



South Campus Neighborhood Project
Advanced Design

CONCEPTS

Prepared By

Dr. DingXin Cheng & Dr. Kun Zhang

Engineering 441: Transportation Engineering | Fall 2018

Department of Civil Engineering, College of Engineering,

Computer Science & Construction Management

California State University, Chico



Resilient Cities Initiative
Institute for Sustainable Development
California State University, Chico

The South Campus Neighborhood Project

The South Campus Neighborhood Project is an award-winning neighborhood improvement planning effort coordinated by the Resilient Cities Initiative at California State University, Chico and the Public Works-Engineering Division at the City of Chico, CA. The project is focused on the public rights-of-way in Chico, California's South Campus Neighborhood, a six by seven square-block area bound by 2nd Street to the North, 9th Street to the South, Orange Street to the West and Salem Street to the East. Immediately adjacent to both downtown Chico and the University, it is Chico's oldest residential neighborhood and was laid out by the town's founder, John Bidwell, in the 1860's.

The neighborhood today is densely populated with university students and is also home to a number of small businesses, restaurants, bars, churches, community organizations, a school, a fire station, a police station, a railway station and transit center. Given its location, population and mixed uses, the neighborhood faces a unique set of circumstances and challenges. This three-year project aims to assess existing conditions and to develop and refine neighborhood improvement concepts to address a range of identified issues. The neighborhood improvement planning process is focused on concepts for complete streets and public works that will enhance public health and safety, quality of life, sense of place and environmental sustainability.

➤ *More information can be found online at <http://scnpchico.com/>*



City of Chico Public Works-Engineering

The overall Mission, Vision and Goal of the City of Chico Public Works Department is to provide the best possible Quality of Life through our abilities to protect, plan, construct and maintain the physical assets of the City. This is achieved through teamwork, integrity, professionalism, innovation, respectful customer service, value to the citizens of Chico, accountability and stewardship of the City's infrastructure and public resources. We serve the public in a manner that supports the rich heritage of Chico, as well as progressing into future improvements desired by the community in a sustainable manner. We continue to look for new technology that assists in meeting these goals so that we can operate at the most efficient level and continue to be at the leading edge of modern standards.

Our Mission, Vision and Goals include ensuring public safety through detail oriented and strategic improvements to mitigate unsafe operation and use of our Public property; Providing safe, sustainable, integrated and efficient transportation systems to enhance the City of Chico's economy and livability for all modes of transportation; Efficiently and effectively providing a reliable, sustainable and cost effective sanitary sewer and storm water collection system for our residents and businesses in-line with our overall Mission and Vision. We are stewards of the natural environment and through responsible practices, we construct and maintain our natural environment to the highest of standards. We will continue to make the City of Chico a leader in sustainable and clean practices so that our residents can experience the quality of life that is desired for an infinite length of time.



Public Works-Engineering

City of Chico, California

The Resilient Cities Initiative

The Resilient Cities Initiative (RCI) is an interdisciplinary university-community partnership program established by the Institute for Sustainable Development at California State University, Chico in 2016. The RCI connects real-world community sustainability projects— identified and funded by partner agencies— with faculty expertise and student innovation from departments and disciplines across the University’s academic colleges. The RCI recruits partner agencies through a competitive selection process and matches projects with existing courses across the university’s curricula. Partner agencies are able to harness incredible momentum for their projects in large part because the partnership is realized on a bigger scale than more typical one-off university-community projects. Faculty are able to opt-in and augment their existing curriculum with real-world projects that have been identified, funded and supported by the leadership

and staff of the partner agency— ultimately delivering their students’ work for consideration and implementation. The RCI is a member of the Educational Partnerships for Innovation in Communities (EPIC) Network, a nationwide network of over 25 universities that have replicated the highly successful Sustainable City Year Model that was established at the University of Oregon in 2009. The model is based on university-community partnerships with a defined geographic and temporal scope, focused on advancing sustainability and the social good, leveraging the multidisciplinary knowledge and capacity of the university to ‘move the needle’ on pressing community issues. The RCI directly engages hundreds of CSU, Chico students each academic year, providing impactful opportunities for them to put theory to practice in their own community and region, connecting them with decision-makers in practitioners in their fields of study, and helping develop the next generation of workforce professionals and leaders.



Course Participants

Engineering 441: Transportation Engineering | Fall 2018 | Dr. DingXin Cheng & Dr. Kun Zhang

Department of Civil Engineering, College of Engineering, Computer Science & Construction Management, California State University, Chico

Akayla Lipscomb	Christopher Cervantes	Jason Blum	Mark Pemberton	Robert Davenport
Alan Villalta-Gutierrez	Davis Walker	Jonathan Campos	Meng Xie	Santiago Bustos
Allison Downs	Diana Gonzalez	Kaitlyn Konecny	Michael Mekuria	Stephanie Gutierrez
Amber Conklin	Felix Gonzalez	Kathryne Tetrault	Miguel Mendez	Sulaim Alsubaihi
Austin Silva	Freddy Hurtado	Kimberly Joslin	Noah Hennecke	Tracy Rice
Ben Swaffer	Gregory Cannon	Maria Murillo	Noah Macias	Trenton Duncan
Brandon Romero	Hannah Braun	Mario Lozano	Oscar Hermsillo	Tutulu Finau
Brent Harrison	Isaiah Andrade	Marisol Alvarez	Oscar Rodriguez	Uriel Dominguez
Christine Larrance	Ivan Juarez	Mark Campbell	Ramon Huerta	



Staff



Resilient Cities Initiative
Institute for Sustainable Development
California State University, Chico

Dr. James C. Pushnik
RCI Executive Director

Fletcher Alexander
RCI Associate Director

Jacob Back
*RCI CAD Specialist,
BS Civil Engineering Candidate*

Kaeti Park
*RCI CAD Specialist,
BS Civil Engineering Candidate*

Jordan Alm
RCI Program Coordinator

Paris Trollope
RCI Marketing & Outreach Coordinator



Public Works-Engineering
City of Chico, California

Brendan Ottoboni
Director of Public Works-Engineering

Lane Green
Senior Civil Engineer

Bikram Kahlon
Senior Traffic Engineer

Street Redesign Concepts: 4th & Orange

Prepared by Christopher Cervantes, Diana Gonzalez, Tracy Rice, Dr. DingXin Cheng, Dr. Kun Zhang
Engineering 441: Transportation Engineering | Fall 2018

Project Problem and Goal

Suggested alternatives to the problems involved with the south side of Chico.

Problem Definition

4th and Orange Street runs 2 blocks south of Chico State University campus and is a popular route for traffic, pedestrians, and bicyclists. This location is also next to the city of Chico train station attracting more bus, vehicle, pedestrian, and bicyclist traffic. This area utilizes an outdated street design not only for the vehicles and busses, but for pedestrians as well too.

Goal of Project

The primary goal of this proposal is to increase safety and serviceability while keeping costs at a minimum. Improvements will include resurfacing, lighting, a buffer zone for bicyclists, and repurposing 4th street into a west bound one-way street.

Existing Conditions

Following City of Chico guidelines, data was collected on traffic volume, ADA compliance, current street measurements, and a survey was taking of the existing roadway.



Current existing ramps are not ADA compliant and lead directly to the middle of intersection.



Large trees which may be safety threats due to large branches. Roots are also breaking through concrete and making pavement uneven.

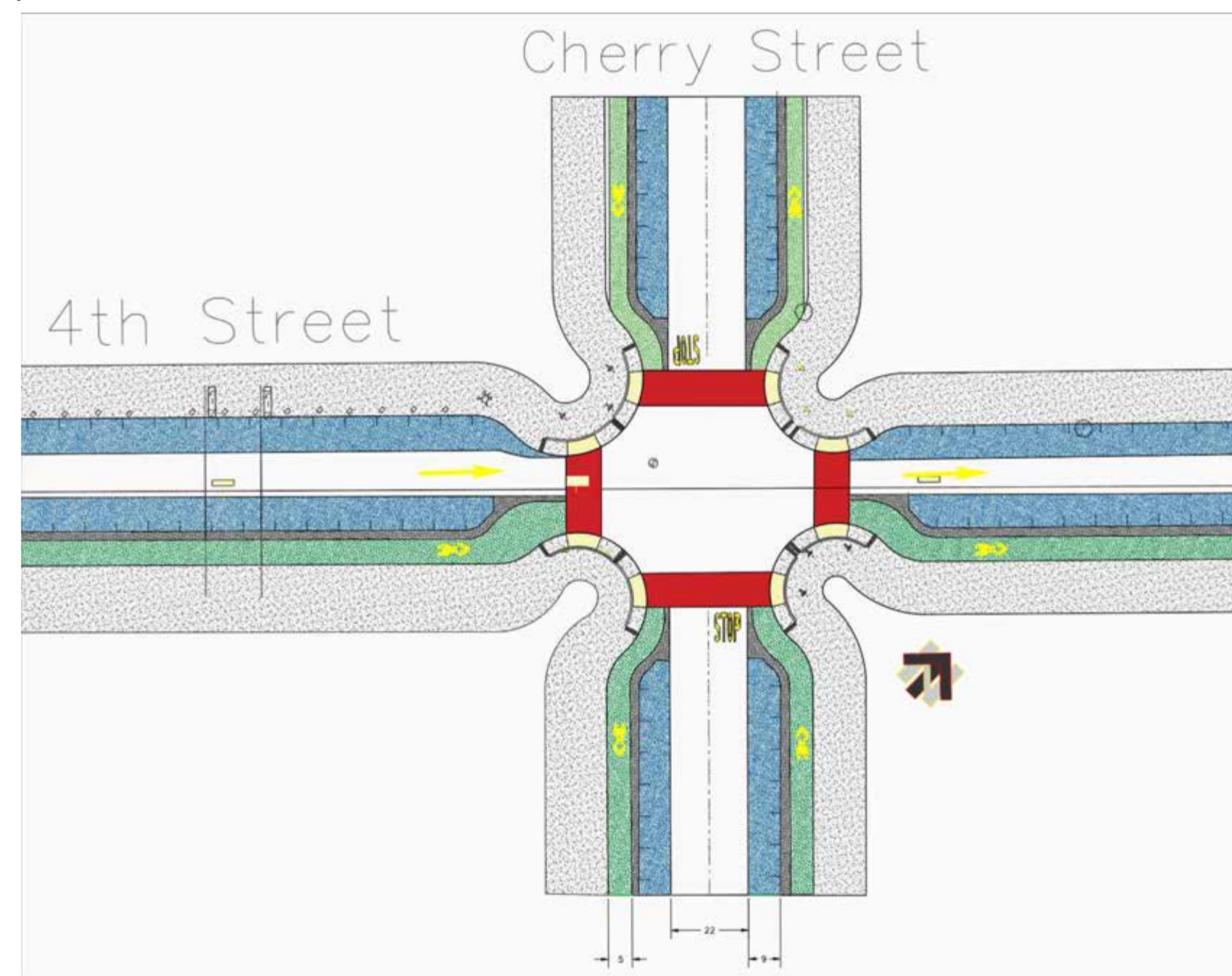


Immense amount of alligator cracking on the asphalt and sidewalk.



4th and Orange Street Design

The scope of the Complete Street Design begins at the intersection of 4th and Ivy spanning west down 4th Street to Orange. We studied and evaluated traffic and design metrics to increase serviceability, including emphasis on traffic flow taking into major account the safety of traffic, bicyclists, and pedestrians. The recommendations include: One-way traffic flow on 4th street, a buffered bike lane between parallel parking and curb to increase bicyclist safety, a resurfaced roadway, street lighting, and ADA compliant features.



Design



Figure 2: Cross-sectional view of 1-way 4th Street

Figure 3: Cross-sectional view of 2-way intersection

Cost Analysis

Description	QTY	Unit	Unit Cost	Total	\$/GSF	COMMENTS
Pavement Grinding	244	CY	\$2.50	\$611.11	\$0.02	
Retrofit Existing Concrete Curb	16	EA	\$600	\$9,600	\$0.24	
Restriping	39,600	SF	\$3.50	\$138,600	\$3.50	
Hot Mix Asphalt Needed	957	TN	\$100	\$95,700	\$2.42	Assumed 4" paving
Removal of Concrete Curb & Gutter	1433	LF	\$50.00	\$71,650	\$1.81	
Removal of Sidewalk, Ramp or Driveway	2359	SF	\$7.00	\$16,513	\$0.42	
Relocate Roadside Sign	4	EA	\$350	\$1,400	\$0.04	
Install City Std. Handicap Ramp	8	EA	\$600	\$4,800	\$0.12	
Install Concrete Curb & Gutter	1433	LF	\$27	\$38,691	\$0.98	
Lower and Raise Manhole to Grade	8	EA	\$1,800	\$14,400	\$0.36	
Tree Removal	2	EA	\$1,200	\$2,400	\$0.06	We highly recommend.

Table 4: Cost Analysis for Desired Street Improvement

Our total cost would be **\$9.96** per square foot. Our grand total is **\$394,365.11**.

