City of Davis
Cool Pavement Project

Application to the PROTECT Grant Program

August 2023

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I. Project Overview

Introduction

The Davis Cool Pavement Project, proposed by the City of Davis in California, addresses the imminent threat of extreme heat through effective changes in pavement as identified in the City's Climate Adaptation and Action Plan. The project would apply the best practices in solar reflective, "cool" pavements while repaving 15 roadway segments of failing pavement and bring the roadways up to current progressive City striping standards that strive to achieve ambitious active transportation goals set forth in the *Beyond Platinum Bicycle Action Plan* and the *Street Design Standards*. Many of the project segments focus on disadvantaged community areas and serve a variety of land uses such as neighboring residences, schools, restaurants, shops, and religious institutions. While the project provides significant benefits to all road users, active transportation users would especially benefit from the creation of more comfortable roadways, lowering both ambient temperatures caused by the heat island affect and lower traffic stress by slowing traffic with narrower lanes and widened bikeway facilities.

The Davis Climate Adaptation & Action Plan, developed through a community-driven approach, proposes this cool pavement project as a key method of addressing climate risk through adaptation measures to decrease urban heat island impacts. The *Davis Climate Change Vulnerability Assessment* provides information on areas at risk of flooding, as well as identifying disadvantaged community areas.

These efforts will improve the safety, health, and comfort of people traveling along these corridors. Supporting this project "paves the way" for the City to meet its goal of creating a cooler, more resilient city.

Location & Background

The Davis community is widely known as the bicycle capital of the United States due to its success in encouraging active transportation through transportation facility design, land use decisions, and partnerships. However, extreme weather threatens this legacy by forcing people who may have chosen to bike or walk to drive instead. Worse still, sensitive populations in Davis (12% of people over 65, or the 9% of households that do not have access to a vehicle[1]) may not be able to travel to vital services safely with life-threatening temperatures. To contend with this, the project would implement methods to lighten asphalt and utilize high albedo surface treatments to reduce the impact of the urban heat island effect.

The project roadway segments are located in the City of Davis and encompass a mix of arterial and collector roadways critical to multimodal travel in the city.

Selected project roadway segments represent areas with:

- Poor or failing pavement
- High land surface temperatures
- Lower than average tree canopy
- High average daily pedestrian, bicycle, transit, and vehicle traffic

[1] U.S. Census, American Community Survey 2017-2021 5-Year estimate.

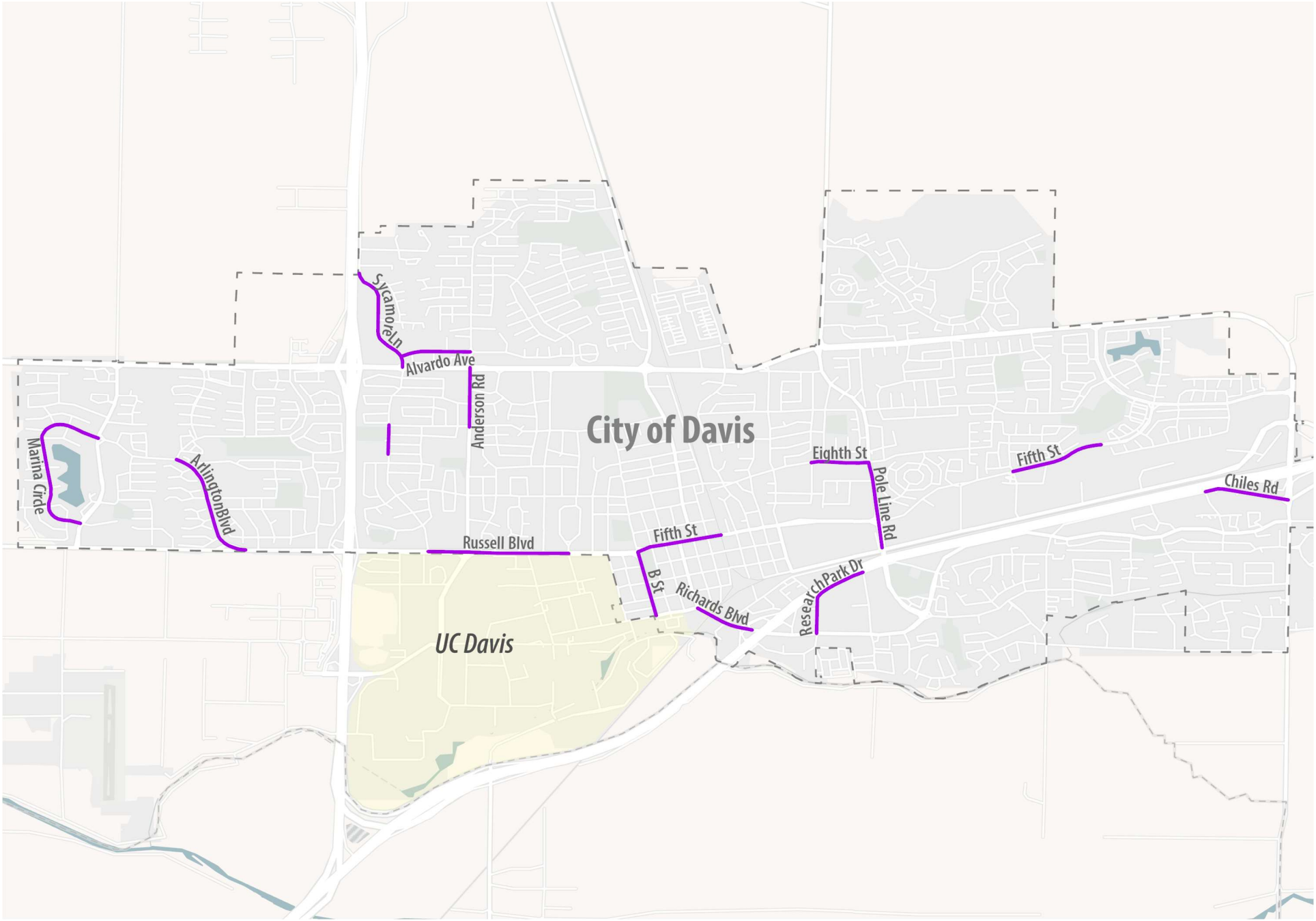
Figure 1 shows the proposed project locations within the City of Davis. Though the segments only represent a fraction of the roadway network in the city, they represent areas in need of immediate attention due to high surface temperatures and failing pavement quality. By focusing on upgrading existing facilities with scarce transportation funding, the City can incentivize the existing land use productivity and density in Davis.

The project would bring meaningful funds to the City, revitalizing several roadway segments integral to the local economy. Some of these segments include:

- Russell Boulevard from Sycamore Lane to College Park, a busy east-west principal arterial with over 19,000 average daily traffic serving student housing and commercial areas.
- B Street from 1st to 5th Street, the "gateway" between downtown Davis and the UC Davis campus.
- 8th Street from M Street to Pole Line Road, a key arterial serving low-income housing and two grocery stores.
- Richards Boulevard from First Street to I-80, a critical connection to Interstate-80 that experiences the heaviest congestion in the city and is a key walking and biking route under an active rail line.

While pavement improvements may improve vehicle throughput, updated facilities have the potential to shift trips to biking and walking.

Figure 1: Proposed Project Locations



Regulatory Setting & Previous Planning

The *City of Davis Climate Action & Adaptation Plan* (CAAP) previously identified the greenhouse gas reduction potential of cool surfaces and reducing the heat island effect. The Davis CAAP creates specific goals to implement "cool surfaces, reflective materials, coatings, and other emerging technology to reduce the heat island effect," and suggested a pilot program for cool pavement roadways.

The *Yolo County Multi-Jurisdictional Hazard Mitigation Plan* specifically identifies cities as a primary concern during heat waves, where the urban heat island effect prevails. Susceptible populations include the young and elderly, as well as those without adequate air conditioning.

