19 of these 20 sites were provided by the Design Standards team at Los Angeles Unified School District.

school's development costs, not knowing how much parking is at California's schools is a hindrance to creating effective school facility planning policies.

While parking spots were carefully counted, parking spots could have been slightly miscounted if there were ADA (Americans with Disabilities Act Standards for Accessible Design) spots (which require a buffer on the driver-side of the spot), under solar arrays, or if the counts which were sent to me via school district or school staff were outdated.[13] With support from Maintenance Department personnel at school districts across the state, the CDE could facilitate on-the-ground data collection to eliminate some of the inconsistencies or inaccuracies which may result from methodology used in this study. Lastly, although many high schools have separate parking facilities for students, faculty/staff, and visitor parking areas, this study aggregates parking spaces for each user type into one count. It also does not distinguish between ADA and non-ADA accessible parking spots and does not provide a motorcycle parking spot count.

4.3 Analyzing the Relationship between School-Site Parking Provided, Eligible Drivers, and State and Local Code

After completing data collection for the total count of parking spots at each of the selected high schools, I assembled relevant school-specific data from the CDE on total enrollment and the total education workforce[14] at each school. This information was used to calculate a ratio of how many eligible drivers there were at each school site compared to how many parking spots were available. This data was utilized to create the following metrics:

- Number of Driving Age Students: This variable was calculated assuming that students turn 16 and are eligible drivers at the start of 11th grade. This calculation, therefore, assumed that *half* of a high school's enrollment (9-12th grade) is of driving age.
- Number of Eligible Drivers: This variable is a sum of all driving age students and the whole education workforce at a school.
- Driver to Parking Spot Ratio: This variable was calculated dividing the number of eligible drivers by the total number of parking spots at the high school to create a ratio of drivers to parking spots.

The creation of driver to parking spot ratio is impactful when comparing the provision of parking across schools, school districts, or counties because it creates a standard metric – across enrollment sizes – which allows one to analyze how many eligible drivers there are per parking spot. A higher driver to parking spot ratio effectively means that there are more eligible drivers assigned to a single parking spot and less space overall devoted to parking based on the number of eligible drivers.

Actual parking counts were also compared with the CDE's recommendations for parking, to determine if schools were providing above or below the CDE's recommended parking counts. Going this extra step beyond initial parking and user demographic quantification to compare parking counts to those who utilize the space as well as to the existing structures which guide decision-making, may persuade Department staff that revisions to the school facility planning guides could encourage more sustainable school-site planning standards.

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[13] It is relatively common for schools to add parking when doing small renovations after initial construction, so it could be possible that counts sent to me may not reflect today's true count. Site and architectural plans were not used for this reason.
[14] The education workforce is composed of three groups: credentialed staff (i.e., teachers), classified staff (i.e., custodial staff), and administrative staff.

4.3.1 Analysis of Parking at School Sites in Relation to the CDE's *Guide to School Site Analysis and Development*

An analysis of how each school performed against the CDE's enrollment-based parking recommendations (Figure 3.2 from Section 3.2.2) was performed to provide a basic understanding of whether new high schools are providing above or below the Department's recommendations. To determine to what degree a school had fulfilled or exceeded the CDE's recommendation, I divided the manual parking counts by the Department's recommendation (Calculated and displayed in Figure 3.2 in Section 3.2.2). In doing this, I generated a percentage where new high schools with values less than 100% had not exceeded the enrollment-based parking recommendation and values of more than 100% had exceeded the recommendation. I then created five thresholds to distinguish between schools closer and further from the CDE's parking guidelines. These five thresholds are listed below in Figure 4.3.

Figure 4.3: Explanation of Parking Threshold Definitions

Percent of the CDE Guideline
Far Below: Less than 75% of Recommendation
Just Below: 75-95% of Recommendation
At Recommendation: Between 5% Below and 5% Above Recommendation
Just Above: 105-125% Recommendation
Far Above: Over 125% over Recommendation

4.3.2 Analysis of Parking at School Sites in Relation to a Sample of City and County Codes

This analysis looks at 54 high schools spread throughout 41 cities in 17 counties across the State of California. Because of this variation in geographic location, this study does not investigate actual parking counts in relation to each city- or county-level parking code. Instead, this study compares a one city and one county's minimum parking requirements (Figure 4.4) – both of which had many new high schools – to the actual parking counts. This comparison allowed me to determine if the school is providing above or below the amount of parking specified in jurisdiction's code for minimum parking requirements. As was emphasized in Figure 3.3 in Section 3.3.1, cities and counties have many unique ways of defining minimum parking requirements. Minimum requirements may be based upon the auditorium size, students per spot, faculty per spot, or a combination of these approaches. Due to data availability, this analysis just compares actual parking counts of high schools located in the City of Los Angeles and Riverside County (total of 18 schools) to a calculation of how many spots are recommended based on the city or county parking code, described in Figure 4.4 below. The way the city and county of Los Angeles consider parking may, however, not be an accurate reflection of how minimum parking requirements are created across the state.