Final Recommendations

One-way Street Design 4th Street



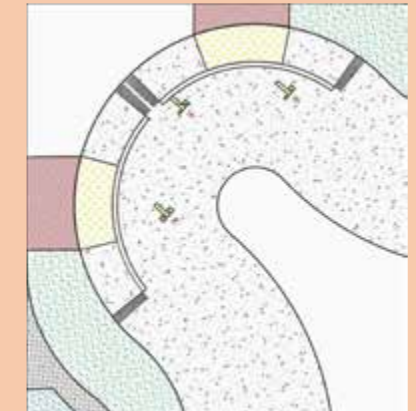
Utilizing a One-way street will promote a better flow of traffic and increase capacity

Parking Buffer



A buffered bike lane paired with an adjacent motor vehicle parking space will increase biker safety by separating the path of travel between bicycle and vehicle

Bulbed Intersections



In an effort to improve pedestrian conditions for all intersection crossing bulbed-out intersections will be incorporated into this design

ADA Features



Updating ADA features to include a detectable warning system (truncated domes)

Pavement Resurfacing



Resurfacing the pavement will improve the long-term condition of the roadway, helping to prevent future problems

Striping and Lights



A green bike lane will indicate a protected area decreasing vehicle travel in those designated spaces

Street Redesign Concepts: 4th from Chestnut to Salem

Prepared by Freddy Hurtado, Meng Xie, Oscar Hermsillo, Ramon Huerta, Dr. DingXin Cheng, Dr. Kun Zhang
Engineering 441: Transportation Engineering | Fall 2018

Project Goals & Scope

Alternatives to the issues involved with the south side of Chico.

Problem Definition

West 4th St. is an extremely busy road considering it is an access point to many homes, businesses, and public buildings. This road is commonly used by bicyclist, pedestrians, and cars. With that being said, this road is not safe, and it is susceptible to heavy traffic congestion.

Goal & Scope

The goal throughout these intersections is to improve public safety, traffic conditions, and accessibility. Public Safety will be increased by restriping, repaving, and redesigning the entire roadway/intersections. Traffic conditions and accessibility will be improved by implementing a one way road with both parallel parking and bike lanes.

Design Plans

Based on redesigning W. 4th St. into a one-way road.

Traffic - Increase traffic flow and potentially reduce traffic congest. The bulb-out curves decrease turning speed of vehicles.

Bicyclist - The two bike lanes will encourage bicyclists to ride in the correct direction. Always flowing in the same direction of traffic, never being congested. The lanes will increase the comfort level for bicyclists in traffic and make crossing pedestrians more visible to drivers.

Pedestrians - The existing curbs have been bulbed out to extend the sidewalks into parking lane to narrow the roadways and provide additional pedestrian walking space. The curb extensions increase pedestrians visibilities at intersections through improved sight lines and shortening crossing distance for safety.

Eliminate the need for a center turn lane that can instead be used for travel. Better traffic flow in densely built-up areas where road widening may not be feasible.

Design Cross Section & Intersection

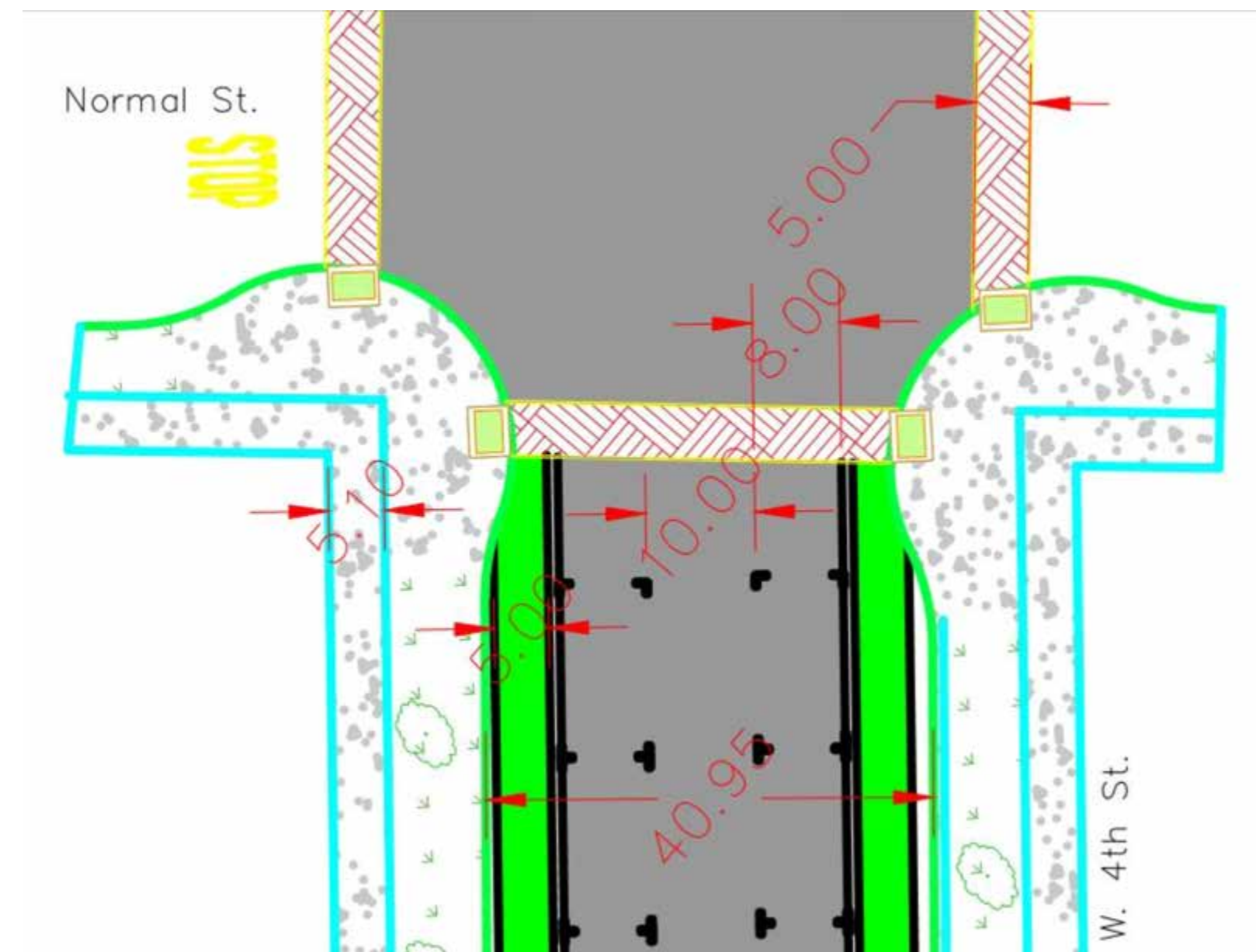
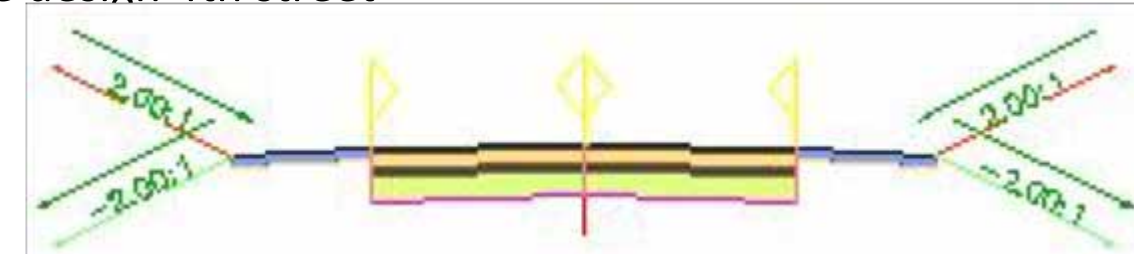


Figure 1. One lane design 4th street



Modifications Necessary

Sidewalks: The sidewalks currently located on W 4th St. Chestnut - Salem Intersections are not meeting the ADA requirements. Through the research and after experiencing it first hand, we found that some of the curb ramps on these intersections are not helpful to those with disabilities who require a wheelchair.

Roads: There are cracks and potholes that can cause a driver to lose control of the vehicle, as well as faded paint markings that are invisible from the driver's seat. Dangerous conditions can also arise from the poor physical condition of a road and its surroundings.



Figure 3: W. 4th St. Road



Figure 4: W. 4th St. Curb



Figure 5: W. 4th St. Crosswalk

Based on the base design and existing pavement conditions.

Results of Economic Analysis

1. Restriping: \$106,470
2. Retrofit Curb Ramps: \$9,600
3. Hot Mix Asphalt: \$304,300
4. Resurfacing: \$5,635
5. Maintenance and Control of Traffic: \$22,000
6. Jobsite Management: \$10,000
7. Mobilization: \$5,000
8. Construction & Staking: \$30,000
9. Clearing & Grubbing: \$30,000
10. Removal of Concrete: \$304,200

Total Cost: \$827,205

W. 4th Street Mix Design



Figure 6: Usage illustration

The image above shows our proposed design clearly. The A-Team truly believes this is the most effective and efficient one-way street design.

Street Redesign Concepts: 3rd & Ivy

Prepared by Amber Conklin, Christine Larrance, Kathryne Tetreault, Davis Walker, Dr. DingXin Cheng, Dr. Kun Zhang
Engineering 441: Transportation Engineering | Fall 2018

Project Goals & Scope

Suggested alternatives to the problems involved with the south side of Chico.

Problem Definition

Ivy, 2nd, and 3rd street is near Chico State University and is commonly used by cars, bikes, and pedestrians. Walking and biking is a common method for the Chico Community to get from place to place; its apparent improvements would benefit quality of life. Improvements include: creating space for bikers, making the bike lanes protected from live traffic, making 3rd street a one way, lighting, and traffic safety at intersections.

Goal and Scope

The goal is to increase safety, create a safe way for students to get from place to place, and retrofit outdated streets in Chico up to City code.

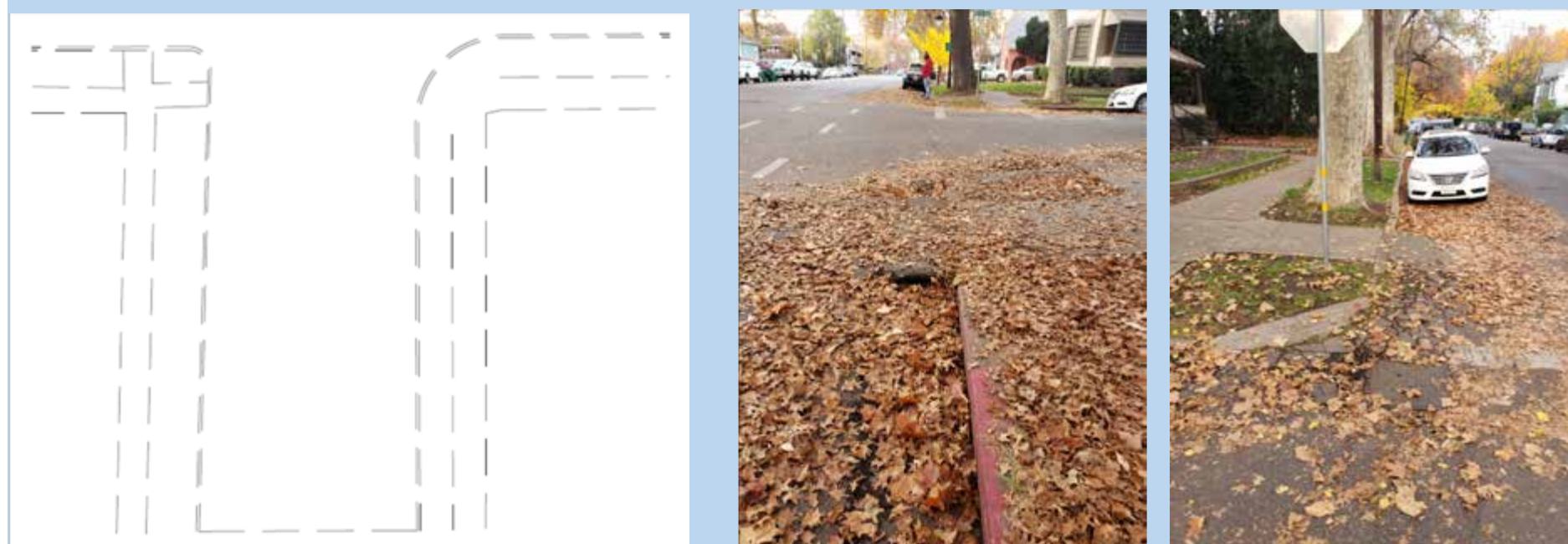


Figure 1A-D: Existing Conditions of 3rd & Ivy Street

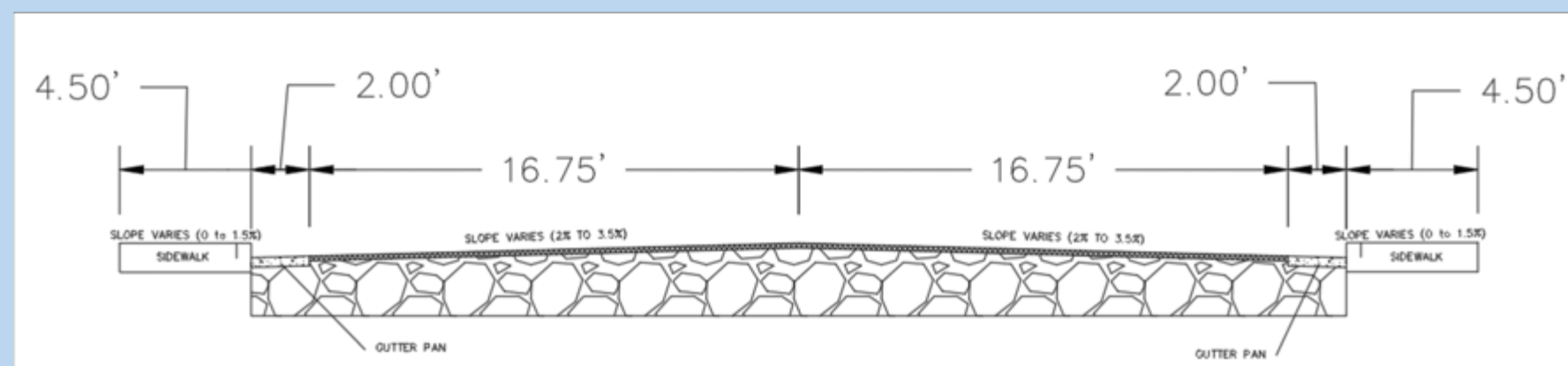


Figure 2: Proposed Cross Section

2nd & 3rd Street on Ivy Redesign

The scope of the Street Design is focused on 2nd and 3rd street on Ivy. The city has asked to propose new ideas to the city of Downtown Chico. CT Walker & Larrance Inc. proposes that 3rd Street should be changed to a west bound one-way street with a protected bike lane separated by a 3' buffer and parallel parking separating bikers from live traffic; which allows fast bikers to be in the lane of traffic.