The City of Davis regularly updates its *Pavement Maintenance Program*, last updated in October 2022. The City's pavement network consists of approximately 166 miles of streets and 52 miles of bike paths, which represent a substantial investment of $421.5 million. Overall, the City's pavement network is currently in "Fair" condition with a 2022 average street pavement condition index (PCI) of 57 and a 2022 average bike path PCI of 50. Of the street network, 33.8 percent are in "Poor" or "Failed" condition. The Cool Pavement Project prioritizes the "Poor" and "Failed" roadways to bring segments up to a "Good" level to receive cool pavement surface treatments.

Extreme Heat

Statistics over the past 30-years show extreme heat is the leading cause of weather-related deaths in the United States. A recent analysis of heat-related mortality found extreme heat has led to 3900 deaths in California between 2010 and 2019. Extreme heat may have serious direct health-related impacts, degrade air quality, and increase gradual wear and tear on infrastructure such as the energy grid, building mechanical systems, roadway pavement, and more, resulting in increased maintenance costs.[2] Extreme heat also jeopardizes Davis' existing tree canopy, as "summer branch drop" from sudden limb failure in trees feeds into the death of key natural resources.

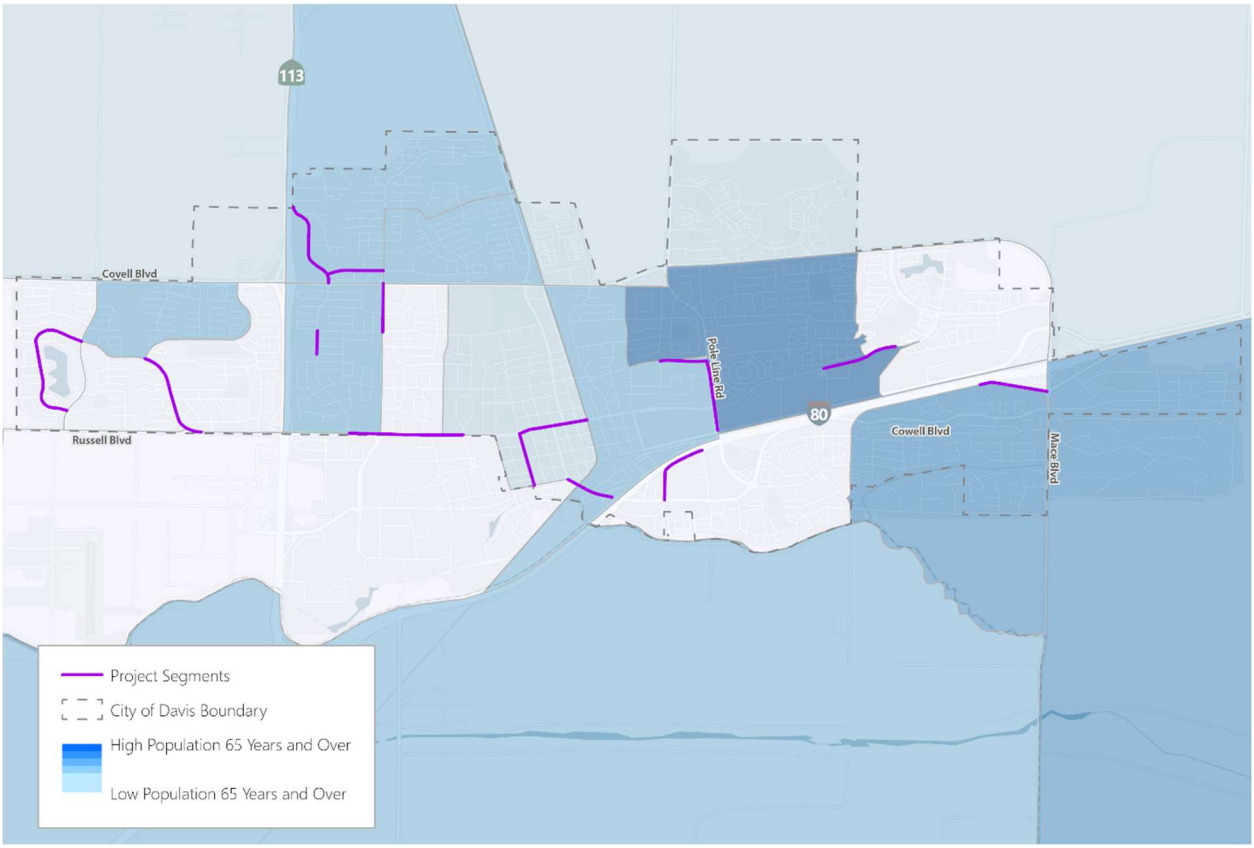
As the Davis Vulnerability Assessment states, an increase in the annual number of extreme heat days may also increase the need for maintenance and repairs for City transportation assets. Roadways, bike paths, and parking lots are composed of materials, which can be affected by prolonged periods of extreme heat. Exposure to extreme heat may cause these assets to soften and experience deformation, cracking, or splitting. Electrical equipment is usually designed to operate optimally within a specified temperature range and extreme heat days may affect performance and shorten the lifespan of electrical equipment. Traffic signal control cabinets are therefore sensitive to extreme temperatures and control cabinets for transportation infrastructure are increasingly fitted with air conditioning units. In addition, backup power is available at some, but not all signals, and thus the electricity supply powering the cabinets may be interrupted during power outages or "brownouts" that may occur during extreme heat days if the power grid becomes overloaded.

[2] City of Davis Climate Action & Adaptation Plan: https://www.cityofdavis.org/home/showpublisheddocument/18401/638173234962900000

Urban areas face significant challenges as the threat of extreme heat rises, owing to a built environment that concentrates and amplifies heat, creating urban heat islands.[3] Urban heat islands can increase the daytime temperature by 7 °F and nighttime temperatures by up to 4 °F.[4]

Extreme heat can lead to increased respiratory difficulties, heat exhaustion, and heat stroke. Extreme heat also exacerbates pre-existing conditions such as cardiovascular diseases, respiratory illnesses, and diabetes. These heat impacts most significantly affect the most vulnerable— children, the elderly, and those with preexisting conditions. As shown in **Figure 2**, Davis is home to many elderly people, especially in central Davis. 13% of Davis residents are over 65 years old. The percentage of people over 65 is expected to increase to almost 20% of the Davis population by 2045 due to decline in fertility rates and increases in life expectancy[5].

Figure 2: Census Tracts by Age 65 Years and Older

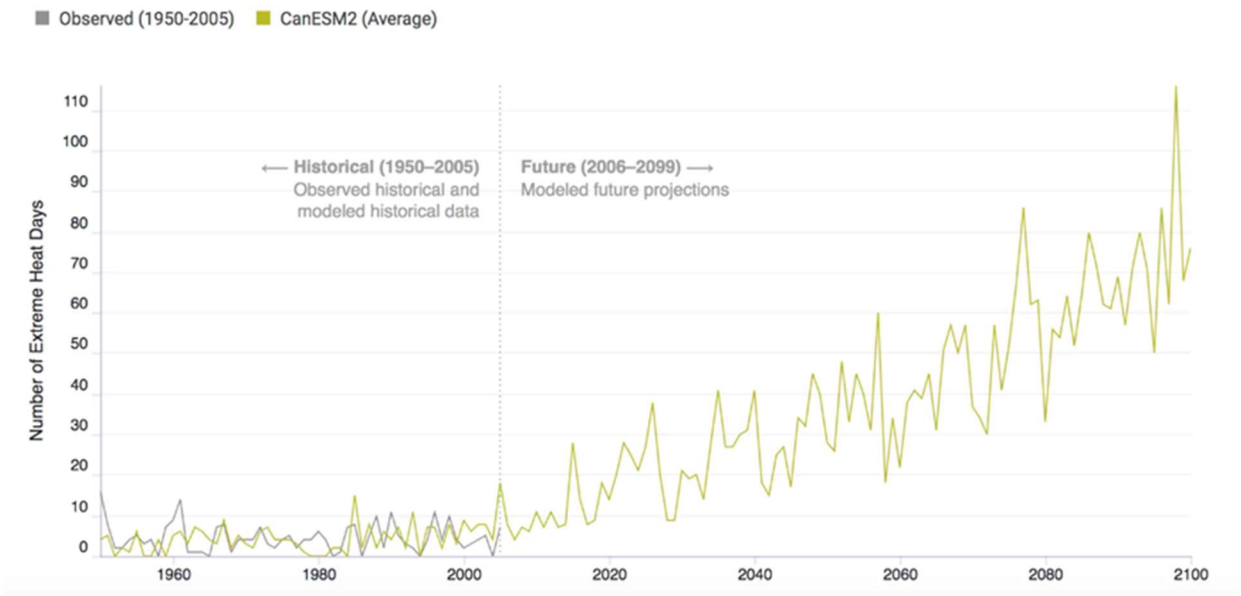


Source: U.S. Census Bureau

[3] Kalkstein et al. 2022, https://link.springer.com/article/10.1007/s00484-022-02248-8
[4] Ortiz et al. 2018, https://journals.ametsoc.org/view/journals/apme/57/4/jamc-d-17-0125.1.xml
[5] California Department of Finance, P-2B County Population by Age, https://dof.ca.gov/forecasting/demographics/projections/