Figure 4.4: Method for Comparing Parking to City or County Minimum Parking Requirements to School Parking Counts

City / County	Minimum Parking Requirement	Number of Schools in Area	Calculation
City of Los Angeles	1 per 35 square feet or 1 per 5 fixed seats	13	Utilized school enrollment data to determine number of parking spots by dividing enrollment by 5. (e.g., An enrollment of 1,000 has a recommended parking lot size of 200 spots).
Riverside County	1 space/employee, PLUS 1 space/faculty member, AND 1 space/8 students	5	Utilized sum of total workforce and ⅛ of school enrollment to determine number of parking spots (e.g., An enrollment of 1,000 students and 50 employees/faculty has a recommended parking lot size of 175 spots).

5. Findings

I now turn to the findings from the analysis of off-street parking provided at 54 new high schools constructed between 2008 and 2018 across the State. In total, 23,911 parking spaces were recorded in this analysis. While parking counts varied widely from school to school, if the spots were distributed evenly, each school would have approximately 442 parking spaces (3.9 acres). Utilizing the CDE's assumption of 380 square feet per spot for parking and maneuvering space, approximately 9.1 million square feet or 205.6 acres of land may be devoted to parking and car maneuverability at these 54 schools.[15] Space devoted to cars (208.6 acres) on new high school sites is equal to approximately 92% of the space devoted to buildings (225.5 acres), and it also makes up 8.6% of the total property acreage (2,415.3 acres) for the 54 schools. The land acreage devoted to parking is significant and should be discussed. Based on these calculations, the space devoted to cars is, cumulatively, nearly 10% of a properties' profile and is nearly equal to the land area devoted to educational and administrative space. The remaining land uses on school properties include courtyards, athletic fields and courts, and undeveloped land.

These initial findings make it clear that *a lot* of land at new high school campuses goes toward supporting driving to school by students and staff. However, the amount of land devoted to parking seems to vary based partly on density of development. Next, I group schools by locale designation type to show how schools in regions with varying levels of development density are allocating space for parking at high schools.[16]

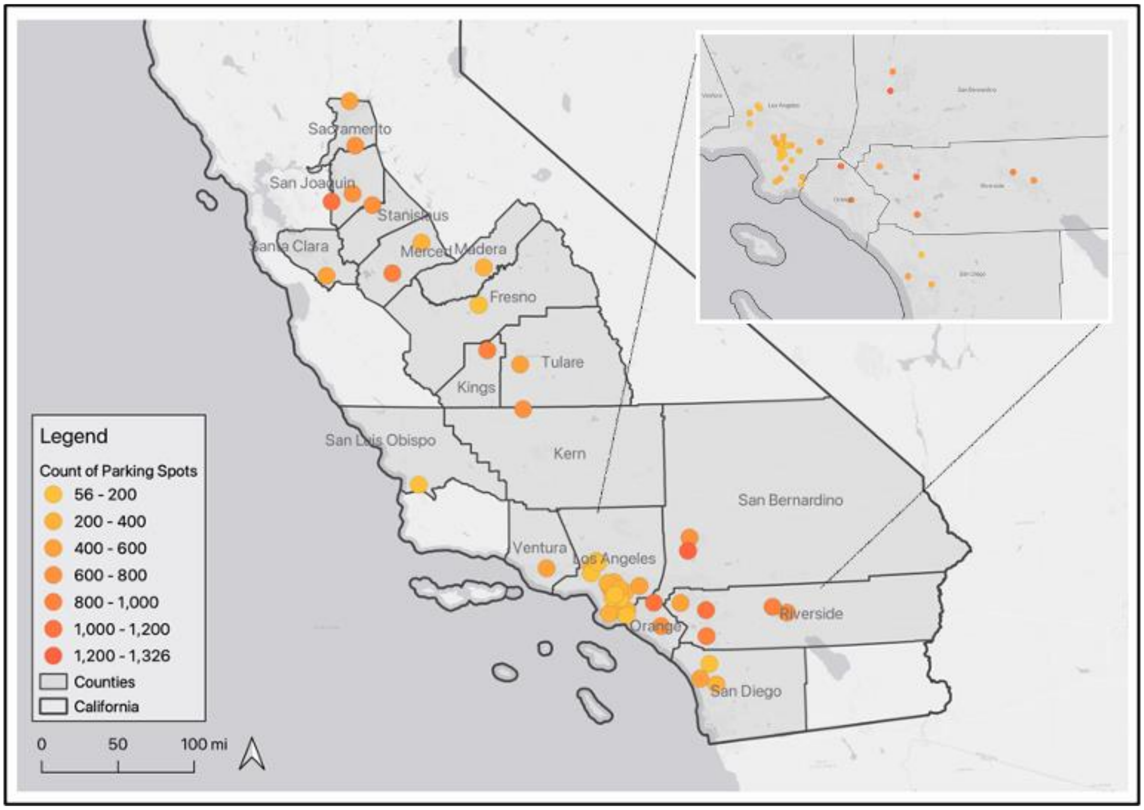
5.1 How Does the Provision of Parking Vary Across Locale Designations (e.g., "city" vs. "rural") and Accessibility to Alternative Forms of Transportation?