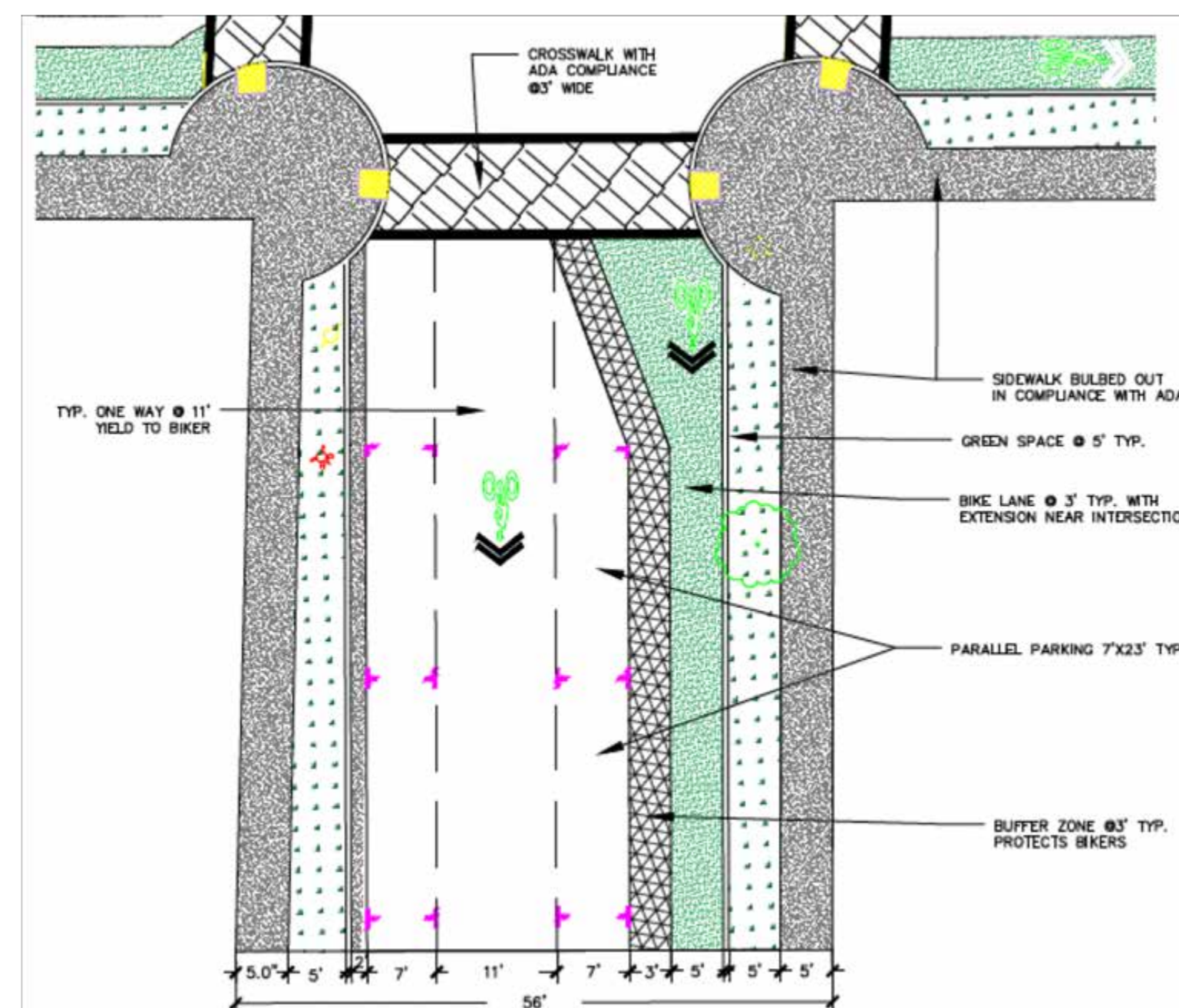


Figure 3: Proposed Street Mix Design for 3rd Street

Street Mix Design



Figure 4: Layout of 3rd street converted to one way, west bound.

Cost Analysis

Table 1: Cost Estimate for Bid Items

Engineer's Estimate on "Big Ticket Items"					
	Big Ticket Items	Quantity	Unit	\$/Unit	Cost
1	Hot Mix Asphalt	9.7	TN	\$100.00	\$970.00
2	Cold In-Place Recycling	5172	SY	\$7.00	\$36,204.00
3	Pavement Grinding	5172	SY	\$2.50	\$12,930.00
4	Bike Lane Striping	6400	SF	\$3.50	\$22,400.00
5	Striping	2000	SF	\$3.50	\$7,000.00
6	Retrofit ADA Ramps	4	EA	\$600.00	\$2,400.00
7	Remove Concrete Curb & Gutter	1200	LF	\$50.00	\$60,400.00
8	Removal of Concrete Sidewalk	3000	SF	\$10.00	\$30,000.00
9	Install City Std. P.C.C. Sidewalk	3200	SF	\$45	\$135,000.00
					\$306,904.00

Final Recommendations

- **2nd Street Intersection** – Due to recent improvements already completed, there will be no changes.
- **3rd Street** – Will be converted 3rd into a one way heading West bound, with bulbed out curbs in its intersection, and one bike lane on the left side of the road.
- **Ivy St** - A bike lane will be added so there will be one in each direction, in doing so parking spaces will be removed
- **Lighting** – Updating light fixtures, cutting back trees for more visibility.
- **Parking** – About 8 parking spot removed along Ivy
- **Green Space** – Update foliage and introduce bioswales

Street Redesign Concepts: Ivy from 4th to 6th

Prepared by Marisol Alvarez, Trenton Duncan, Noah Macias, Michael Mekuria, Maria Murillo, Dr. DingXin Cheng, Dr. Kun Zhang
Engineering 441: Transportation Engineering | Fall 2018

Transportation Issues and Project Goals

Suggested alternatives to the problems involved with the south side of Chico.

Ivy is a popular multi-modal route to and from California State University Chico. The heavy traffic makes it a good candidate for upgrades to bicyclist and pedestrian safety. Along with pedestrian safety due to design issues, safety issues also include asphalt and sidewalk cracking (Shown below).



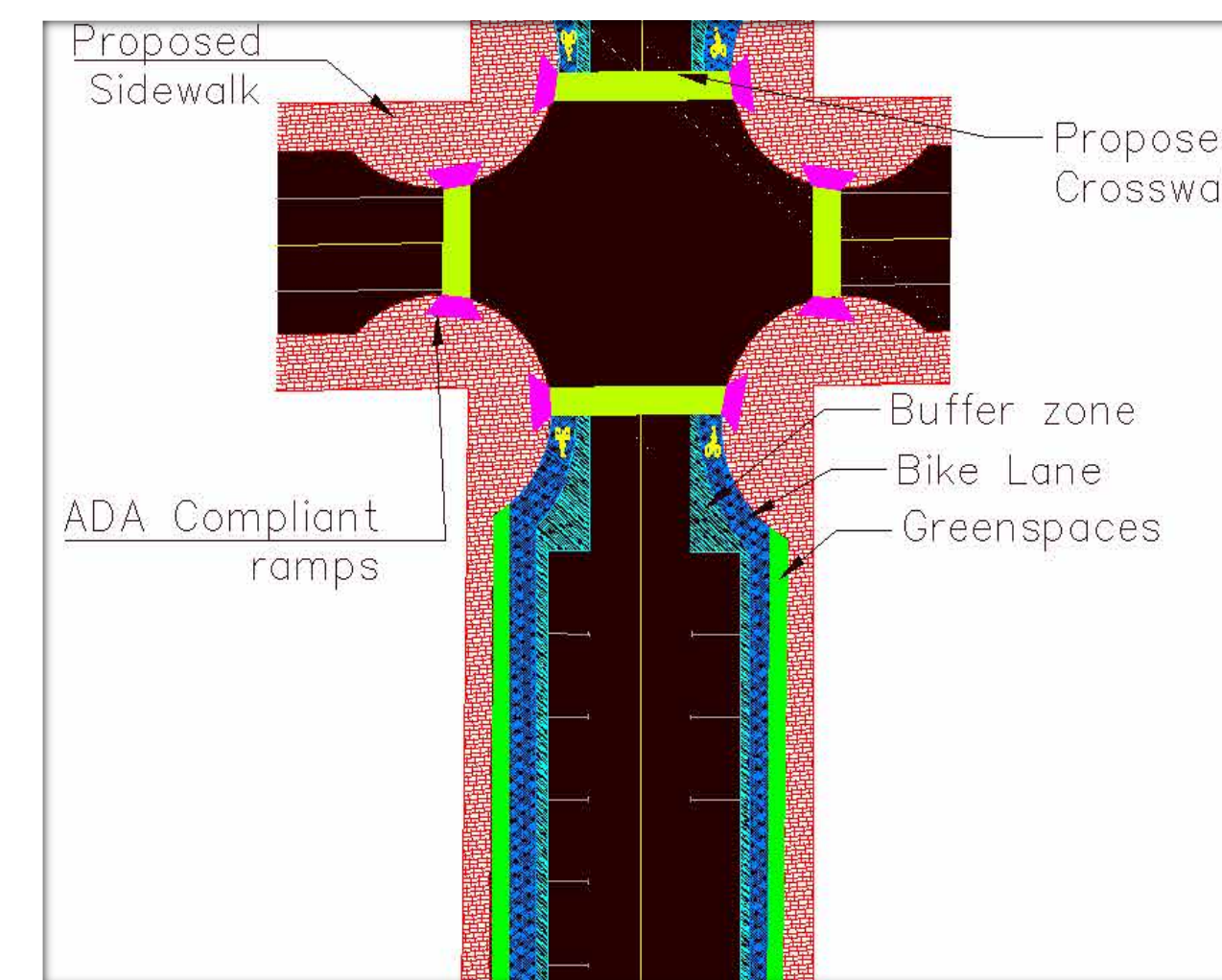
The goal is to increase safety, and improve aesthetics on Ivy street from 4th to 6th street.

Recommendations For Improvement

- Street Layout:** The current street layout is outdated and has not been updated to ensure the safety of the population of Chico. We have recommended an innovative design to propose pedestrian and bicyclist friendly intersections.
- Protected Bike Lane:** A protected bike lane is essential to ensure the safety of bicyclists. The proposed protected bike lanes are to have a buffer zone that will separate the bike lanes from the parking spaces using reflectors.
- Sidewalk Geometry:** Curb extensions that bulb-out at the intersection can provide a smaller crossing for pedestrians and therefore increase the safety of pedestrians.

Ivy from 4th Street to 6th Street Design

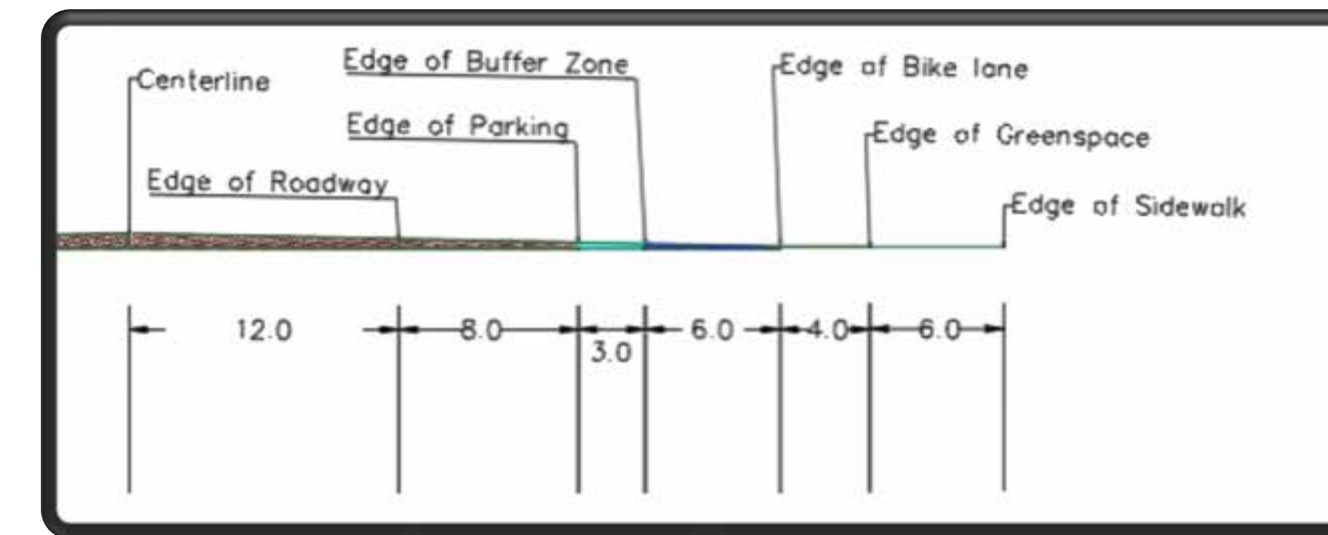
The scope of the Complete Street Design is Ivy Street between 4th and 6th street. Main issues with the street include cracks in the asphalt and sidewalk, and unsafe intersections. Our proposal for the redesign of the street includes a protected bike lane, repaving and restriping of the roadways, crosswalks at 4th and Ivy, and replacing the green spaces.