In the City of Davis, the number of extreme heat days (maximum temperature above 103.7°F) is projected to increase from 5 days in 2005, 22-28 days by mid-century, and 30-50 days by end-of-century.[6] **Figure 3** shows the projected number of extreme heat days in Davis over the next century.

Figure 3: Projected Extreme Heat Days in Davis



Source: Cal Adapt, https://cal-adapt.org/

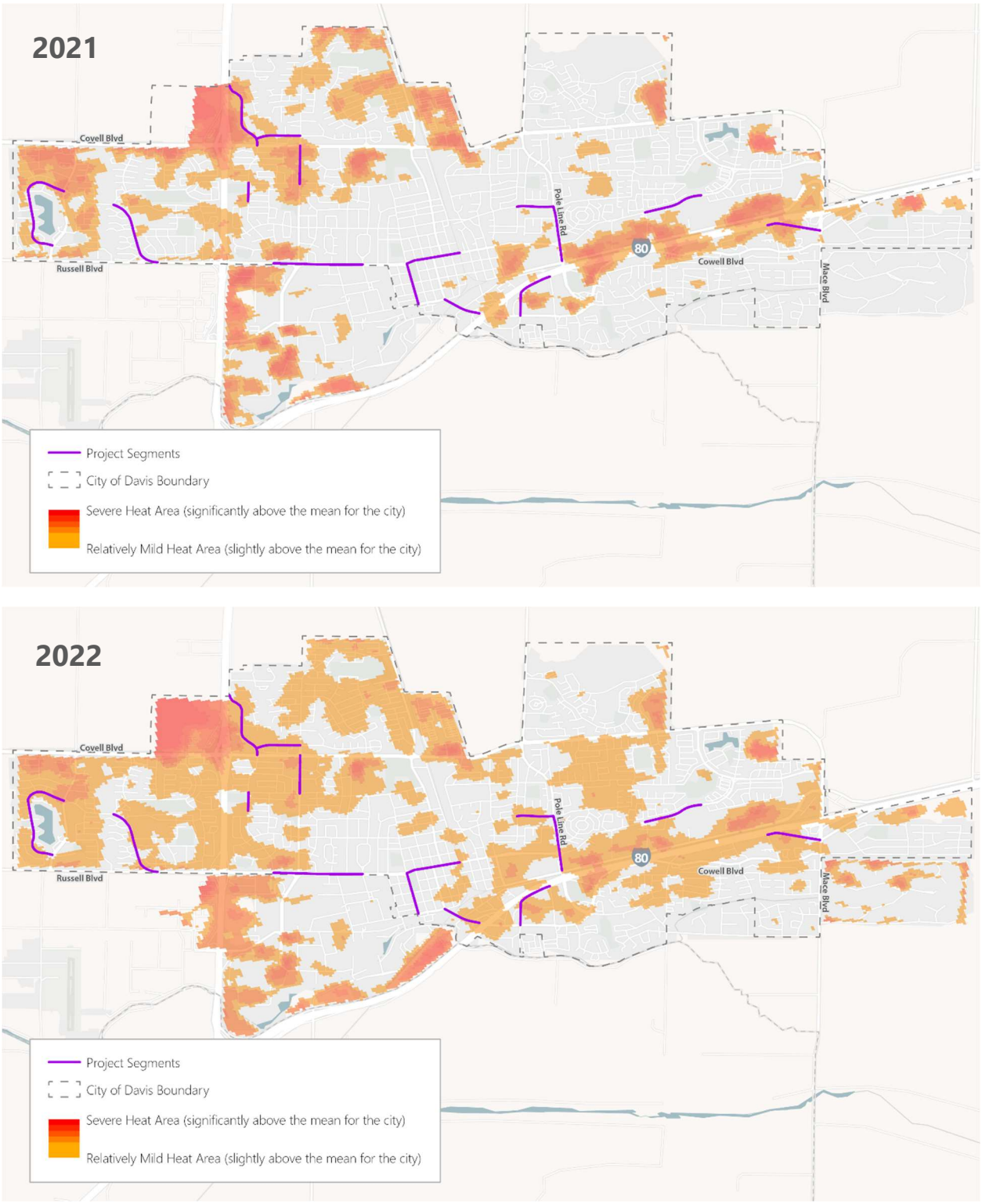
The cumulative impacts of increased heat may be substantial. Stagnant air during heat waves increases the amount of ground-level ozone and concentrates particulate pollution in urbanized areas leading to poor air quality. Heat waves, like the one experienced in September 2023 where temperatures in Davis topped 113°, degraded air quality to "unhealthy" levels. The City of Davis regularly struggles with high ozone and PM2.5 levels, as evidenced in **Appendix A**.

Last year's heat wave not only caused air quality degradation but resulted in loss of power to roughly half of the city, as utility company PG&E proactively deenergized some of its equipment to "prevent safety hazards and system failure"[7]. The extreme heat resulted in 12,400 households losing power for several hours on one of the hottest days in years.

Figure 4 shows heat severity in Davis for the summers of 2021 and 2022. This information was used to prioritize locations for the proposed Cool Pavement Project.

[6] CalAdapt, Extreme Heat Days: https://cal-adapt.org/tools/local-climate-change-snapshot/
[7] https://www.kcra.com/article/live-coverage-california-rolling-outages-pge-smud/41097480#

Figure 4: Heat Severity in Davis (2021 and 2022)