The majority of school campuses in this analysis are located in regions classified as either "city" or "suburban" by NCES. Sixty-one percent (33) of the schools are in "city" localities, 30% (16) schools are classified as being located in "suburban" regions, and 4% (2) and 5% (3) of schools are located in "town" and "rural" localities, respectively (Figure 4.1). Because this analysis skews to be more urban, and because urban regions tend to have less parking capacity, the amount of parking at high schools in this analysis might be lower than the average amount of parking available at all high schools across the state. Conducting a similar analysis on a large sample size of both new and older high schools across the state could shed additional light on the status of parking at all high schools across California and would be an important next step before policy changes are made.

Schools across the state range widely in how much parking is provided. Schools included in this analysis had as few as 56 parking spaces and as many as 1,326 parking spaces. Interestingly, the notoriously auto-dependent Los Angeles had relatively low parking counts compared to schools in San Bernardino and Riverside Counties and some of the other sites in the central valley (Figure 5.1). Schools with less parking are displayed in Figure 5.1 in yellow, and schools with more parking are displayed in orange. While the sample size for new high schools in "town" and "rural" localities is small (5 schools), schools in these locale types provide more parking than their "city" and "suburban" counterparts. Schools in "city" areas have less than half the number of parking spots on average (307) than "rural" schools (690) (Figure 5.2).

[15] Actual land area occupied by parking may differ in actuality if a school site averages less parking and maneuvering space than 380 square feet per spot. It may also differ when one considers schools with multi-story parking facilities.
[16] For key findings broken down by county, please see the appendix.

Figure 5.1: Proportional Bubble Map of Total Parking Spot Counts at New High Schools



Source: Author generated.

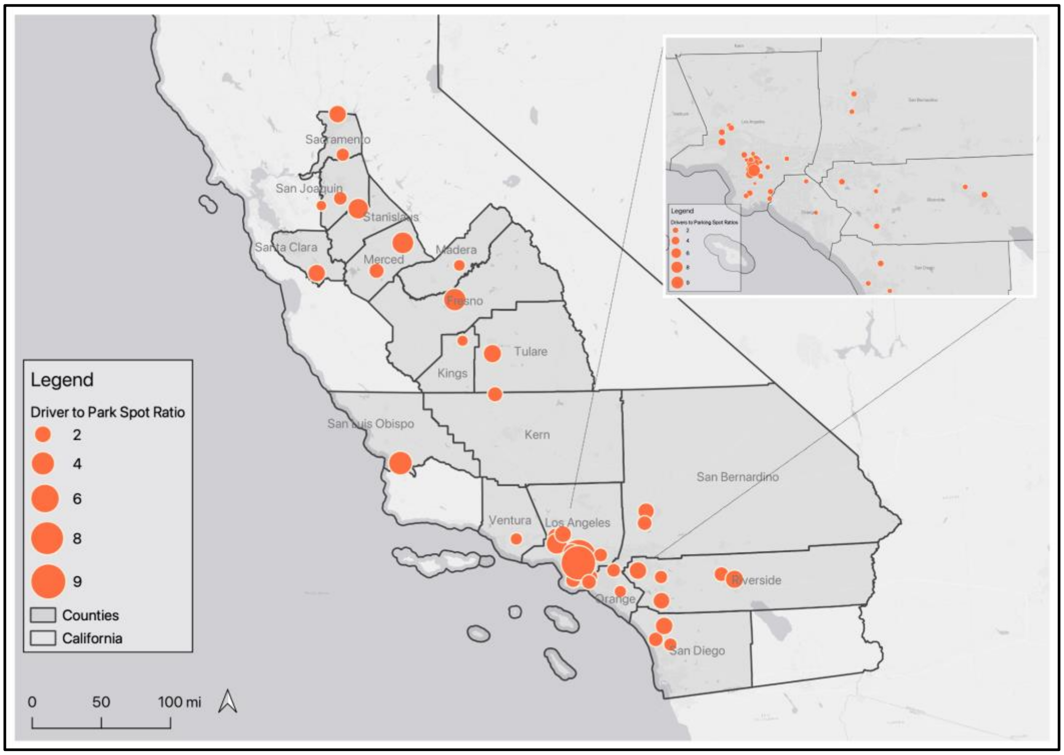
Figure 5.2: Summary Findings of Eligible Drivers and Driver to Parking Spot Ratios, by Locale Type

Summary Findings by Locale Type (n = 54)							
Locale Types	Number of High Schools	Average Enrollment (2017 - 2018)	Average Enrollment of Driving Age	Average School Workforce (Credentialed, Classified, Administrative Staff)	Average Number of Eligible Drivers (Students & All School Workforce)	Average Number of Parking Spaces	Average Driver to Parking Spot Ratio
City	33	835	418	220	637	307	2.7
Suburb	16	1,339	669	354	1,023	634	1.8
Town	2	1,460	730	505	1,134	792	1.4
Rural	3	878	439	259	698	690	1.1

Source: Author's analysis from data analysis and data collected in the VMT Study ((Vincent, Maves, and Thomson 2022).