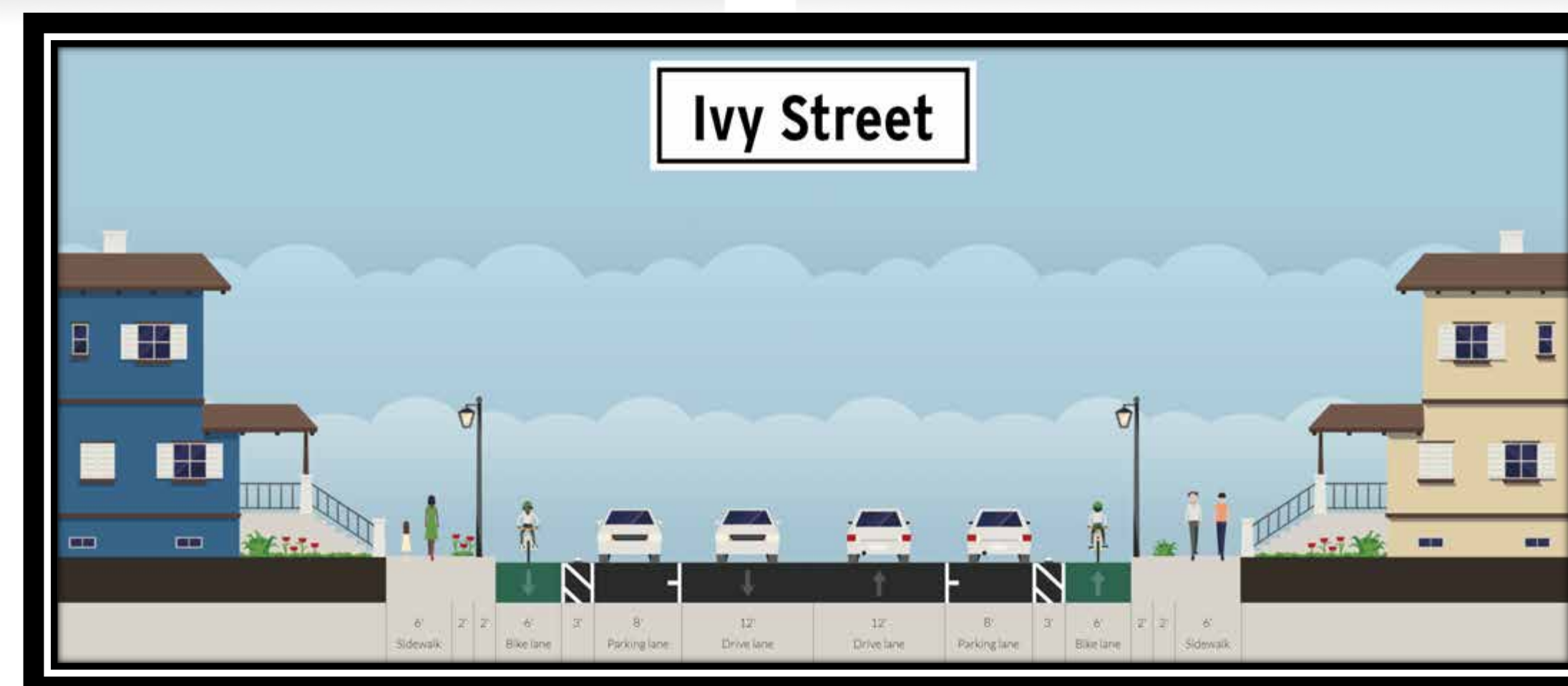
Proposed Intersection



Existing Roadway



Proposed Cross Section



Proposed Street Design

Estimated Costs

Shown in the table below are the estimated costs of the major components for the street redesign. Typical lump sums, minor components of the design, and labor costs were not included.

Item No.	Description	Quantity	Units	Unit Price	Total Price
1	Sign Relocations	8	EA	\$350.00	\$2,800.00
2	Pull Box Relocation	7	EA	\$500.00	\$3,500.00
3	Manholes	4	EA	\$1,800.00	\$7,200.00
4	Modify Drainage Inlet/Culvert	8	EA	\$350.00	\$2,800.00
5	Restriping Firelines	82	LF	\$2.20	\$180.40
6	Hot Asphalt	968	TN	\$100.00	\$96,836.00
7	Crosswalk	849	SF	\$3.50	\$2,971.78
8	Concrete Removal	2465	SF	\$7.00	\$17,255.06
9	Curb and Gutter Removal	1328	LF	\$27.00	\$35,856.00
10	Centerline Striping	687	LF	\$3.50	\$2,405.55
11	Edge Striping	312	LF	\$3.50	\$1,092.00
12	Bike Lane	531	LF	\$3.50	\$1,859.55
13	Buffer	531	LF	\$3.50	\$1,859.55
Total					\$176,615.89

Existing Conditions

- Re-pavement of Roads:** Re-pavement of the roads is essential to ensure that ADA compliance is met for pedestrians who are wheelchair users. Below is an image captured from the Ivy and 5th intersection, a popular intersection for residents of Chico.



Street Redesign Concepts: 3rd from Ivy to Orange

Prepared by Mario Lozano, Brandon Romero, Santiago Bustos, Oscar Rodriguez, Gregory Cannon, Dr. DingXin Cheng, Dr. Kun Zhang
Engineering 441: Transportation Engineering | Fall 2018

Project Goals & Scope

Suggested alternatives to the problems involved with the south side of Chico.

Problem Definition

3rd and Ivy to Orange runs parallel to Chico State University and is commonly used by cars, bikes, and student pedestrians. This area of the South Campus neighborhood needs improvements and upkeep in order to make the college community a safe place. Improvements include: lighting, traffic safety at intersections, creating space for bikers, and adding green spaces.

Goal and Scope

The goal is to increase safety, redesign the roadway, and improve aesthetics for the scope of the project.

3rd Street from Ivy to Orange

The scope of the Complete Street Design is the intersections of 3rd and Ivy as well as 3rd and Orange. We devised a design that incorporates a one way roadway across the length of 3rd street. Parallel parking spaces will be available on either side of the roadway including a buffer zone and protected bike lanes. Upon viewing the project setting we came up with some final recommendations to further increase the safety and accessibility of the south campus neighborhood.



Figure 1: System Boundary and Overview of 5th and Cherry St.

Roadway Cross Section

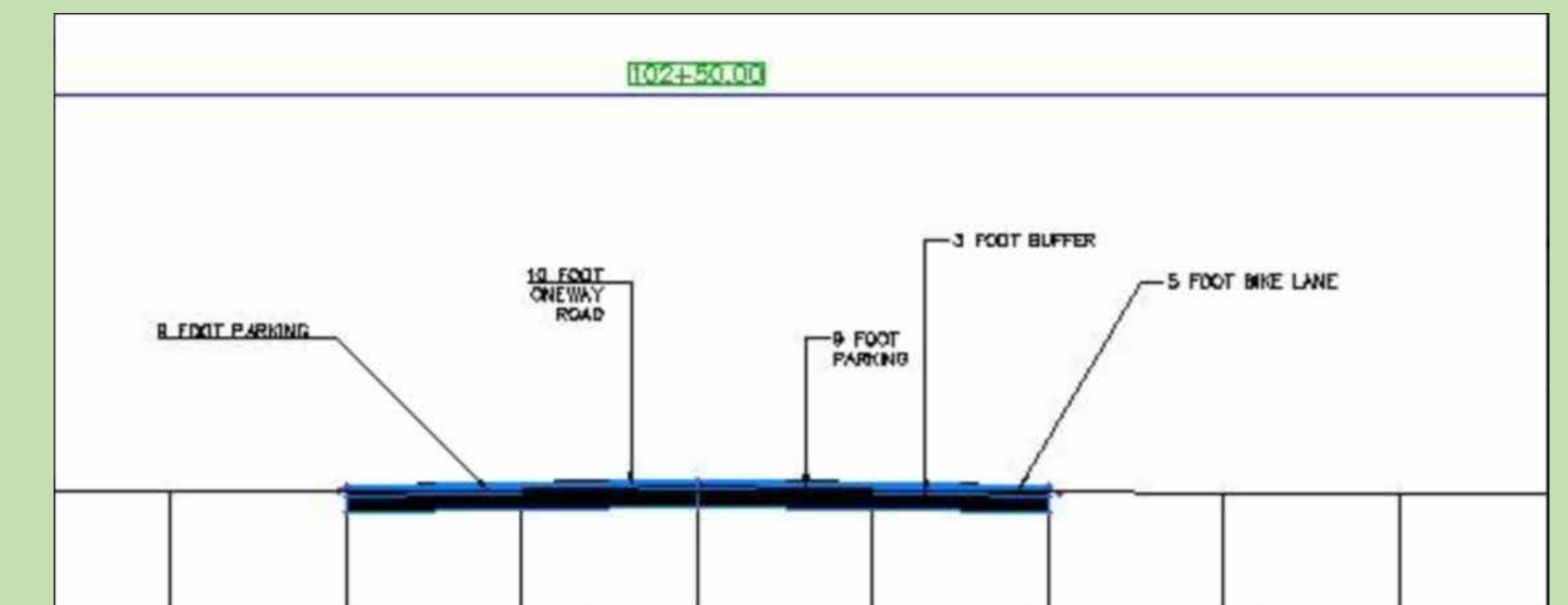


Figure 4: Cross section design of 3rd street for optimal crown and improved drainage.

Transportation Issues

Our team walked the project area and took note of the various transportation issues that are currently in place in the south campus neighborhood.

Key Metrics:

Transportation: Motorized vehicles, Bicycles, and Pedestrians

Social: Sense of Safety, Sense of Community, and Aesthetics

Economic: Net Present Worth

- The main transportation goal of the project involves the redesign of third street from a two way street into a one way street with parking, protected bike lanes, buffer zones, and new improved crosswalks.
- Using autocad we devised a new corridor and cross section data to provide insights on future design options.
- Social Impacts define below:
 - Sense of Community:** Design a street that makes people want to be outside and be involved
 - Sense of Safety:** Design a safer street by converting the existing roadway into a one way with protected bike lanes
 - Aesthetics:** Design a street with good aesthetics including improved crosswalks.

Final Recommendations

5A. Sidewalk Repair



Sidewalk repair will make this area more handicap friendly and will provide pedestrians with safe access to their normal routes.

5B. Double Parallel Parking



Parallel parking spaces on either side of the roadway in order to maximize efficiency.

5C. Buffer Zones



Buffer Zones to increase the safety near intersections.

5D. Crown Slope



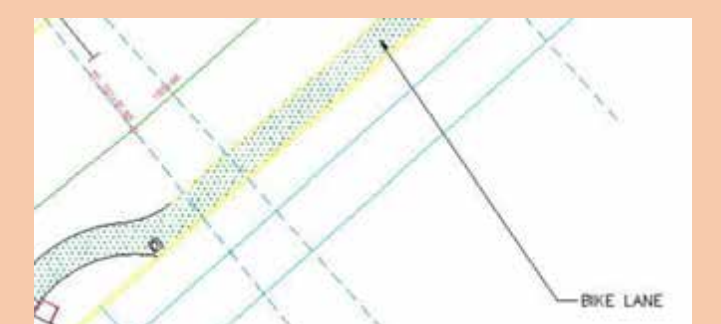
Redesigned roadway crown to maximize efficiency.

5E. Cross Walks



New crosswalk design to enhance the neighborhood aesthetics as well as make the pedestrians right of way more noticeable.

5F. Bike Lanes



Road design with a protected bike lane to provide increased safety for student commutes.