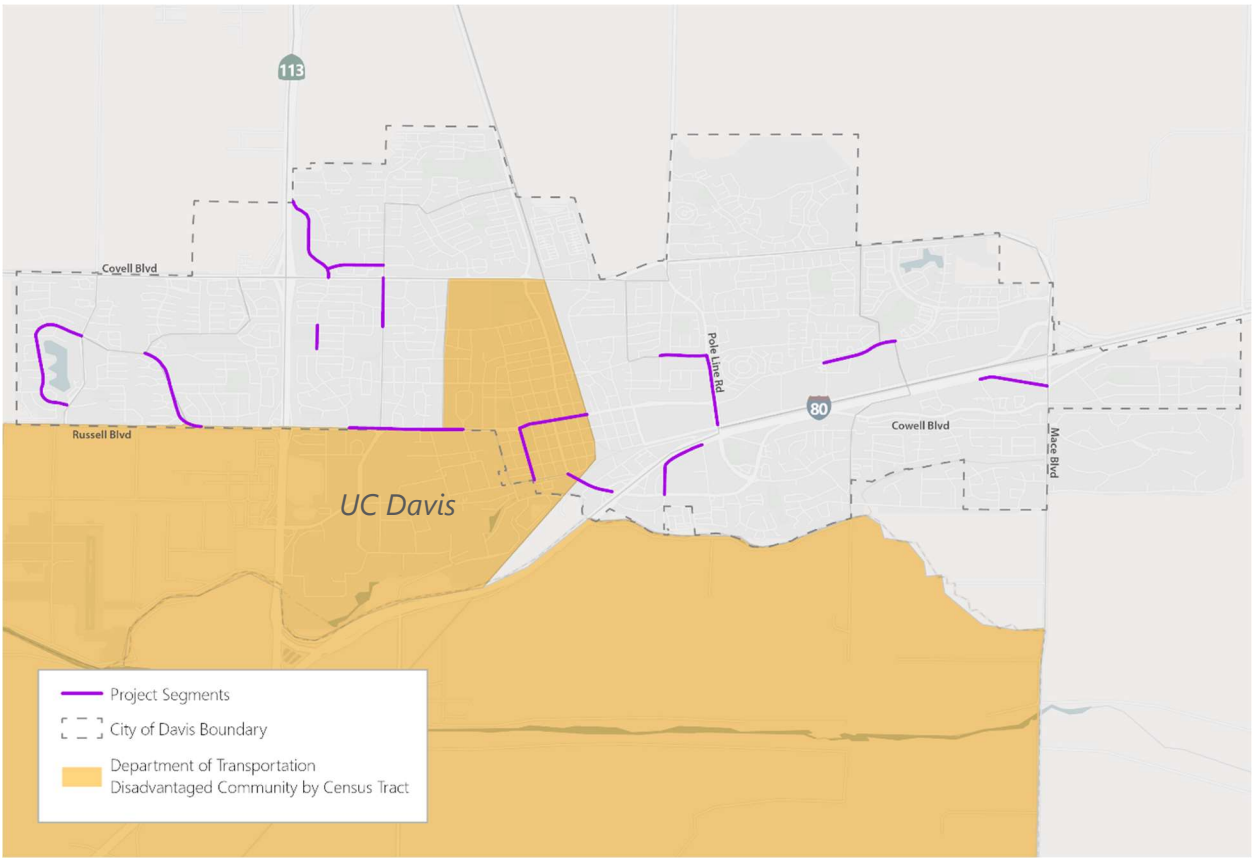
Source: Urban Heat Island Severity for U.S. cities, https://www.arcgis.com/home/item.html?id=4f6d72903c9741a6a6ee6349f5393572

Disadvantaged Communities

Income inequality and high cost of housing are issues of particular concern within the city. Davis is home to a large student population who tend to be renters who have a high rate of turnover, have limited incomes, and may be disproportionally affected by high housing costs. The city and UC Davis are rapidly building more housing to meet demand for university services, however, infrastructure maintenance is necessary to keep up with demand.

Figure 6 shows Historically Disadvantaged Communities in the City of Davis, as identified by the USDOT. As shown, four of the 15 project road segments are in disadvantaged communities, though all segments of the project provide access to key destinations, serving the entire Davis population.

Figure 6: USDOT Transportation Disadvantaged Census Tracts

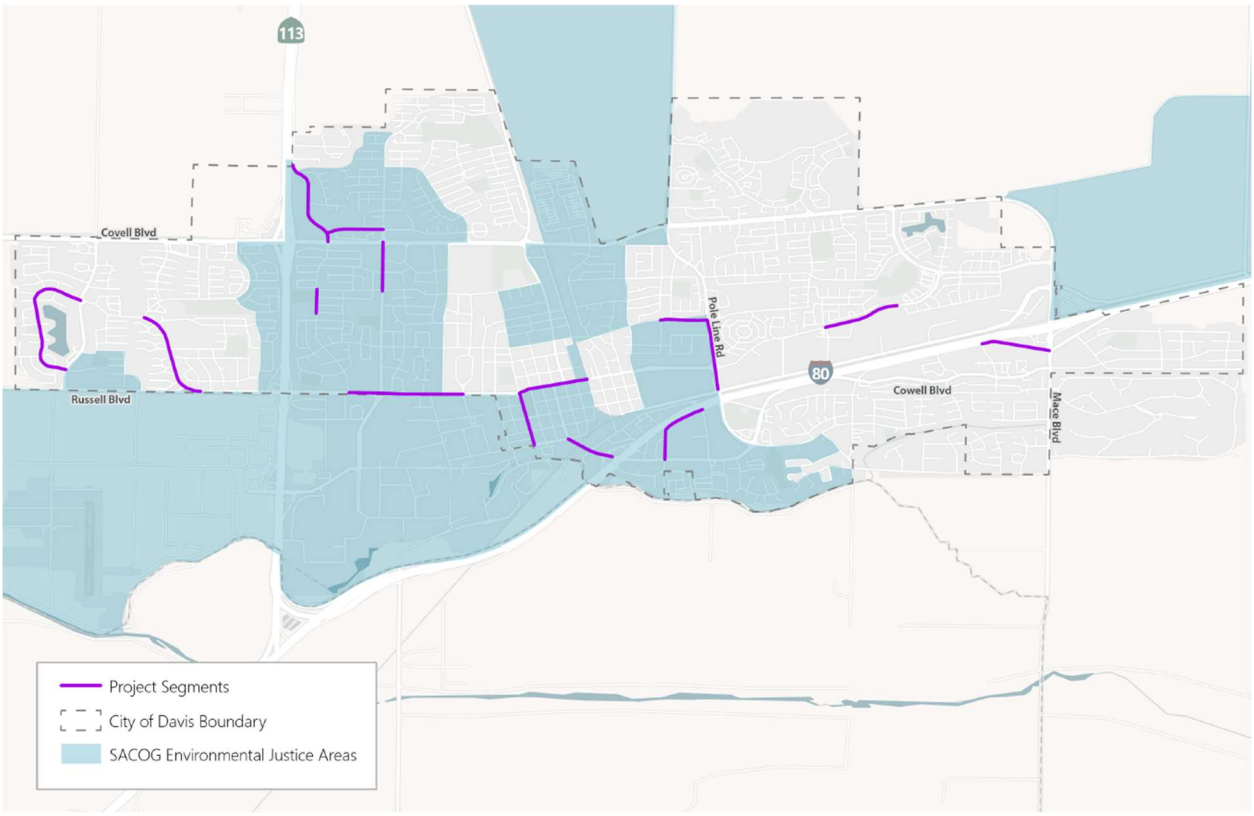


Source: USDOT, Historically Disadvantaged Census Tracts, https://usdot.maps.arcgis.com/apps/dashboards/d6f90dfcc8b44525b04c7ce748a3674a

No areas of Davis qualify as disadvantaged under the Council on Environmental Quality's Climate and Environmental Justice screening tool. However, several other tools have identified various communities in Davis as overburdened and underserved. The Sacramento Area Council of Government (SACOG)'s Environmental Justice (EJ) communities index, which utilizes the framework of vulnerable communities described by the California Governor's Office of Planning and Research. EJ communities, shown in **Figure 7** below, identify areas that have concentrated populations of one or more socioeconomic/environmental

factors: low income, communities of color, high pollution burden, 75 years or older, single parent household with children under 18, disability, linguistic isolation, housing burdened, and education attainment. **Notably, 11 of the 15 project segments (73%) fall within these communities.**