Although it is valuable to quantify the total number of parking spaces at each property, it may be more insightful to examine standardized quantities across sites through an average driver to parking spot ratio. Schools in "city" localities had 2.7 drivers per parking spot, over twice as many drivers per parking spot as new high schools in both "town" and "rural" localities. This difference between how "rural" and "city" localities provide parking may also be seen in Figure 5.3. Smaller bubbles indicate a smaller driver to parking spot ratio, whereas larger dots (most often seen in urban areas) indicate more drivers to parking spots. This is likely partially because "rural" and "town" geographies are unable to waive out of the school size requirements mentioned previously, they are farther from the communities they serve, there are community or cultural expectations around how much parking should be provided, or they lack proximity to infrastructure which supports non-vehicular travel. Typically, if parking is built, it will be used. This fact may bring school facilities to believe they have provided the needed amount. In this case, supplier-induced demand might be taking place. Interestingly, similar to what was seen in the parking count map above (Figure 5.1), even though Los Angeles is known for its dependence on automobiles, the cluster of new high schools analyzed in the downtown region has much larger ratios than in the greater Los Angeles metropolitan area extending into San Bernardino and Riverside counties. This means that less land may be devoted to parking in urban schools, while more is devoted to parking in more "suburban" schools.

Figure 5.3: Proportional Bubble Map for Ratio of Drivers to Parking Spots at New High Schools



Source: Author generated.

When comparing how eligible driver to student ratios changed with proximity to infrastructure that supports alternative forms of transportation, the ratio steadily declines (meaning there is more parking per eligible driver) when there is less infrastructure available to support alternative modes of transportation (Figure 5.5). The four pieces of infrastructure informing this analysis are proximity to bicycle infrastructure, proximity to high quality public transportation, attendance area, and whether the high school was or was not in a walkable area.

Figure 5.5: Analysis of New High School Proximity to Infrastructure that Supports

Proximity to Active & Public Transportation Infrastructure	Number of Schools	Average Eligible Driver to Parking Spot Ratio
Three (3) Alternative forms of Transportation	15	3
Two (2) Alternative Forms of Transportation	14	2
One (1) Alternative Form of Transportation	14	2
Zero (0) Alternative Forms of Transportation	11	2

Source: Data on proximity to infrastructure which supports non-vehicular travel was collected in (Vincent, Maves, and Thomson 2022). The three alternative forms of transportation included in this analysis were proximity to bicycle infrastructure (within 0.25 miles of the school)[17]proximity to high quality public transportation (¼ mile of a high quality bus stop and/or ½ mile of a major transit stop), and walkability (areas which scored greater than or equal to 10.5 in the EPA's National Walkability Index).

5.2 How Much Land is Devoted to Parking?

With each parking spot requiring 380 square feet for parking and maneuvering, clearly, new high schools in California devote a lot of land and resources to parking. To explore this question of land use distribution further, I aggregated the land area (from my parking polygon shapefile layer) devoted to parking at each site I manually counted. This resulted in an estimate of the total acreage devoted to parking at each site. I then compared it to the property acreage and the acreage devoted to buildings at each property (calculated in Vincent, Maves, and Thomson 2022). Figure 5.6 indicates that even in "city" localities, 3.8 acres of land, on average, is devoted to parking, which is almost as much land as is devoted to school buildings (4.0 acres). Overall, approximately 12% of the land area (3.8 acres of 32.1 acres) at new high schools in "city" localities is devoted to parking – a land use which does little to support learning and active lifestyles. The proportion of land devoted to parking remains consistent for "suburb" and "town" localities. The parking acreage rises significantly from 3.8 acres to 6.3 acres in "suburban" regions even as the building acreage only rises 0.7 acres between these two locality types. Surprisingly, in "town" and "rural" localities, the amount of land devoted to parking (7.0 and 6.0 acres, respectively) surpasses the amount of land devoted to school buildings (5.6 and 2.5 acres, respectively).[18] The significant increase in space devoted to parking between locality types is likely to result from select contributing factors: More land availability, dependence on automobiles, less abundant public transportation options, perceived or actual safety concerns of using active transportation, community expectations of parking, and/or local minimum parking requirements.