Estimated Cost

ANALYSIS MADE USING "ENGINEER'S ESTIMATE"					
ITEM NO.	DESCRIPTION	QUANTITY	UNIT PRICE	UNIT	AMOUNT
1	Maintenance and Control of Traffic	1	\$22,000.00	LS	\$ 22,000.00
2	Jobsite Management	1	\$10,000.00	LS	\$ 10,000.00
3	Mobilization	1	\$ 5,000.00	LS	\$ 5,000.00
4	Construction Layout and Staking	1	\$30,000.00	LS	\$ 30,000.00
5	Storm Water Pollution Prevention Plan	1	\$10,000.00	LS	\$ 10,000.00
6	Remove Concrete Curb & Gutter	1462	\$ 50.00	LF	\$ 73,100.00
7	Install City Std. S-2 P.C.C. Curb & Gutter	1462	\$ 27.00	LF	\$ 39,474.00
8	Install City Std. S-27 P.C.C. Handicap Ramp	512	\$ 15.00	SF	\$ 7,680.00
9	Hot Mix Asphalt	463	\$ 100.00	TON	\$ 46,300.00
10	Pavement Grinding (2" depth)	4250	\$ 2.50	SY	\$ 10,625.00
11	Thermoplastic Pavement Markings, White	111	\$ 3.50	SF	\$ 388.50
12	Relocate Roadside Sign	22	\$ 350.00	EA	\$ 7,700.00
TOTAL:					\$262,267.50

Street Redesign Concepts: 3rd from Ivy to Chestnut

Prepared by Felix Gonzalez, Ivan Juarez, Austin Silva, Mark Basil Pemberton, Alan Villalta-Gutierrez, Dr. Dingxin Cheng, Dr. Kun Zhang
Engineering 441: Transportation Engineering | Fall 2018

Project Goals & Objectives

Objectives

- Improve overall quality of Road
- Increase Safety for pedestrians, bicyclists, and drivers
- Minimize traffic accidents
- Make ADA safe crosswalks
- Maximize the flow rate

Goals

- The goal is to increase overall safety while designing to maintain proper serviceably for future traffic volumes and improve the road's overall aesthetics.

Transportation Issues

- Road weathered and cracked
- Tree roots uplifting sidewalk making it unsafe along with handicap ramp
- No bike lane creates hazard for bicyclists



West 3rd Street from Ivy to Chestnut Design



Existing street layout

Redesigned street layout



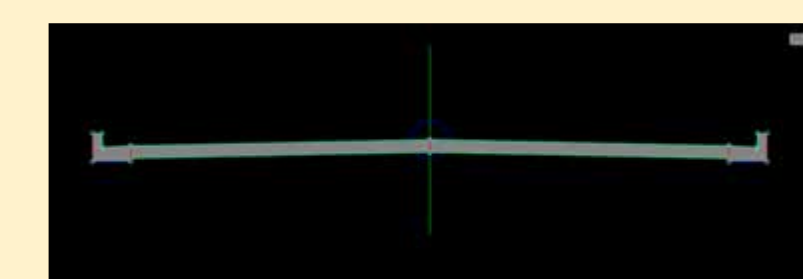
North arrow

Design Plans

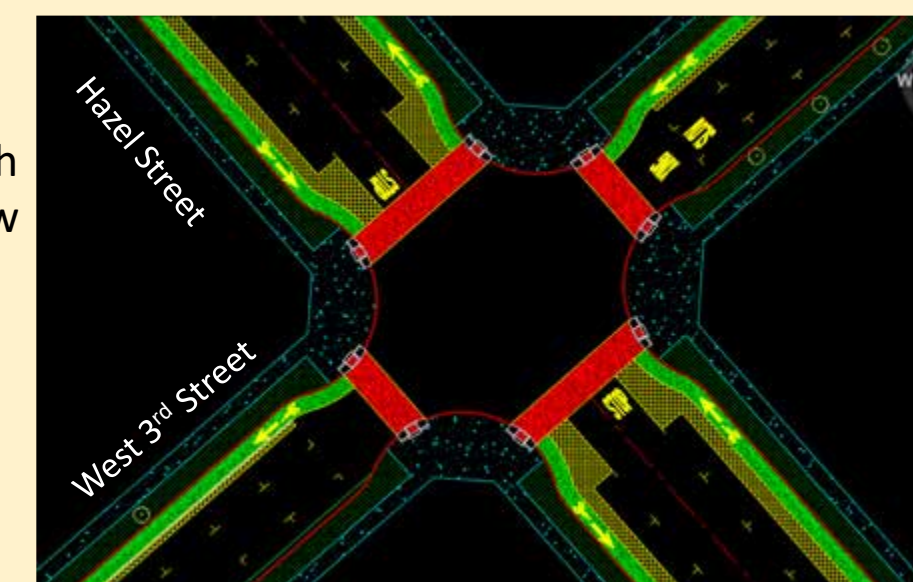
- Bulb out corners at intersections.
- Repave and repaint road
- Convert into a southbound one-way street
- Install bike lane
- Use parking and buffer to protect bicyclists
- Specify parking spots



North arrow



Typical Cross-section of 3rd street
• 2% crown from gutters to center of street



West 3rd Street



West 3rd Street



Cost Estimations

Cost Estimate			
Task	Quantity	Cost/Unit	Cost
Grinding	250 yd ³	\$2.50/yd ³	\$650.00
Repaving	220 Tons	\$100/Ton	\$22,000.00
Restriping/Decals	840 ft ²	\$3.50/ft ²	\$3,000.00
Rebuilding Corners	8	\$1,250 ea.	\$10,000.00
Bike Lane	3125 ft ²	\$3.50/ft ²	\$10,950.00
Buffer Zone	625 ft ²	\$3.50/ft ²	\$2,200.00
Cross Walks	1900 ft ²	\$3.50/ft ²	\$6,650.00
Total			\$55,450.00

Final Recommendations

- Add a bike lane to increase bicyclist safety
- Paint crosswalks to be highly visible
- Repair sidewalks
- Make all sidewalks and ramps ADA certified
- Remove and replant some of the trees

Street Redesign Concepts: 5th & Chestnut

Prepared by Jonathan Campos, Uriel Dominguez, Allison Downs, Tutulu Finau, Miguel Mendez, Dr. DingXin Cheng, Dr. Kun Zhang
Engineering 441: Transportation Engineering | Fall 2018

Background

The Road Runners group analyzed the intersection of W 5th St. and Chestnut St. where traffic and roadway can be improved. The condition of the existing road exposes issues such as bicyclists safety, handicap ramps, and parking availability. Our mission was to redesign the current street to provide a safe and efficient roadway.

Parking and ADA Requirements

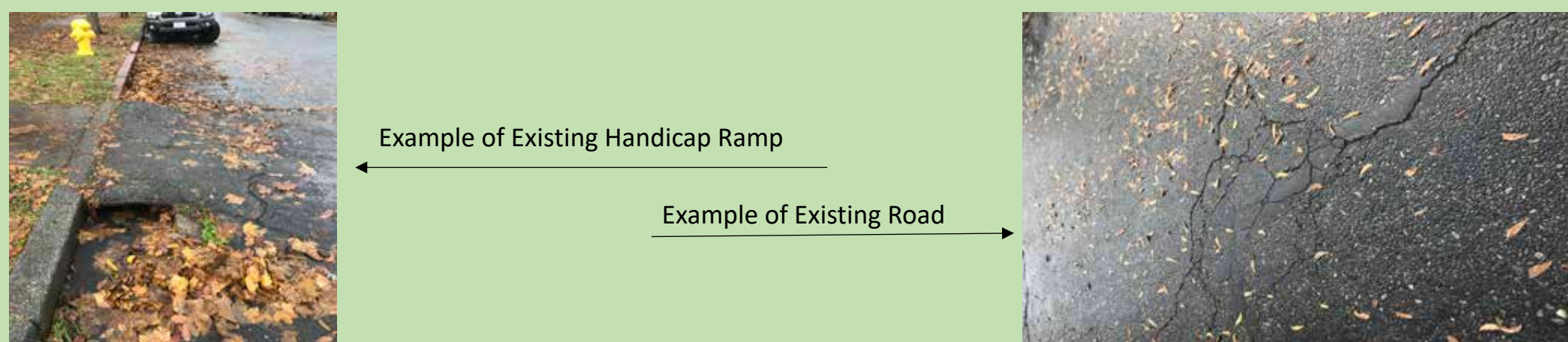
Accommodating ADA necessities within the project scope is a key factor for this proposal. Each corner of the intersection will have a bulb-out design to facilitate the needs of pedestrians accordingly. To capitalize on the safety of the public, the parking lane will be placed between the designated Cyclelane and traffic lanes.

Economic Impacts

To ensure that the goals are met within the specifications of this project, it was essential to keep the project cost minimal while ensuring public safety. Following inspection of the existing roadway, numerous alternatives were proposed. An economic analysis was created for the re-infrastructure of the proposed roadway.

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Maintenance and Control of Traffic	1	LS	\$22,000.00	\$22,000.00
2	Mobilization	1	LS	\$5,000.00	\$5,000.00
3	Construction Layout and Staking	1	LS	\$30,000.00	\$30,000.00
4	Jobsite Management	1	LS	\$10,000.00	\$10,000.00
5	Cycle Lane (Protects bikers from Cars)	410	EA	\$55.00	\$22,550.00
6	Remove concrete curb and gutter	245	LF	\$50.00	\$12,250.00
7	Install City Std. S-2 P.C.C Curb & Gutter	472	LF	\$27.00	\$12,744.00
8	Install City Std. S-27 P.C.C. Handicap Ramp	208	SF	\$15.00	\$3,120.00
9	Pavement Grinding	4500	SY	\$2.50	\$11,250.00
10	Hot Mix Asphalt	525	TN	\$100.00	\$52,500.00
11	Thermoplastic Crosswalk & Limit Line, 12" White	2100	SF	\$3.10	\$6,510.00
12	Thermoplastic Pavement Markings, White (Road)	325	SF	\$3.50	\$1,137.50
13	Thermoplastic Traffic Lines, Detail 39 (Bike Lane Line)	1200	LF	\$0.55	\$660.00
TOTAL PROJECT COST =					\$189,721.50