Figure 7: SACOG Environmental Justice Communities

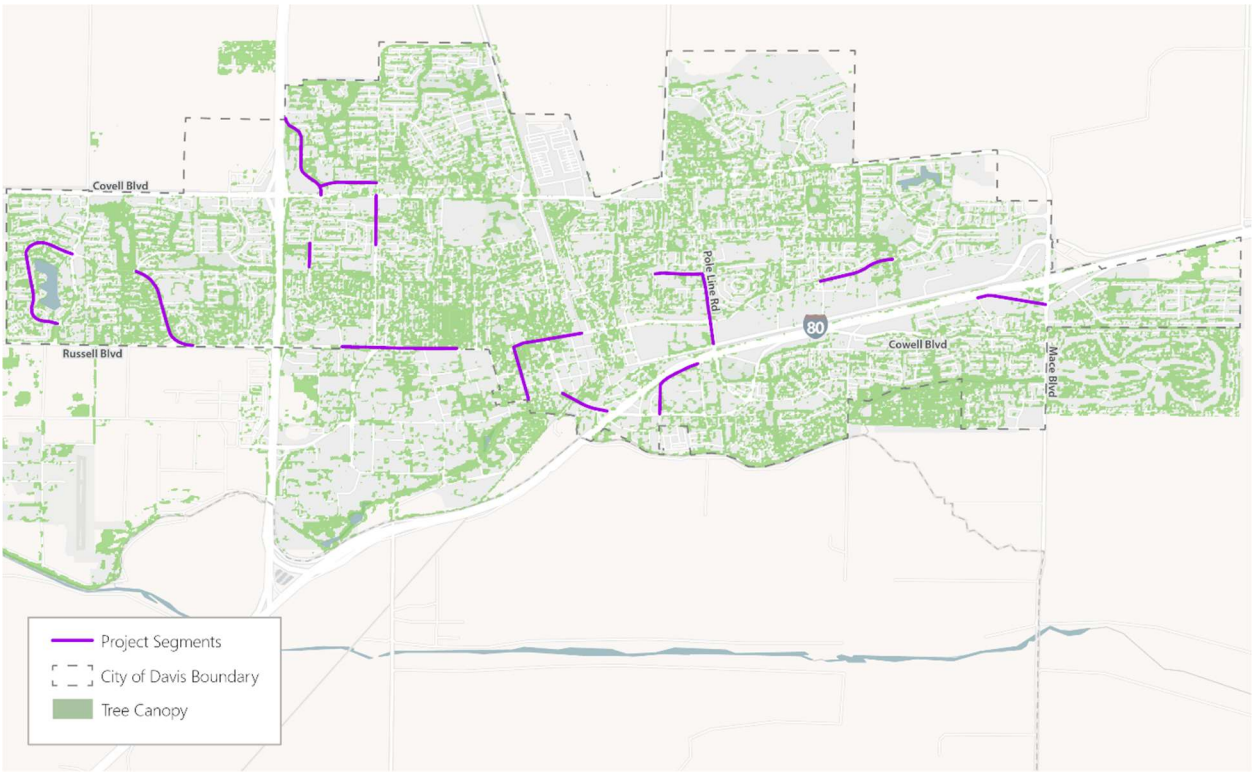


Source: Sacramento Area Council of Governments, Environmental Justice Areas, https://data.sacog.org/datasets/bd8e95f309f54ea5b9a50f159b941c81/explore?location=38.542602%2C-121.700548%2C12.88

Disadvantaged communities often live in neighborhoods that have less tree cover, less vegetation, and more hardscape — living conditions that contribute to a pronounced urban heat island and which can create a feedback loop of heating effects.

Figure 5 shows the existing tree canopy with proposed project locations. Several project segments, especially those near Interstate 80 and State Route 113, were selected due to their lack of adequate tree cover.

Figure 5: City of Davis Tree Canopy Cover



Source: Fehr & Peers, 2023.

Cool Surface Treatments

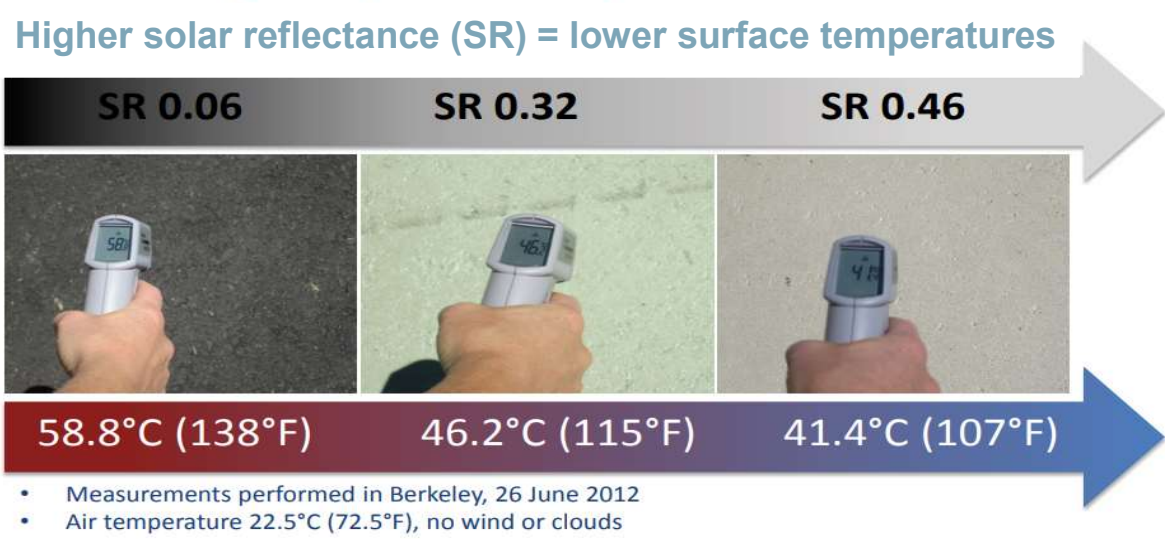
Implementing cool surface treatments on roadways, designed to absorb less heat than standard surfaces, reduces heat transfers from the roadway to the air and thus can limit the heat island effect. Traditional asphalt collects and retains heat during the day and releases heat at night. U.S. EPA data shows the difference in nighttime temperatures in heat island areas can be as much as 22 degrees warmer than temperatures measured outside the heat island. Higher nighttime temperatures lead to more energy consumption, greenhouse gas emissions, air pollution, and other harmful effects.

The conventional roadway paving material used across the U.S., asphalt, has solar reflectances of 5 to 30 percent, absorbing 95 to 60 percent of energy rather than reflecting it into the atmosphere.

The City understands that the cool surfaces may have higher upfront costs, but the environmental and public health benefits outweigh this cost differential. The City needs to start implementing cool surfaces today to prepare for temperatures increasing each year.

Figure 8 shows the solar reflectance ratings for different pavements.

Figure 8: Relationship between Solar Reflectance and Surface Temperature



Source: Environmental Protection Agency – Solar Reflectance

Project Scope

The City of Davis would manage the project and be responsible for the selection of any consultants and contractors for facility design, materials selection, construction management, and construction/repavement.

A rigorous community outreach and engagement process was previously conducted for the Davis Climate Action & Adaptation Plan, which resulted in the conception of this cool pavement project. A continued public involvement process will be conducted as part of this project, including public outreach and stakeholder implementation partners, focusing on disadvantaged community members. Academic partners, such as the UC Pavement Research Center, will provide best practices specific to Davis.

Pavement design, restriping and signage upgrades, as well as necessary pedestrian improvement will be performed by the selected design consultant or in-house design staff with review from experienced City staff for oversite and inspection. All roadway segments will be brought up to current City striping standards, which include 10-foot vehicle travel lanes and 7-foot minimum bike lanes. In many cases, excess pavement width will be converted to bikeway buffers lowering traffic stress and encouraging a broader spectrum of bicycle rider ages and abilities.

The repavement process will include:

1. Cold planing the existing roadway ~2.5 inches.
2. Pouring a hot-mix asphalt with a mix of lighter aggregates.
3. Applying a cool pavement surface treatment based on approved available products at the time of installation.

Before and throughout the construction process, surrounding homes, businesses, and organizations will be made aware of construction activities through mail notice, the city website, local news, and signage.

The project will not end with completion of construction, as the City will study the long-term benefits, costs, and wear of these novel, cool roadway treatments. Evaluation of a successful first phase of cool pavement implementation will involve various public commissions and stakeholder groups within the City to accelerate broader application of cool pavements across Davis.

Demonstrated Experience

The City of Davis has successfully completed several projects and programs supported by Federal-aid highway program funding. Past projects include:

- Montgomery Elementary School Safe Routes to School Infrastructure Program | FID: 5238-068 | 2022
- Mace Boulevard Road Improvements | FID: 5238-061 | 2018
- Third Street Redesign | FID: 5238-064 | 2017
- L Street Improvements | FID: 5238-062 | 2016
- Davis School District Safe Routes to School Program | FID: 5238-057 | 2016
- Eighth Street R.R. Crossing Bike/Pedestrian Safety (FID: 5238-060) | 2015
- B Street Improvement and Rehabilitation | FID: 5238-059 | 2014
- Fifth Street Road Diet | FID: 5238-053 | 2014

See descriptions of these past projects in **Appendix B**.