[17] Please note data on bicycle infrastructure was only collected for the following MPO regions: FCOG, MTC, SACOG, SCAG, and SJCOG. Data on proximity to bicycle infrastructure was not available for 11 high schools in this analysis, however, each of these schools were in close proximity to zero alternative transportation with the exception of two schools (which were both close to one alternative form of transportation).

[18] These land use allocation estimates may be slightly different if I would have been able to count and create shapefile polygons for parking at all of the high school sites in the Greater Los Angeles area. Because they often have multi-story parking facilities, a smaller portion of the total land area may be devoted to parking on these sites.

Figure 5.6: Quantifying the Amount of Land Devoted to Parking and Buildings

Area of Land Devoted to Parking & Buildings								
Locale Types	Number of Schools	Average Enrollment	Average Number of Parking Spaces	Average Driver to Parking Ratio	Parking Area (Acres)[A]	Building Area (Acres)[B]	Average Property Size (Acres)[C]	Parking as a Percent of Total Land Area
City	33	835	307	2.7	3.8	4	32.1	12%
Suburb	16	1,339	634	1.8	6.3	4.7	48.8	13%
Town	2	1,460	792	1.4	7	5.6	56.6	12%
Rural	3	878	690	1.1	6	2.5	154.2	4%

Source: Author's analysis from data analysis and data collected in VMT Study

[A] Parking area polygons were generated by the author in GIS using satellite imagery. An area calculation was performed in GIS to determine approximately how much space is devoted to parking. This calculation does *not* include all areas devoted to cars, including all pick-up/drop-off areas and all driveways.

[B] Building areas shapefile created using Microsoft's building footprint data. Building areas were then calculated in GIS.

[C] The property shapefile spatial inventory was built using county assessor parcel ownership data from California's 58 counties.

5.3 How Do Parking Counts at New High Schools Compare to the Department of Education's Recommendations?

Although this study does not provide information on the daily parking lot occupancy rates at new high schools across the state, initial findings from this research show that most high schools included in the analysis are providing below the CDE's recommended number of parking spots, based on enrollment (Figure 5.7). When thinking about this in relation to the known externalities of providing parking, this is a good sign, but it also means that the Department's guidelines may not be as effective in shaping school site development patterns as it could be. A valuable next step would be to determine occupancy rates at school campuses.

Of the 54 high schools in this study, 37 schools (69%) are providing 75% or less of the CDE's recommendation, 9 schools (17%) are providing slightly under the Department's recommendation, 2 schools (4%) are providing parking which meets the CDE's recommendations, and 6 schools (11%) are either providing just above or far above the Department's recommendations. A key takeaway from this is that schools are not following the recommendation and are functioning just fine. Schools providing far above the CDE's recommendation may not pay attention to CDE's recommendation. To other schools, this recommendation may seem binding, leading to more parking than may otherwise exist. Interestingly, the six schools which are providing over the recommended number of spots are *not* all located in "town" or "rural" geographies. Three of them are in "city" localities, one is located in a "suburban" locality, and two are located in "rural" localities.

In researching proximity to alternative forms of transportation, only two of the schools are located in areas that either are not considered walkable (National Walkability Score of at least 10.5), are not in close proximity to high quality transit, *or* are not in close proximity to bicycle infrastructure.[19] The remaining four schools, on the other hand, are located in close proximity to at least one of these measures known to reduce VMT, indicating there may be opportunities to reduce parking at the site. Language which encourages school districts to prioritize locating schools near these types of infrastructure may be an effective way to reduce the proportion of school district-owned land

[19] Data used to support these findings was generated from the forthcoming CC+S VMT Report (Vincent, Maves, and Thomson 2022)

which is devoted to parking, motivate sustainable transportation choices, reduce VMT associated with school travel, and contribute to positively transforming local development patterns.

Figure 5.7: Analysis of Actual Parking Spot Counts Compared to Guidelines Provided in the CDE's Guide to Site Analysis and Development

Percent of the CDE Guideline	Number of Schools	Percent of Total
Far Below: Less than 75% of Recommendation	5	9%
Just Below: 75-95% of Recommendation	1	2%
At Recommendation: Between 5% Below and 5% Above Recommendation	2	4%
Just Above: 105-125% Recommendation	9	17%
Far Above: Over 125% over Recommendation	37	69%

Source: Author's Analysis using the CDE's *Guide to School Site Analysis and Development* (2000 Edition)

An analysis was also performed using one city and one county which had the largest number of schools to provide some context on whether schools are providing over or under the minimum parking requirements specified in the local jurisdiction or county code (Figure 5.8). Of the 18 new high schools included in this analysis, 61% (11 high schools) are providing *above* while 39% (7 high schools) are providing *below* the local city or county minimum parking requirements for high schools.