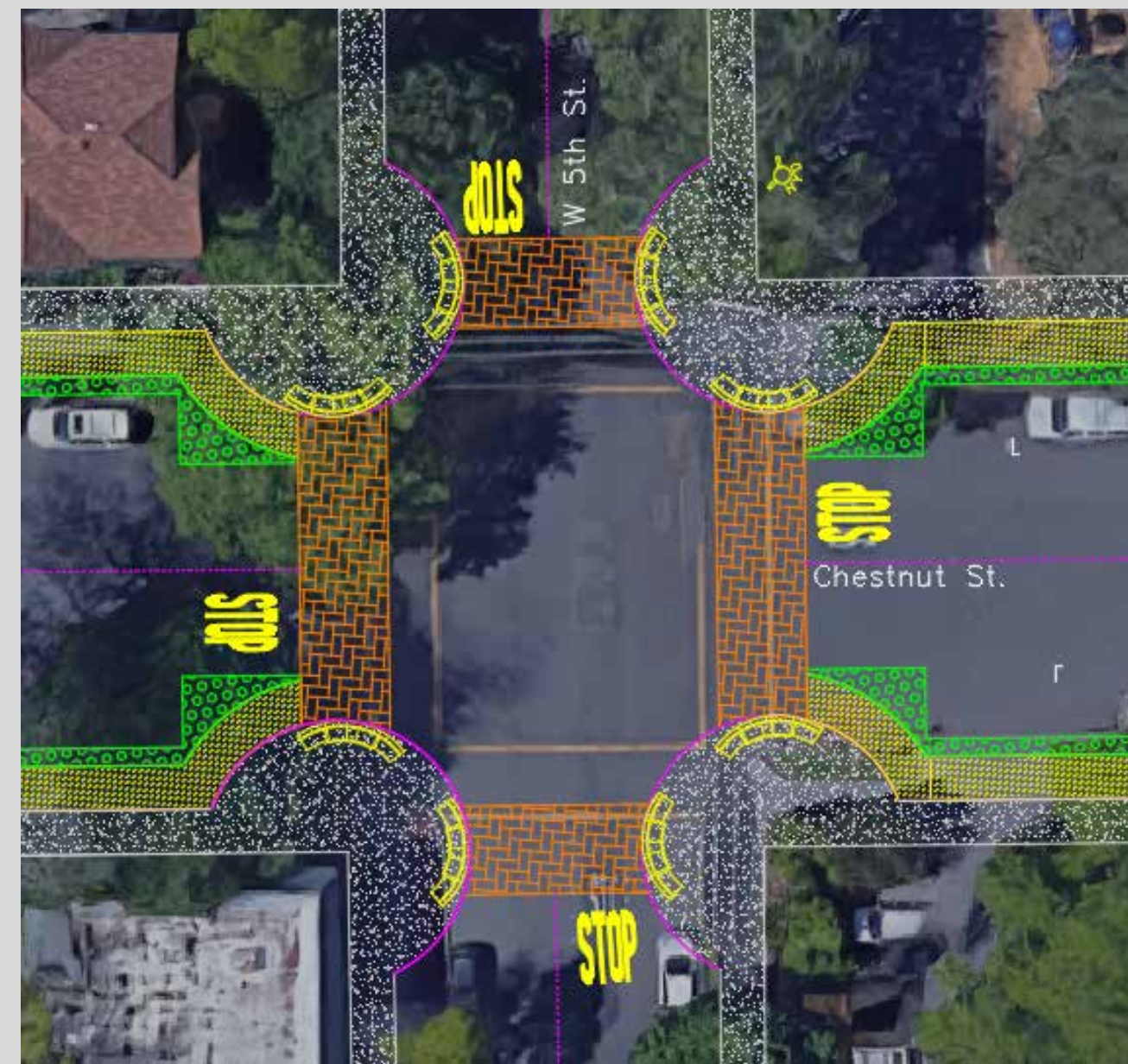
Cost of Project



Example of Existing Handicap Ramp

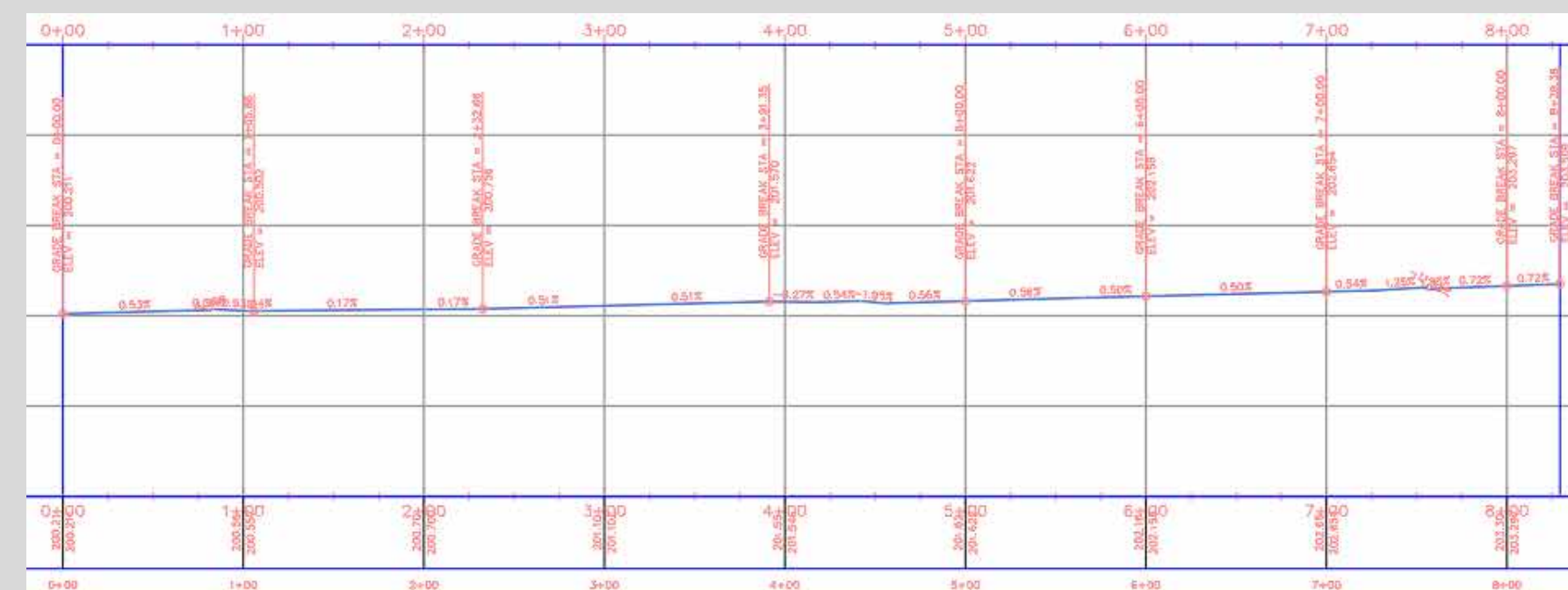
Example of Existing Road

Aerial Photo with Proposed Changes



- Crosswalk
- Cyclelane Strip
- Bike Lane
- Parking
- Handicap Ramps
- Sidewalk

Proposed Roadway Profile



Proposed Section View



Bike Lane

The incorporation of bike lanes into rural streets provide both economical and environmental impacts as a less demand of vehicle transportation is required. The integration of such lane not only benefits the local community, but students as well as it is an efficient alternative of transportation. The proposed bike lane will be adjacent to the sidewalk at a width of 5 feet. This separation will ensure the safety of the bicyclist as well as the pedestrian. Furthermore, cyclelane's, also known as armadillos, will be set every 6" to secure safety of bicyclists from the parking lane.

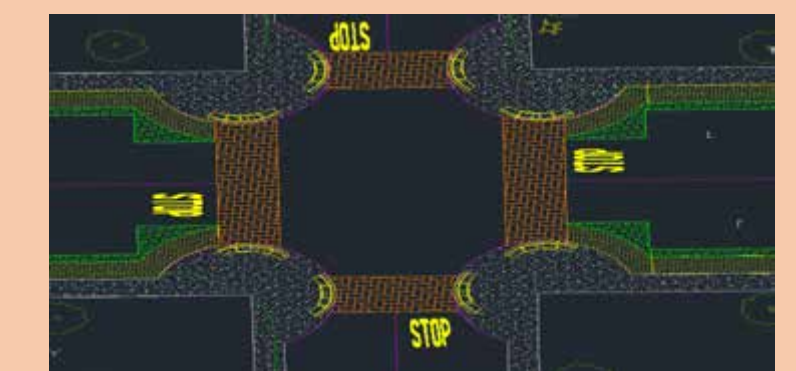
Final Recommendations

Cyclelane



Incorporating Cyclelane's to the project provides both safety to commuters and environmental purposes as the material is composed of recycled PVC.

Bulb-Out Intersection



The addition of "Bulb-out" intersections contributes to the safety of the public, especially regarding wheel chair users.

Handicap Ramps/Truncated Domes



Based on the current conditions of ramps, replacement is needed to comfort the needs of handicap pedestrians.

Crosswalk



Integrating a crosswalk to the project will highlight where pedestrians can cross safely.

Street Redesign Concepts: Chestnut from 8th to 9th

Prepared by Amal Al Qumber, Kaeti Park, Ethan Retherford, Holly Stein, Cody Van de vrugt, Dr. DingXin Cheng, Dr. Kun Zhan
Engineering 441: Transportation Engineering | Fall 2018

Project Goals

Problem Definition

Chestnut Street is near Chico State University and extends the length of the Downtown Chico area, connecting the Chico State Campus to Highway 32. Because of its central location, Chestnut street is subject to heavy traffic consisting of vehicles, bicycles and pedestrians. Transportation issues in this area include: lack of visibility, poor pavement quality, lack of a bike lane and non compliance with ADA.

Improvements

Necessary improvements include increased lighting, traffic safety at intersections, creating a safe space for bikers, and refinishing of sidewalks and ramps to increase accessibility.

Transportation Issues

We analyzed every mode of transportation likely to travel within our system boundary and determined several areas in need of improvement.

Current Design:

Surface Condition:

- Bike Lane: The bike lane along this stretch of Chestnut Street is nonexistent, prompting cyclists to share the road with passing motorists which increases risk of a vehicle-cyclist collision
- Street: The asphalt in this area is in desperate need of resurfacing. Chico's tendency to have hot summers and cold winters has caused drastic cracking as well as pot holes in the area.

Visibility:

- Inadequate lighting makes this area difficult to travel in dark conditions and increases the likelihood of crime.

Accessibility:

- The surface of the sidewalk must be stripped and resurfaced. The existing surface has been destroyed as a result of growing tree roots causing uplift on the concrete slabs (see Figure 3). These uplifts make it extremely difficult to travel on a wheelchair in this area.

Chestnut Street (between 8th and 9th street) Street Design



Figure 1: Complete Street concept for Chestnut St.

Existing Surface



Figure 2: Intersection of 9th and Chestnut



Figure 3: Existing asphalt



Figure 4: Sidewalk within system boundary

Cost Assessment

Team Full Throttle Cost Analysis (Chestnut St. between 8 th and 9 th St.)		Engineer's Estimate			
ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Maintenance and Control of Traffic	1	LS	\$15,000.00	\$15,000.00
2	Jobsite Management	1	LS	\$10,000.00	\$10,000.00
3	Mobilization	1	LS	\$5,000.00	\$5,000.00
4	Construction Layout and Staking	1	LS	\$20,000.00	\$20,000.00
6	Storm Water Pollution Prevention Plan (SWPPP)	1	LS	\$5,000.00	\$5,000.00
9	Remove Concrete Curb & Gutter	413	LF	\$50.00	\$20,650.00
10	Removal of Concrete Sidewalk, Curb Ramp, or Driveway	3101	SF	\$10.00	\$31,010.00
12	Install City Std. S-1 P.C.C Sidewalk	3083	SF	\$7.00	\$21,581.00
13	Install City Std. S-2 P.C.C Curb & Gutter	432	LF	\$27.00	\$11,664.00
14	Install City Std. S-5 Residential Driveway	398	SF	\$6.00	\$2,388.00
15	Install City Std. S-27 P.C.C Handicap Ramp	364	SF	\$15.00	\$5,460.00
23	Hot Mix Asphalt	227	TN	\$100.00	\$22,700.00
25	Pavement Grinding	1390	SY	\$2.50	\$3,475.00
32	Thermoplastic Crosswalk & Limit Line, 12 in. White	1080	SF	\$3.10	\$3,348.00
33	Thermoplastic Pavement Markings, White	400	SF	\$3.50	\$1,400.00
34	Blue Retroreflective Raised Pavement Marker	8	EA	\$15.00	\$120.00
35	Lower and Raise Manhole to Grade	1	EA	\$1,800.00	\$1,800.00
40	Adjust Traffic Signal Box to Grade	2	EA	\$250.00	\$500.00
41	Install Street Light Crossing	2	EA	\$250.00	\$500.00
44	Modify Drainage Inlet	8	EA	\$350.00	\$2,800.00
				Total	\$184,396.00
				Contingency @ 5%	\$9,219.80
				Construction Management @ 6%	\$11,063.76
				Total	\$204,679.56

Table 1: Cost Analysis for reconstruction of street segment.

Final Recommendations

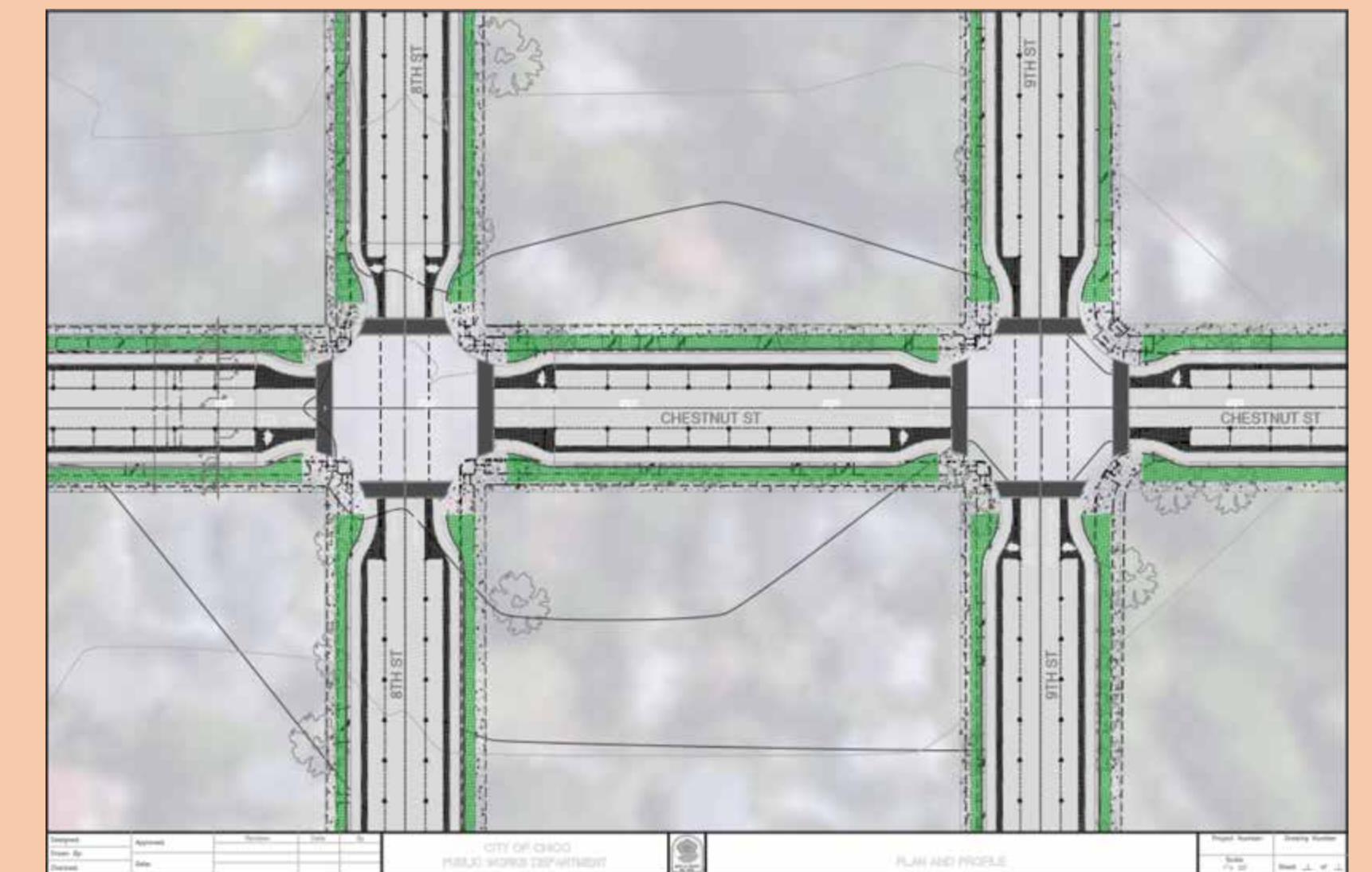


Figure 5: Base design for Chestnut St. between 8th and 9th St.