Mace Boulevard Road Improvements (2018)

II. Grant Funds, Sources, and Uses of Project Funding

The proposed project budget is broken down into the following categories:

- **Project Administration:** Conducted by City staff during the duration of the project. Includes project management, collaboration with grant managers and other relevant agencies (e.g., Caltrans, SACOG, etc.) and the public, and oversight of selected consultants.
- **Design**: conducted by qualified consultant team with oversight from City staff during the first year and a half of the project. Includes striping plans as well as review and selection of cool pavement materials based on current industry standards.
- **Construction Management & Construction**: conducted by qualified consultant during project years 2-6. Includes labor and materials to construct the cool pavement project segments.
- **Project Review**: Conducted by City staff and partners from academia or non-profit organizations after construction. Includes summary of challenges during cool pavement implementation, study of effectiveness of materials in lowering surface temperatures and induced demand effects, and consideration of next steps for additional opportunities.

The proposed project budget, broken down by grant and local funds, is provided in the table below.

Tasks	PROTECT Discretionary Grant Program	Local Funds (non-Federal)	Estimated Total Project Cost
Phase 1: Project Administration (FY2024 - FY2030)			
Project Administration	$611,972	$152,993	$764,965
Phase 2: Design (FY2024 - FY2025)			
Design	$1,835,915	$458,979	$2,294,894
Phase 3: Construction (FY2025 - FY2029)			
Construction Management	$2,203,098	$550,775	$2,753,873
Construction	$15,911,264	$3,977,816	$19,889,080
Contingency	$3,182,253	$795,563	$3,977,816
Phase 4: Project Review (FY 2029 - FY 2030)			
Project Review	$244,789	$61,197	$305,986
Totals	**$23,989,290**	**$5,997,323**	**$29,986,613**
Percentages	**80%**	**20%**	**100%**

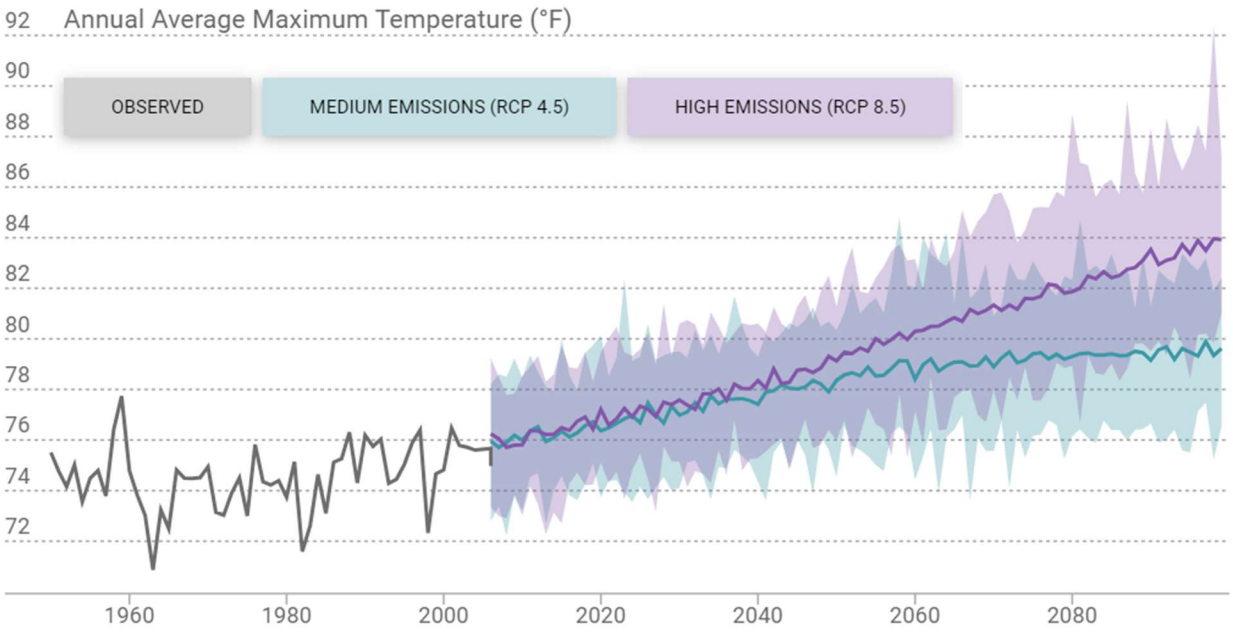
No other federal funding sources beyond PROTECT discretionary grant funding would be utilized for this project. Matching local funds consist of a combination of local transportation dollars, California sales tax, highway user tax account, local construction tax, and local sales and property tax revenue.

III. Merit Criteria

1. Vulnerability and Risk

Davis, located in the northern Central Valley in California has and will continue to experience extreme heat events, as shown in **Figure 9** from CalAdapt models. With the number of extreme heat days only expected to increase, health, economic, social, and environmental consequences will continue to increase as well.

Figure 9: Projected Annual Average Maximum Temperature



Source: CalAdapt, https://cal-adapt.org/tools/local-climate-change-snapshot

The application addresses the following in regards to vulnerability:

- Exposure: Implementing cool pavement would reduce surface temperatures and the resulting heat island effect. This would not only provide for more comfortable facilities for the many people that walk, bike, access transit, and drive on these facilities, but cumulatively reduce the incidence of health issues resulting from extreme heat.
- Sensitivity: Existing roadway segments include aging asphalt in poor condition. The project would give these segments a much-needed upgrade and improve the ability of these roadways to reduce impacts from extreme heat.
- Adaptive Capacity: The project would improve the ability of road users to withstand extreme heat through reflective materials.

Other projects also underway by City of Davis include expanding the urban forest canopy and plans/policies for transitioning to climate ready tree species (Urban Forestry Management Plan); addressing stormwater capture through "Resilient Streets" design and implementation program on neighborhood streets; and incorporating flood risk into street and pavement assessment.

2. Criticality to Community

The project road segments represent several important corridors that form the backbone of the Davis community. Maintenance and upgrades to these facilities would address the critical needs of residents to travel from home, work, school, medical services, and other destinations safely and comfortably.

9% of Davis households do not have access to a vehicle[8] and many others do not have the ability or preference to drive given various economic, social, and health factors. To provide equitable options for all Davis residents, special consideration must be given to those with limited transportation options. Given the anticipated increase in extreme heat days and heat waves, providing cooler transportation facilities is of vital importance for the community's health, safety, economy, and comfort, especially groups with pre-existing health conditions, which are often intertwined with past environmental injustices.

3. Design Elements

Service Life

The anticipated service life of the cool pavement is estimated to be 20 years. This was determined through research conducted by Cambridge Systematics and Houston Advanced Research Center[9] as referenced in the Cool Pavement chapter in the US EPA's Reducing Urban Heat Islands: Compendium of Strategies.[10] While the hot-mix asphalt would have a service life between 10 to 20 years, additional cool pavement surface treatments which seal cracks and extend the life of the pavement would bring the life of the asphalt on the high end of the range. As this is a developing technology, service lives of surface treatments have a wide range of values, ranging from 2 to over 10 years. Careful material selection during the design phase, based on previous work in California, will focus on extension of the service life.

Design Elements

The major design element that addresses current and future extreme heat vulnerabilities is the application of cool pavement materials. As discussed above, this is a time-sensitive issue given the projected increase in extreme heat days and the failing asphalt of these roadways. Implementing cool pavement would reduce surface temperatures, thus reducing the heat island effect, community exposure to extreme heat, and cumulatively reduce the incidence of related health issues. The project would improve the adaptive capacity of the traveling public to withstand extreme heat. Specific cool pavement surface treatments will be selected based on best practices and successful regional implementation examples at the time of construction.