Figure 5.8: Analysis of Actual Parking Spot Counts Compared to Municipal or County Code Minimum Parking Requirements (N=18)

City / County	Minimum Parking Requirement	Number of Schools	Above City/County Minimum Parking Requirement	Below City/County Minimum Parking Requirement
City of Los Angeles	1 per 35 square feet or 1 per 5 fixed seats	13	8	5
Riverside County	1 space/employee, PLUS 1 space/faculty member, AND 1 space/8 students	5	3	2

6. Discussion of Findings, Recommendations, & Next Steps

6.1 Discussion of Findings

The findings from this study provide new insight on parking being provided at new high schools constructed in California between 2008 and 2018. Now, I turn to a discussion of the implications and recommendations for reducing the demand for parking at schools across the state.

In the policy review, I found that the CDE recommends parking allotments based on student enrollment and class size.[20] This approach to determining the school and parking acreage was established in an era of new school development, suburban expansion, auto-oriented development, and higher birth rates. Given today's focus on planning for climate change and reducing society's dependence on fossil fuels, this approach to school facility planning is outdated.

As was mentioned in the introduction, the NHTS travel survey data suggests that only 55% of students of driving age in California are driving to school. Although the sample size in that analysis was relatively small, this finding reveals that schools may be over providing parking for daily student use by recommending there be parking for each and every student of driving age. These recommendations may also be accommodating *peak* demand, but over providing parking for everyday use. School facility planners must consider local context to better align with today's sustainability and smart growth-oriented planning environment. Policies that better capture this complexity rather than recommend parking based on obsolete assumptions may be more appropriate. Future research should also consider using the NHTS or California Household Travel Survey (CHTS) to understand how students in different regions with varying levels of accessibility to alternative transportation commute to school.[21]

The availability of and proximity to local municipal infrastructure that supports taking public transportation or safe active transportation to school is an important factor which may enable a school to adequately meet the commuting needs of its community. In this research, I found that many students are already taking alternative modes of transportation. I also found that high schools near more infrastructure which aids in non-vehicular travel had a higher eligible driver to parking spot ratio. To remain in compliance with SB 743 objectives and other goals meant to reduce community GHG from transportation, the CDE should acknowledge that school location impacts what transportation choices are made by students and staff. The Department may also consider helping facilitate conversation between school districts and municipalities to best coordinate the development of municipal transportation services adjacent to high schools as well as other school types.

Overall, this analysis finds that the provision of parking varies significantly across the state and is highly dependent on the availability of land in different locale types. Because most high schools in this research are located in "city" and "suburban" localities, 33 and 16 schools, respectfully[22] (Figure 5.1), the status of parking at high schools across the state may vary from what is portrayed in this analysis. Likewise, because of the more urban nature of this study, the percentage of students driving to the schools used in this research may be lower than this state-wide average.

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[20] Class size is a strong determining factor impacting how many teachers and administrative staff a school has.
[21] The last CHTS survey includes data collected from 2010-2012. Once a new survey has been created and data has been released, this survey could provide more granular information from different regions throughout the state.
[22] The percentage of schools in "city" and "suburban" localities in this analysis is slightly higher than across all new schools constructed across the state from 2008-2018 and is likely higher than all schools in general.

Based on the analysis conducted in this study, however, I have developed a series of eight recommendations for reducing the reliance on automobiles in commutes to school. By implementing these guidelines, the CDE can determine how much parking to provide at new schools (especially high schools) and ensure long-lasting impacts on VMT, travel commute behaviors, and community development patterns. Given that public high schools serve a multitude of roles depending on the community, policy recommendations may differ depending on availability of resources, infrastructure, and locale designation.

6.2 Recommendations

6.2.1 Additional Data Collection

Recommendation #1: Ensure maintenance personnel record parking counts at school campuses.

The State of California should require school districts to keep an active record of how much parking is being provided at each school. A record of occupancy rates on a typical weekday would also be valuable to determine utility rates of parking facilities across school campuses. As the State works to reduce parking requirements at sites near transit and at different land use types, not knowing how much parking is at California's schools is limiting the creation of forward-thinking and sustainable school site planning policies. Without this information, it also is difficult to determine the degree to which schools across the state are in line with their local minimum parking requirement trends. With 50% of school development costs covered by California, knowing how much parking is provided at high schools should be a priority.

Recommendation #2: Utilize travel survey datasets to inform local school districts of how many students are driving to school today in the region.

As this study found, the CDE's recommendations may be leading to the overprovision of parking for everyday needs based on estimates of how many students are driving themselves to school and parking at school campuses. NHTS provides school facility planners with estimates of how many students are currently driving to school. California Household Travel Surveys (CHTS) can provide school facility planners with metropolitan-level travel-to-school information to estimate how students are traveling to school within a region.[23] The proportion of students driving to school may vary across regions depending on levels of accessibility to alternative forms of transportation. These variations in travel patterns could be used as an input into recommendation #3 below as a contributing factor impacting site size.

6.2.2 Policy and Planning

Recommendation #3: Update the CDE guidance to school districts such that it strongly encourages school districts to consider proximity to measures known to reduce VMT (see SB 743 Technical Guidance).