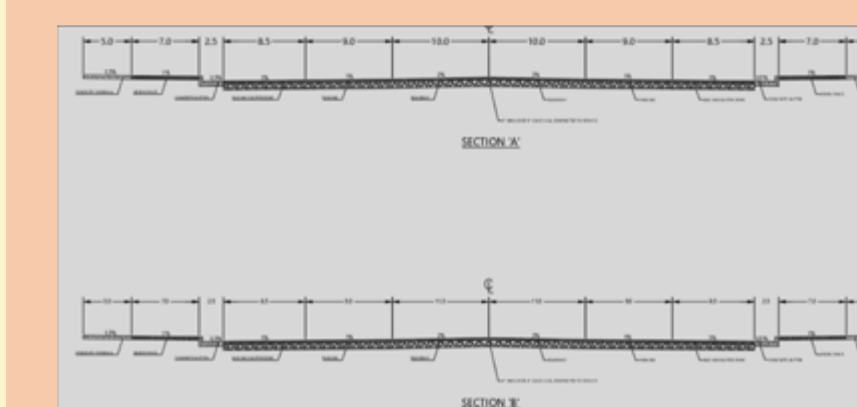


Figure 6: Cross Sections A & B

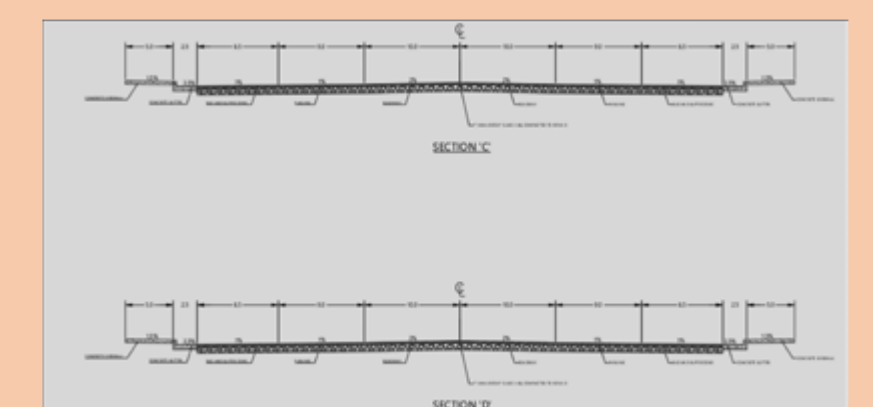


Figure 7: Cross Sections C & D

Street Redesign Concepts: 3rd from Chestnut to Salem

Prepared by: Isaiah Andrade, Jason Blum, Hannah Braun, Mark Campbell, Stephanie Gutierrez, Dr. DingXin Cheng, Dr. Kun Zhan
Engineering 441: Transportation Engineering | Fall 2018

Project Objectives

Where?

This three-year project aims to assess existing conditions and to develop and refine neighborhood improvement concepts to address a range of identified issues. The neighborhood improvement planning process is focused on concepts for complete streets and public works that will enhance public health and safety, quality of life, sense of place and environmental sustainability.

Why?

The neighborhood today is densely populated with university students and is also home to a number of small businesses, restaurants, bars, churches, community organizations, a school, a fire station, a police station, a railway station and transit center. Given its location, population and mixed uses, the neighborhood faces a unique set of circumstances and challenges.

Class Objectives

Experience using Civil3D and Raster Design Software

Follow the Design Standards of The City of Chico

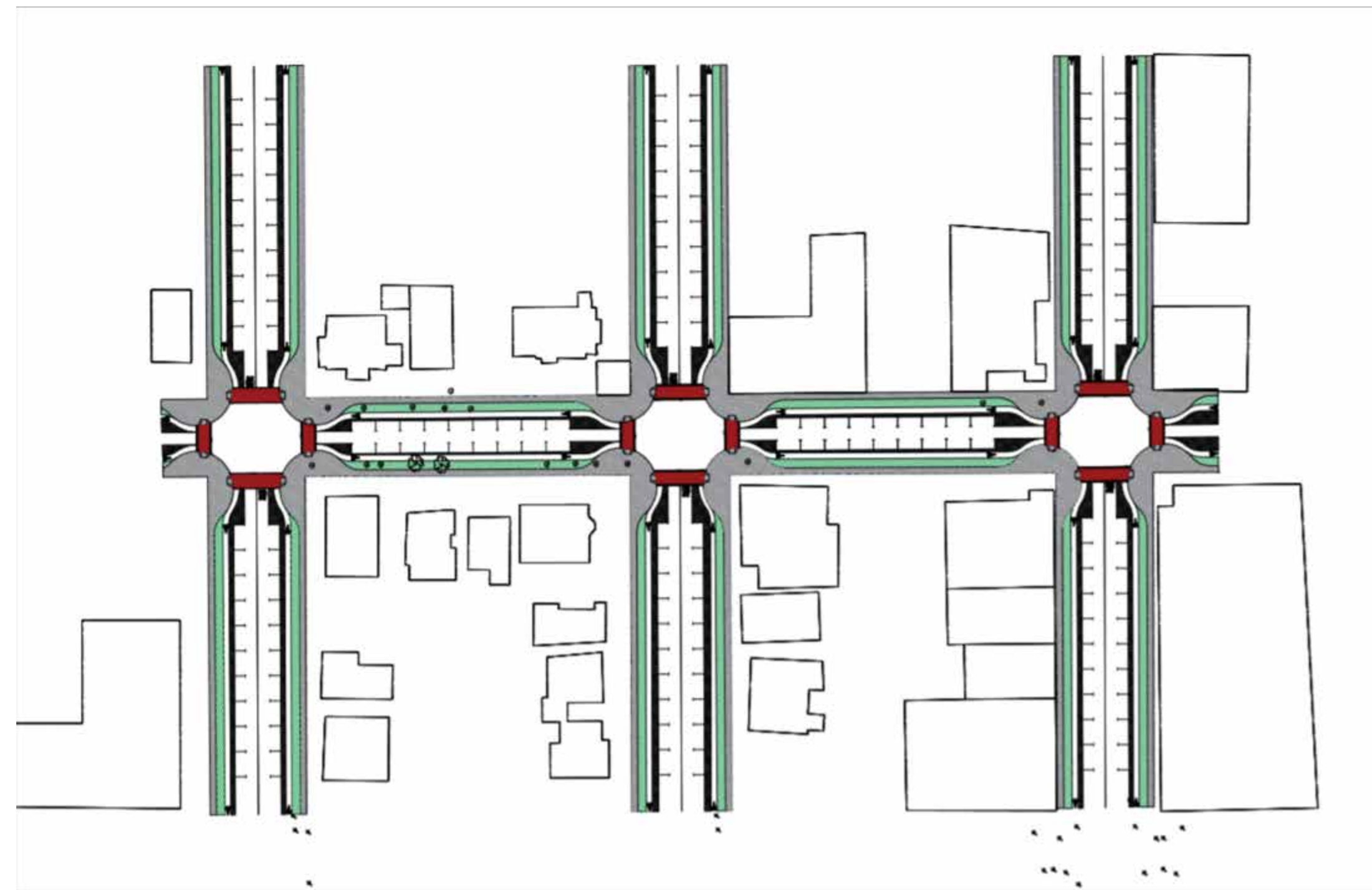
Overall Objectives

Create smoother traffic flow for vehicles, bicycles and pedestrians

Increase safety

Add aesthetics to the neighborhood .

West 3rd St. from Chestnut St. Intersection to Salem St. Intersection



Final Recommendations

Two-Way to One-Way Street Conversion

Making 3rd Street into a one way will reduce traffic and potential collisions while simultaneously providing safer transportation for pedestrians and bicyclists.

ADA Ramp Installation

Install wheelchair ramps that are compliant with the Americans with Disabilities Act specifications, codes and handicap access guidelines.

Sidewalk Improvements

Improve Sidewalks to allow safer and easier travel for pedestrian and wheelchairs. Resurfacing areas of the sidewalk that have been impacted by tree growth.

Road Resurfacing

Resurfacing the road will improve existing conditions and texture while also helping to prolong the road life.

Improved Striping

Improve and alter striping for new one-way street design.

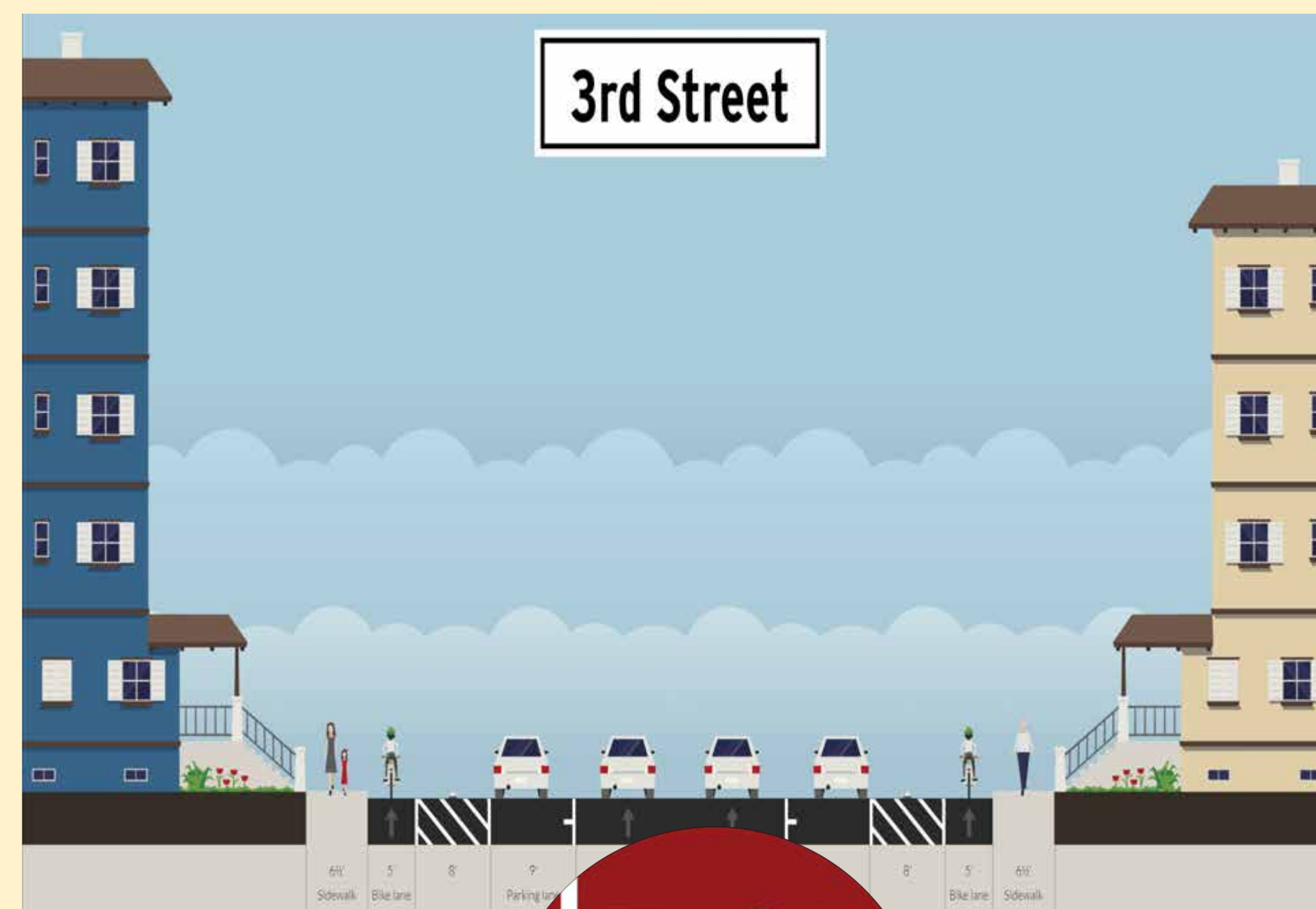
Cost Analysis

South Campus Neighborhood Design Project
3rd Street, Chestnut to Salem
Location: Salem

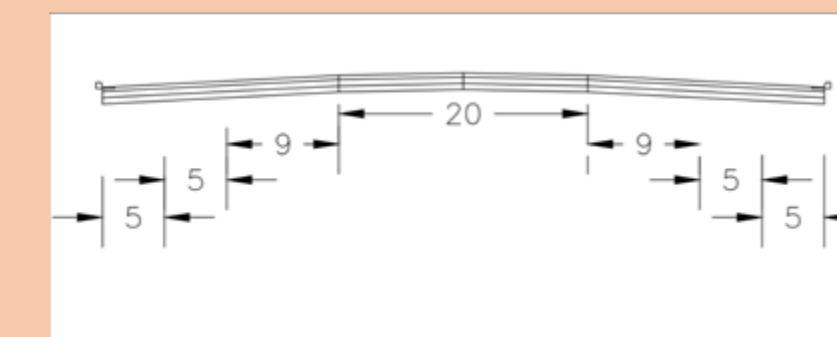
Group Name: Highway to Hell
Estimator: Andrade

ENGINEER'S ESTIMATE

ITEM NO.	DESCRIPTION	QTY	UNIT	UNIT PRICE	AMOUNT
1	Project Management	1	LS	\$10,000.00	\$10,000.00
2	Maintenance of Traffic	1	LS	\$22,000.00	\$22,000.00
3	SWPPP Construction	1	LS	\$10,000.00	\$10,000.00
4	Layout/Staking	1	LS	\$30,000.00	\$30,000.00
5	2" Asphalt Resurfacing	5502	SY	\$2.50	\$13,755.56
6	Concrete Curb Demo	1200	LF	\$50.00	\$60,000.00
7	Concrete Sidewalk Demo	6000	SF	\$10.00	\$60,000.00
8	Concrete Installation	16992	SF	\$7.00	\$118,944.00
9	ADA Ramp Installation	12	EA	\$600.00	\$7,200.00
10	Thermoplastic Striping	2294	SF	\$3.50	\$8,029.56



Final Recommendations



Road Resurfacing



Improved Lighting



Improved Striping

PROJECT CO-DIRECTOR

Dr. James Pushnik, Executive Director
Resilient Cities Initiative
California State University, Chico

PROJECT CO-DIRECTOR

Fletcher Alexander, Associate Director
Resilient Cities Initiative
California State University, Chico



PRINCIPAL PARTNER

Brendan Ottoboni, Director
Public Works-Engineering
City of Chico, CA

www.scnpchico.com

Project Introduction

Suggested alternatives to the problems involved with the south side of Chico.