Another key design element of the project is that all segments will be restriped to meet the City of Davis updated *Street Design Standards* (2016). These standards embrace complete street principles to prioritize lower stress roadways that can more effectively accommodate all ages and abilities of users. Typical

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[8] U.S. Census, ACS 5-Year Survey, Selected Housing Characteristics: https://data.census.gov/table?tid=ACSDP5Y2021.DP04&g=040XX00US06_160XX00US0618100

[9] Cool Pavement Report, https://rodoviasverdes.paginas.ufsc.br/files/2010/05/CoolPavementReport_Former-Guide_complete.pdf

[10] US EPA, Using Cool Pavements to Reduce Heat Islands, https://www.epa.gov/heatislands/using-cool-pavements-reduce-heat-islands

vehicular traveled lanes will be reduced to 10' maximums (with explicit exceptions) and bike lane standards will be adjusted to have 7-foot minimums, with opportunities for even wider bike lanes and bikeway buffers. Bringing the roadways segments identified in the Cool Pavements Project to the new standards will bring notable traffic calming and safety benefits for all users.

Maintenance Plan

Maintenance of the pavement and selected surface treatments will be integral to ensure continued safety and comfort benefits to active transportation road users and the reduction of extreme heat vulnerabilities. The project roadway segments would be included in the City of Davis's thorough *Pavement Management Program*. The City of Davis regularly updates its *Pavement Maintenance Program*, with the last update occurring in October 2022. Cool surface treatments on project roadway segments would be reapplied as a preventative maintenance activity, as specified by the manufacturer and through program evaluation. It is anticipated that the rehabilitated roadways with the cool pavement treatments will have a service life of at least 20 years with preventive maintenance.

Maintenance costs will depend on material selection, traffic volumes, weather, and a variety of other factors that may shorten or lengthen the service life of surface treatments. Maintenance of cool pavement surface treatments will be the responsibility of City of Davis, with funding coming from California sales tax, local transportation dollars, and local construction taxes.

4. Public Engagement, Partnerships and Collaboration

Collaboration with Community Stakeholders

A rigorous community outreach and engagement process was previously conducted for the Davis Climate Action & Adaptation Plan. This previous engagement and planning resulted in a cool pavement recommendation, and similar outreach methods will be extended to this project, including a series of workshops, pop-ups, and meeting with local neighborhood groups prior to initiating cool pavement implementation.

The City's website and social media will provide information about cool surfaces and previous climate and adaptation planning efforts, as well as give project information and updates. Beyond press releases and other city communications procedures, relevant information will also be posted at key locations in the city, including City Hall, libraries, and grocery stores. Project information and solicitation for feedback will be distributed to an established network of climate-focused and topic-area stakeholder groups in the City, which could include the Davis Downtown Street Team, ApoYolo/Yolo Interfaith Immigration Network, Davis Bicycles, Tree Davis, Cool Davis, Purple Tree (a group of disadvantaged and health-challenged community members), and Resilient Embodied Action Davis-Yolo (READ-Y).

Prior to initiating Cool Pavements implementation, the City will release a request for proposals to the above groups and other interested parties to provide the lead on community outreach efforts. The RFP will identify the scope of work and time frame for this public engagement and will contract with up to three community-based organizations (CBOs) to complete the outreach efforts and to continue to stay in contact with stakeholders throughout the process. Additionally, the Davis Natural Resources Commission and Bicycling, Transportation, and Street Safety Commission (advisory boards to the Davis City Council)

will be given presentations throughout the project to solicit feedback. Feedback on the planning and design of these roadway projects from community stakeholders and city advisory boards will be incorporated into final design considerations.

During construction of the various roadway segments, a project-specific virtual complaint form, email, and phone number will be available so concerns can be addressed expeditiously. Upon completion of construction, stakeholders will be requested to provide feedback or gather information as part of the project review process. This will connect stakeholders to the next steps for future implementation and build upon the project for future community success.

Collaboration with Public Agencies & Relevant Sectors

Throughout planning, design, and construction, City staff will also collaborate with staff at the following agencies, as necessary, to ensure efforts align with regional planning efforts, roadway standards, and best practices:

- California Department of Transportation (Caltrans)
- Sacramento Area Council of Governments
- Yolo County: Community Services Department, Health & Human Services Agency, Office of Emergency Services
- University of California, Davis (UC Davis) and partners: UC Institute of Transportation Studies, National Center for Sustainable Transportation, UC Pavement Research Center
- Other relevant regional, state, and federal agencies

Partnership with academic/research institutions will be especially helpful given the recentness of cool pavement technologies, as discussed in the Innovation section below.

5. Equity and Justice40

Public Engagement

As discussed in more detail in section 4 above, meaningful public engagement with disadvantaged communities will occur throughout the project. City staff will collaborate with groups that represent various disadvantaged populations in Davis, including ApoYolo/Yolo Interfaith Immigration Network, Purple Tree, and Resilient Embodied Action Davis-Yolo.

The high turnover in the student population makes consistent community engagement with some vulnerable groups difficult, however, the city has demonstrated a record of success with involving sensitive student groups.

Equity Assessment

While no areas of Davis fall within the current Climate and Environmental Justice screening tool, other tools show how disadvantaged communities in Davis have been evaluated. For example, according to USDOT's Justice40 definition, the entire city of Davis, and thus 100% of project roadway segments, qualifies as an area of Persistent Poverty (See **Appendix A** for information). The City's general poverty rate is 29%, and the non-student poverty rate is 10%; the US poverty rate is 10% and California's is 12%.

The USDOT Equitable Transportation Community (ETC) Explorer demonstrates that Davis experiences a number of environmental burdens and social vulnerabilities (See **Appendix A**). Davis is in the 82nd and 96th percentile of environmental burden for ozone and PM 2.5 levels, respectively. Additionally, Davis residents suffer from higher-than-average traffic proximity and volume and diesel particulate matter. Furthermore, housing cost burden and endemic inequality exceed disadvantage status based on the ETC. This is largely in part to the high student population who tend to be renters who have a high rate of turnover, have limited incomes, and may be disproportionally affected by high housing costs.

The Sacramento Area Council of Government (SACOG)'s Environmental Justice (EJ) communities index (shown with explanation of variables considered in the Project Overview section – Figure 7) shows that 11 of the 15 project segments (73%) fall within EJ communities.

As discussed above, extreme heat first impacts the most vulnerable in our communities. Any adjustment to the surface temperature on roadway segments benefits not just those who live or work in the immediate vicinity, but any who use the network. The transportation system and the built environment affect all residents, workers, students, and visitors to Davis. Specifically, the project comes with a variety of benefits for disadvantaged communities in Davis:

- Reduction in impacts of emergency events: by reducing the heat, less health emergency-related trips may occur.
- Improved access to critical community services: by providing updated roadway facilities, road users will experience enhanced comfort and safety when accessing critical services, such as hospitals, grocery stores, community functions, etc.
- Connection to good-paying jobs: project will bring high-paying, local roadway design and construction jobs to Davis.
- Reduction of current or potential burdens: implementing cool pavements will reduce surface temperatures, thus decrease instances of unhealthy air quality and improve health and safety outcomes.
- Improved access to resources and quality of life: the project will enhance comfort for all road users five bringing the pavement to a new condition. Resulting decreases in heat will enhance comfort for all road users especially those walking and biking.

6. Climate Change and Sustainability

There are a variety of pathways in which the Cool Pavement Project will reduce greenhouse gas emissions. Information from US EPA's Reducing Urban Heat Islands: Compendium of Strategies was the basis of these determinations.

Incentivize Low-Carbon Transportation: By creating a more comfortable biking and walking environment, the project will reinforce existing active transportation trips and incentivize further energy efficient transportation. It will also reinforce the dense, fiscally responsible land use patterns already present in the city of Davis.

Lower Temperatures and Reduce Energy Usage: Increased pavement reflectance will marginally decrease the ambient air temperature, which would result in significant benefits in terms of lower energy

use in buildings and lower associated air pollution and greenhouse gas emissions. Cooler air temperatures also slow the rate of ground-level ozone formation and reduce evaporative emissions from vehicles.