Rather than making a recommendation on how much parking to provide at high schools based on enrollment and the number of faculty and staff, the Department should take a more holistic approach. By urging school districts to consider proximity to infrastructure which supports alternative modes of transportation before determining how much parking it will provide, the CDE could encourage more sustainable development patterns over the long-term. This approach will reduce the demand for parking, in turn, enabling districts to develop on smaller parcels and utilize areas that may otherwise be parking lots for more active uses (e.g., athletic fields or education workforce housing).

[23] The most recent CHTS captures travel patterns from 2010-2012 and therefore may be outdated. Future CHTS results may be helpful to estimate metropolitan-level student travel patterns, however.

This approach would also align with the approach SB 743 takes by focusing on strategies which eliminate the need for an undesirable behavior (driving) instead of focusing on strategies which allow the behavior to continue happening with fewer negative externalities (providing more parking).

To this end, the CDE should rewrite its school facility planning guiding documents including its *Guide to School Site Analysis and Development* to encourage school site development near the neighborhoods it serves and prioritize site development on parcels which are near infrastructure that supports non-vehicular travel, rather than mandating that schools meet arbitrary acreage requirements. The elimination of acreage requirements could allow school districts to more effectively select sites that allow them to meet their educational and program needs while having a lesser impact on VMT and GHG emissions. It could also enable the school to provide less parking. In summary, the Department should encourage development of schools in the communities they serve, rather than on the periphery where enough land is available.

Recommendation #3.1: Charge for parking at major school and athletic events.

The Department's *Guide to School Site Analysis and Development* also encourages school districts to provide enough parking to accommodate athletic and community events based on the capacity of their largest gathering space (i.e., auditorium or stadium). This is problematic because it means the school is planning for peak demand rather than every-day use. Because pricing parking can reduce the demand, the CDE should require the school district to charge event attendees a small fee for parking at such events. By charging a small fee for parking – just like any other good – it normalizes this practice and encourages commuters to carpool or take alternative modes of transportation. On top of charging a nominal fee for event attendees to park, many school districts already require students to pay a yearly fee to park — as much as $90.00 in some places — or prioritize older students for parking to reduce the parking demand.

Recommendation #4: Develop traffic impact analyses (TIA) and active transportation plans (ATPs) at new or expanded school development sites.

New school sites are currently not required to do TIAs in the development process. These studies can be beneficial for (1) assessing the existing traffic conditions in the immediate vicinity of a proposed school site, (2) estimating how much traffic will be generated from the development, (3) thinking about how it will affect existing roadway conditions, and (4) developing roadway improvements which will minimize negative impacts on traffic and congestion levels. It is also uncommon for school districts to create active transportation plans, a comprehensive report which shares information about the existing active transportation network and strategies for making additional opportunities available to walk, bike, or use other forms of micro-mobility.

In partnership with Climate Action Pathways for Schools, the Porterville Unified School District was selected to be part of a pilot program which hired high school students as interns to "develop and implement projects that reduced PUSD's energy costs and greenhouse gas emissions" (Climate Action Pathways For Schools (CAPS) 2022). One component of this was to develop a detailed plan which seeks to provide opportunities for zero-emission travel to school. Within this, they partnered with Safe Routes to School to expand active transportation routes around Porterville, California. Because high schools are large employers, travel demand management (TDM) could also encourage alternative modes of transportation. With state funding supporting new school construction, a progressive legislature could encourage these reports by providing additional funding to schools which create them.

Recommendation #5: Develop lines of communication between stakeholders.

The need for collaborative planning across jurisdiction departments, the school district, and the CDE is critical to develop innovative solutions which reduce the need for parking at school sites. In Santa Monica, for example, one school has worked with the city and a nearby community college to change school start times so the school days start and end at different times. This was done to support student use of public transportation and to ensure that the transit system is not over overwhelmed. Other school districts could work to find a champion or ally in local government to help facilitate safe travel to school on non-vehicular modes. The CDE could also require quarterly meetings across city departments during the school siting process to ensure continuous engagement and discussion.

6.2.3 Infrastructure and Programs

Recommendation #6: Prioritize construction of active transportation networks to high schools from neighborhoods with high levels of enrollment.

School districts should work to identify which neighborhoods have high levels of enrollment for each high school and which neighborhoods have lower incomes or low vehicle ownership. With this information, they can push for the construction of active transportation infrastructure which connects high enrollment neighborhoods and communities in need to schools. This would reduce barriers to taking active transportation to school, promote more equitable access to school, and reduce the demand for parking by students.

Recommendation #7: Encourage programmatic initiatives at the school or school district level to facilitate student travel by non-vehicular modes.

Not only is it important to create policy shifts and supportive infrastructure which enables non-vehicular travel, it is also important for school districts and schools to create programs which educate students about the positive environmental, social, and health benefits of carpooling or traveling via active modes to school. High schools could create carpool campaigns or allow students who carpool to school to park in priority parking spots. A semester-long active transportation to school competition could also encourage students to walk and bike to school. These initiatives could encourage student independence (by not having to rely on parents for transportation), allow for more social interaction, and promote healthy lifestyle habits.