Overview

Chestnut street experiences a large volume of vehicle traffic, as well as pedestrian and bicycle traffic as a result of its proximity to Chico State University. Being right next to the police station as well as a parking structure the street is a popular route for the Chico Community; improvements need to be made.

Project Goal

Our goal for this project is to increase the safety of pedestrians and bicyclists while maintaining adequate traffic flow.

Cost Analysis

Chestnut Street Retrofit (2nd to 4th) Rough Estimate					
Item	Description	Quantity	Price	Unit	Amount
1	Thermoplastic Pavment Markings White	2552	\$3.50	SF	\$8,932.00
2	Crosswalks & Limit lines 12" wide	652	\$3.10	SF	\$2,021.20
3	Curb & Gutter Removal	989	\$50.00	LF	\$49,450.00
4	Curb & Gutter Instalation (city standard)	989	\$27.00	LF	\$26,703.00
5	Sidwalk & Drive way Ramp Removal	6157	\$10.00	SF	\$61,570.00
6	Sidwalk Instalation (city standard)	6233	\$7.00	SF	\$43,631.00
7	Handicap Ramp Instalation	512	\$15.00	SF	\$7,680.00
8	Driveway Ramp Instalation	1212	\$6.00	SF	\$7,272.00
9	Payment Grinding	1204	\$2.50	SQYD	\$3,010.00
10	Hot Mix Asphalt	393	\$100.00	TN	\$39,300.00
11	Project size bid dependent items, traffic control, tree preservation, management, utility relocation, T & M items, etc.	1	\$75,000		\$75,000.00
12	Incedentals and oversights	1	\$100,000		\$100,000.00
13	Subtotal				\$424,569.20
14	Contractor Mark Up 10%				\$42,456.92
15	Grand Total				\$467,026.12

Chestnut Street Revision (2nd to 4th)

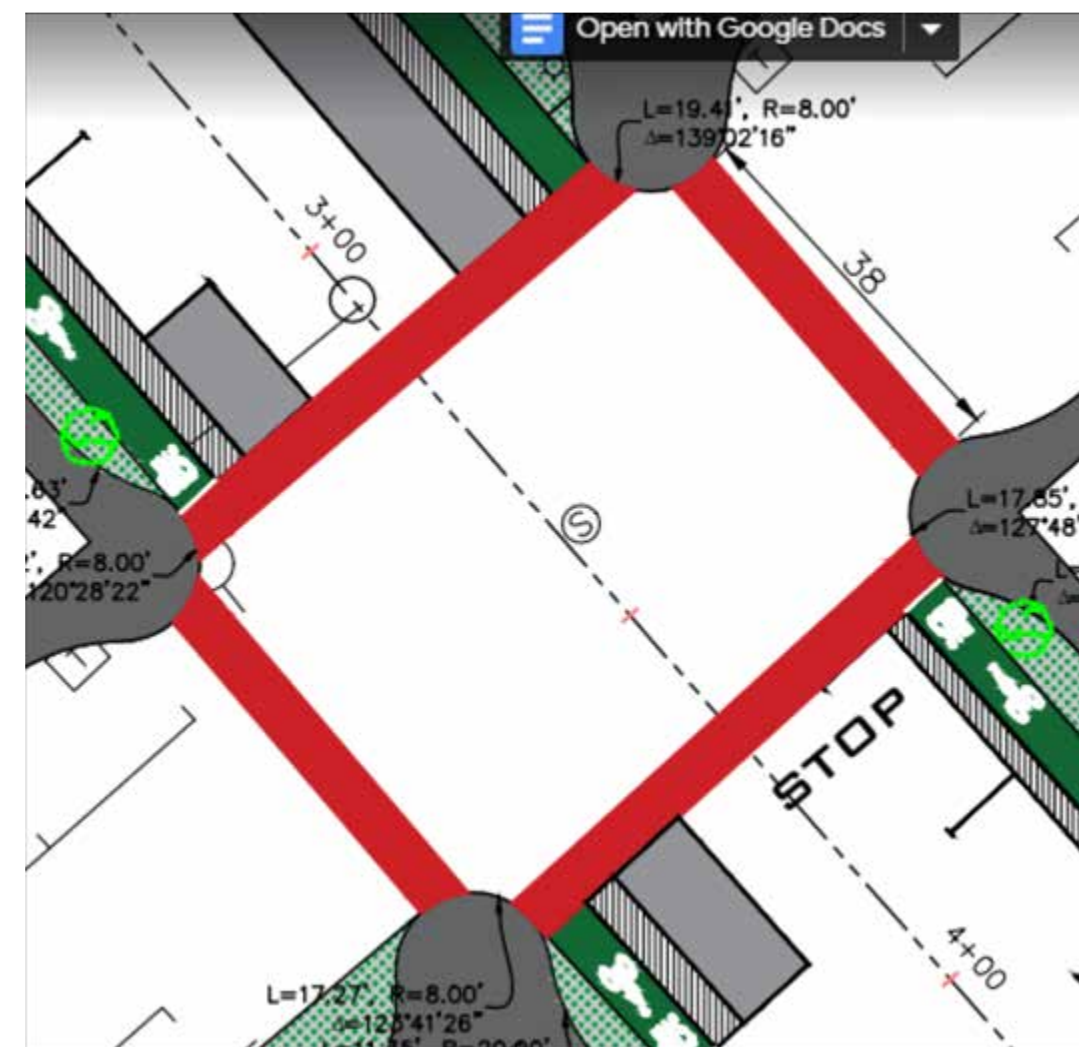


Figure 1: Intersection at 3rd and Chestnut Street.

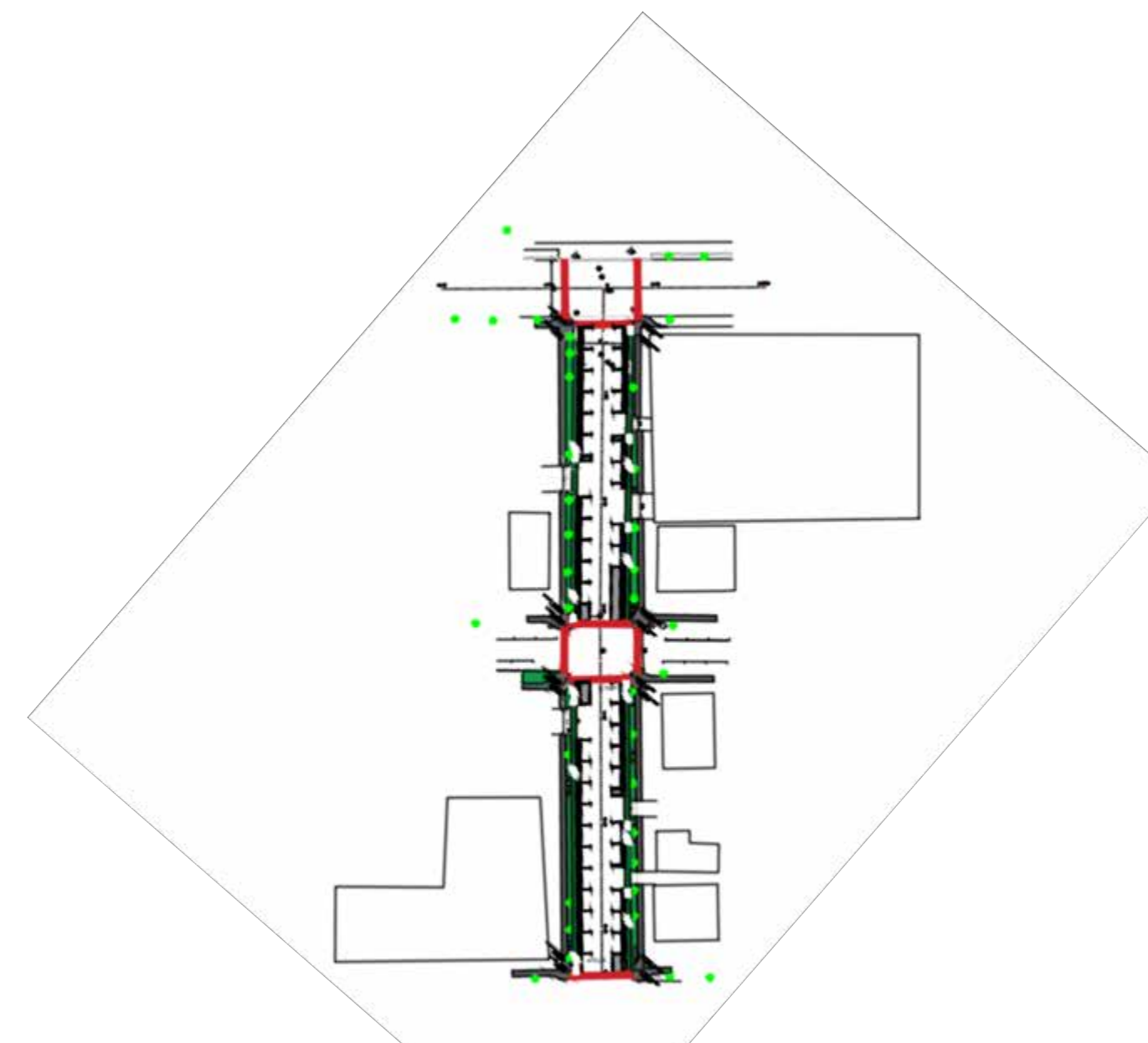


Figure 2: Design for Chestnut Street from 2nd to 4th Street.



Figure 3: Typical Cross Section for Roadway

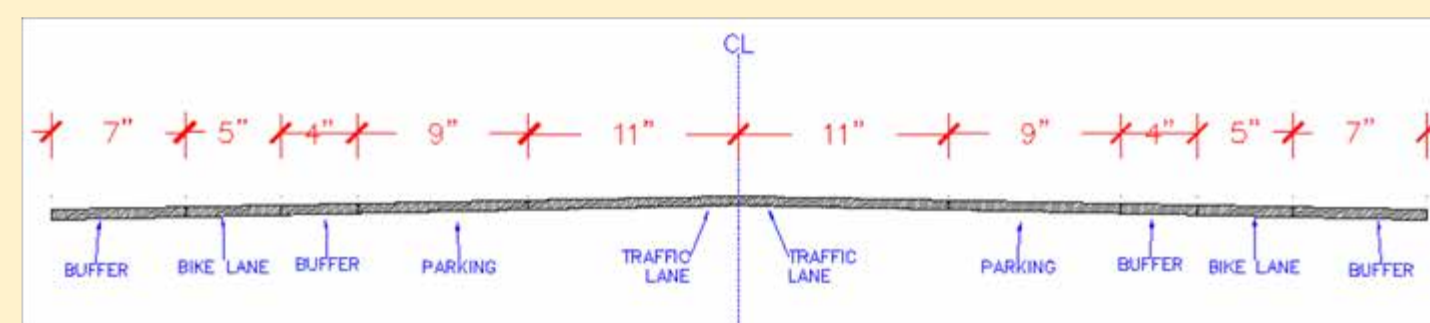


Figure 4: Current street layout

Final Recommendations

The aerial photo above shows the current design of the road and the intersection at Chestnut and 3rd Street. By observing that the volume of traffic was not superior, this roadway is fine to continue to function as a two-way roadway. In our design we decided to make all parking spots parallel parking. Doing this would allow bikers and pedestrians to have more space along the roadway. There is no designated bike lane along Chestnut Street, so we added a 5' wide bike lane with a 4' buffer.

The hardest part about this project was not having any survey points along the street or intersection. Without survey points we could not create a surface. To increase pedestrian safety along the roadway we fixed all cracks within the sidewalk and corrected the elevation differences along the sidewalk. All roads in the South Campus have terrible lighting, so we also put in lighting along the street. With the addition of a bike lane, and no increase in street width; more is taking place along the street despite no change in street width. This will result in traffic slowing down and make the street safer.

Final Recommendations

Seriously consider the ongoing costs associated with trees lining the streets. Side walk replacement is not cheap, neither are the trip and fall lawsuits that come with side walks in disrepair.



Copyright © 2018

Resilient Cities Initiative

California State University, Chico