Increased Pavement Life and Reduction in Waste: Reducing pavement surface temperatures can reduce the risk of premature failure of asphalt pavements by rutting from slow, heavy trucks or buses. In general, reducing the surface temperatures of asphalt pavements will also slow the aging rate contributing to other distresses. To further reduce the emissions from the project's lifecycle, lower carbon cement materials can be procured, such as fly ash in place of Portland cement.

As impacts from extreme heat have disproportionate impacts to disadvantaged communities, any benefits provided from cool pavements in lowering the impacts of extreme heat would first benefit those in communities most susceptible to damages from extreme heat.

7. Schedule and Budget

This application presents a schedule and budget with the amount of funds for each major project activity and milestone. The 15 project segments will be delivered in phases over five subsequent construction seasons at weather permits.

Tasks	Schedule	Estimated Project Cost
Phase 1: Project Administration	May 2024 – September 2030	$764,965
Phase 2: Design	September 2024 – March 2025	$2,294,894
Phase 3: Construction Year 1	March 2025 – October 2025	$5,324,154
Phase 3: Construction Year 2	March 2026 – October 2026	$5,324,154
Phase 3: Construction Year 3	March 2027 – October 2027	$5,324,154
Phase 3: Construction Year 4	March 2028 – October 2028	$5,324,154
Phase 3: Construction Year 5	March 2028 – October 2028	$5,324,154
Phase 4: Project Review	November 2025 – September 2030	$305,986
Total	May 2024 – September 2030	**$29,986,613**

8. Innovation

The City of Davis is well-positioned to employ innovative cool pavement technologies and techniques by utilizing established relationships to research and non-profit institutions. The City of Davis is a member of the Cool Roadways Partnership (CRP), https://globalcoolcities.org/cool-roadways-partnership/. CRP membership serves as an effective way to engage industry, spur innovation, and highlight the need and market potential for cool roadway solutions.

Davis is also home to the University of California Pavement Research Center (UCPRC), which is recognized nationally as a leader in innovative research in the improvement of pavement structures, materials, and technologies. The UCPRC and associated research institutions, such as the Institute of Transportation Studies, would be a key partner in cool pavement implementation techniques to enhance efficiency and reliability.

The cool pavement project would utilize new techniques in pavement surface treatments to increase the comfort, safety, and reliability of the roadway network throughout its anticipated service life. The City of Davis has already partnered with coating vendor, GAF, and a Sacramento-area contractor, Asphalt Impressions, Inc., to complete a pilot project to apply and test a novel cool pavement coating material, StreetBond® DuraShield.

Post-construction, academic and community partners will be brought in to collect and evaluate relevant performance metrics immediately before and after construction. This will allow for documentation of the effectiveness of the cool pavement treatments in reflecting heat and enhancing health and safety outcomes. Cost and construction details will also be documented, adding to a growing body of cool pavement implementation research. This project review will document innovative techniques and best practices so that other parts of the country can consider replicating.

Please note that nature-based solutions, including bioswales and tree planting, will be included in a separate grant application during a future submittal period.

IV. Economic Analysis

See **Appendix C** for details on how the Benefit Cost Analysis (BCA) was calculated. Excel files are also provided as attachments. Methodology for the BCA was based upon USDOT's Benefit-Cost Analysis Guidance for Discretionary Grant Programs.

Costs quantified in the BCA include:

- Capital expenditures for planning, design, labor, and materials, as well as additional costs for ADA compatibility updates, utility relocation, etc.
- Residual Value and remaining service life

Benefits quantified in the BCA include:

- Amenity benefits: pedestrian, cycling, and transit facility/vehicle improvements can improve the quality or comfort of journeys.
- Safety benefits: reduction in injuries, calculated from crash modification factors
- Health benefits: mortality reduction through light exercise

Calculated costs and benefits were accrued annually for a seven year analysis period. The BCA includes the present discounted value of any remaining service life of the asset at the end of the analysis period. The BCA also includes costs and benefits under a limited funding "no-build" scenario for comparison.

No-Build Baseline Scenario

The **No-Build Baseline** scenario relies upon construction of project segments under a financially constrained funding reality, in which only three roadway segments can be milled and overlayed to a state of good repair, without any cool pavement surface treatments. After seven years, the BCR of this scenario would be 1.82.

	Year 7	Year 10
Cost:	$4,129,553	$4,129,553
Benefit:	$7,530,229	$10,546,042
Ratio:	**1.82**	**2.55**

Project Scenario

The **Project** scenario includes construction of all 15 project segments with cool pavement surface treatments, as described in the sections above. After seven years, the BCR of this scenario would be 1.57, and increase thereafter due to the longer service life.

	Year 7	Year 10
Cost:	$23,452,179	$23,452,179
Benefit:	$36,909,231	$52,121,156
Ratio:	**1.57**	**2.22**

While these ratios are lower for the project scenario than the no-build scenario, the associated costs of being unable to bring the other segments to a state of good repair is not quantified. Lack of funding could result in degradation in pavement quality, thus discouraging active transportation trips and reversing any existing health benefits.

Additional, benefits not quantified within the BCA include:

Quality of Life Benefits: Cool pavements may provide additional benefits, such as comfort improvements and nighttime illumination. Using reflective pavements where people walk, congregate, or play can provide localized comfort benefits through the lower surface and near-surface air temperatures. Additionally, reflective pavements can enhance visibility at night, potentially reducing lighting requirements and saving money and energy by better reflecting streetlights and vehicle headlights at nice.

Air Quality and Greenhouse Gas Emissions: Depending on the electric power fuel mix, decreased energy demand associated with cool pavements will result in lower associated air pollution and greenhouse gas emissions. Cooler air temperatures also slow the rate of ground-level ozone formation and reduce evaporative emissions from vehicles, which have benefits to human and environmental health.

Health Benefits: Extreme heat exacerbates underlying chronic conditions such as common respiratory, cardiovascular, and kidney diseases. Thus, consecutive days of intense heat can cause dramatic spikes in incidences of a wide variety of illnesses and acute injuries. Marginal decreases in heat exposure through cool pavement technology will benefit road users and nearby communities alike, especially as extreme heat is projected to increase in length, frequency, and intensity.

V. FHWA Priority Considerations

Workforce Development, Job Quality, and Wealth Creation

The City of Davis follows the California Public Contract Code competitive bidding process for public works projects. Prevailing wages apply to all public works projects. We have standard language in our contract book that will be used for the Cool Pavement Project.

Labor Code Requirements:

Pursuant to Labor Code Section 1773, the City will obtained the prevailing rate of per diem wages and the prevailing wage rate for holiday and overtime work applicable in Yolo County from the Director of the Department of Industrial Relations for each craft, classification, or type of worker needed to execute this project.

In addition, a copy of the prevailing rate of per diem wages will be available at the City's Public Works Department and shall be made available to interested parties upon request. The successful bidder shall post a copy of the prevailing wage rates at each job site. It shall be mandatory upon the Bidder to whom the Contract is awarded, and upon any subcontractors, to comply with all Labor Code provisions, which include but are not limited to the payment of not less than the said specified prevailing wage rates to all workers employed by them in the execution of the Contract, employment of apprentices, hours of labor and debarment of contractors and subcontractors.

Federal Prevailing Wage Requirements - Davis Bacon Act. This Project is partially funded by grant funds from a Federal Grant. The successful Bidder and all subcontractors shall comply with federal prevailing wage requirements under the federal Davis Bacon Act and shall pay the higher of the state and federal wage rates for each labor classification necessary to perform the Project. This Project is subject to compliance monitoring and enforcement by the Department of Industrial Relations.

Construction Readiness

With the recent update of the Pavement Management Program, the analysis and means and methods for the Cool Pavement Project have been determined for all the segments identified. If the City is awarded the PROTECT grant, the City is able to complete the construction documents in order to obligate funding for the first phase of the construction project by 2025. Based on the availability of funding, subsequent phases could be accelerated and combined into earlier construction seasons.