Recommendation #8: Expand California's cash-out law to the K-12 workforce.

The Cash-Out program encourages and rewards employees for taking non-vehicular forms of transportation while still allowing those who choose to drive to park for free. By expanding the program to affect public schools, which employ a significant number of workers across the state, the demand for parking could decrease and schools could repurpose parking space for other uses. Some school employees may be eligible to participate in the program. Eligibility can be determined in CARB's *California's Parking Cash-Out Program: Informational Guide for Employers* (California Air Resources Board 2021). Over the long run, these tactics could potentially enable school districts to locate schools on smaller parcels.

6.3 Recommendations for Future Research

This exploratory study sought to quantify the amount of parking at new high schools constructed throughout the state to begin to understand if school facility planning and the policies which shape the provision of parking at high schools are in line with today's larger policy landscape. Today's policy environment for new development requires that projects analyze and implement measures that reduce VMT rather than congestion. A contributing measure that impacts both congestion and resulting VMT is how much parking is provided. This study explores this idea with a narrowed scope, looking only at new high schools constructed from 2008 to 2018.

A future study that expands upon this work may consider examining how the provision of parking has changed over a long period of time to determine, for example, if high schools constructed in the 1990s have more or less parking than those which are newly constructed. With on-the-ground support from the maintenance offices at schools, one could also collect true parking counts and occupancy rates during school hours. A more complete record of the quantity *and* occupancy rates of parking facilities at *all* public schools throughout the state would be helpful in determining policy and planning guidance that can best support sustainable school facility planning practices. A future study could also consider additional types of schools (i.e., elementary schools, middle schools, magnet schools, or private schools). With this, however, different school types may have different attendance areas. Magnet schools may attract students from farther away than public high schools. How does this affect how much parking is provided, and what mitigation measures could reduce the need to drive and the demand for parking?

School facility planning is challenging, with a multitude of stakeholders representing school districts, the community, and staff from various government departments at the local and county levels. Rightsizing parking is also difficult. As we have seen, countless aspects of an urban environment can reduce the *need* to drive (e.g., land use density, access to high quality transit, etc.), and an equal number of indicators *should* dictate how much parking is provided at a given location. The complexity of these processes created anticipated and unanticipated challenges during the process of understanding the development process.

An interesting component that could add depth to this research would be utilizing a few municipalities as case studies to understand how city and county agencies interact with school districts. In conversation with key stakeholders and experts in school facility planning, I have come to understand that the school siting and planning process can be siloed from other infrastructure planning processes in municipalities. These case study research projects would shed light on select school districts' best practices for strengthening relationships with city agencies as well as other key stakeholders in the development process. This research could also include case studies of school districts or municipalities that have implemented parking mitigation programs (both on-site and off-site), sharing strategic, innovative approaches to reduce the demand for parking. Finally, case studies which show how school districts have partnered with nearby outside organizations to share parking facilities between non-competing land uses (e.g., churches) could be valuable to highlight for other school districts curious about sharing parking with complementary land uses. By expanding this parking study to put the spotlight on school districts that have made innovative changes to decrease the demand for parking or make alternative modes of transportation more accessible could help inform school districts of the creative programs and initiatives which could help them reach their development and educational goals too. These case studies would also shed light on the nuances and complexities of parking, transportation planning, and school site planning on California's public school campuses.

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Appendix

Summary Findings by County (n = 54)							
Schools by Locale Type	Number of Schools	Average Enrollment (2017 - 2018)	Average Enrollment of Driving Age	Average School Workforce (Credentialed, Classified, Administrative Staff)	Average Number of Eligible Drivers (Students & All School Workforce)	Average Number of Parking Spaces	Average Driver to Parking Spot Ratio
Fresno	1	258	129	80	209	56	3.7
Kern	1	1,240	620	373	993	602	1.6
Kings	1	846	423	290	713	939	0.8
Los Angeles	27	656	328	173	501	235	2.7
Madera	1	186	93	248	341	370	0.9
Merced	2	1,687	843	502	1,345	604	2.6
Orange	2	1,329	665	349	1,013	865	1.1
Riverside	5	1,898	949	490	1,439	811	1.9
Sacramento	2	1,525	763	320	1,083	667	1.7
San Bernardino	2	2,143	1,072	604	1,676	1,035	1.7
San Diego	3	790	395	166	561	373	1.7
San Joaquin	2	1,269	635	218	852	905	1.0
San Luis Obispo	1	313	157	130	287	70	4.1
Santa Clara	1	1,678	839	454	1,293	595	2.2
Stanislaus	1	2,298	1,149	692	1,841	602	3.1
Tulare	1	1,550	775	452	1,227	512	2.4
Ventura	1	696	348	171	519	496	1.0