

Downtown Street Redesign

WEST BURLINGTON, IOWA

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Section I Executive Summary

The City of West Burlington has embarked on a revitalization effort to enhance its downtown area, aiming to improve its functionality, aesthetic appeal, and accessibility. As part of a senior design capstone project, a group of engineering students has developed a comprehensive redesign that integrates green infrastructure, improves pedestrian and vehicular movement, and establishes inviting spaces for community events and business activity. This initiative is intended to transform the downtown district into a more attractive, vibrant, and walkable environment that encourages local economic growth and community engagement.

The current downtown area of West Burlington is heavily dominated by concrete, lacking the warmth and visual appeal necessary to foster an inviting public space. The city has recognized the need for improvements to create a more pedestrian-friendly and aesthetically pleasing environment while enhancing stormwater management. In response to these concerns, the engineering team has carefully designed a series of enhancements that strategically address these issues and align with the city's goals.

The proposed redesign introduces several transformative features to improve the downtown area's appeal and functionality. Five grassy medians will be installed—three along Broadway Street and two along Wheeler Street. These medians will introduce greenery to the streetscape while serving as an effective stormwater management tool. The additional vegetation will aid in water absorption and mitigate urban runoff, making the infrastructure more sustainable. The vacant lot east of City Hall will be transformed into a dynamic public space. The design includes a parking overhang with solar panels that promote sustainability, as well as a multi-use gathering structure that will facilitate events such as farmer's markets and community gatherings. Additionally, a small building will be constructed to provide essential amenities, including bathrooms, storage space, and office facilities to support public events.

A key focus of the redesign is to enhance pedestrian safety and accessibility. A new crosswalk will be placed along Broadway Street midway between Mt. Pleasant Street and Wheeler Street to improve walkability and provide safer crossings. Additionally, back-in parking striping will be introduced, improving spatial efficiency and increasing safety for both drivers and pedestrians. The project also features a movable wooden patio for Broadway Bar & Grill that overhangs the on-street parking, allowing seasonal flexibility by extending seating into the parking area during warmer months and removal during the winter.

To address stormwater challenges, the design incorporates permeable pavement at the Broadway-Wheeler intersection and designated parking areas. This solution improves drainage, Downtown Street Redesign West Burlington, IA reduces runoff, and contributes to the overall sustainability of the downtown area. The engineering team utilized Civil3D to meticulously lay out the plan, ensuring technical feasibility and precision. Additionally, SketchUp was employed to create detailed 3D renderings, allowing stakeholders to visualize the proposed changes realistically.

The City of West Burlington initially granted the engineering team creative freedom to explore potential redesign concepts. Following this phase, the team presented their ideas to city officials, who expressed enthusiasm and support for the proposed grassy medians, parking structures, public event space, permeable pavement, and aesthetic enhancements. A final presentation to city officials, local business owners, and residents ensured transparency and stakeholder engagement.

The anticipated impact of this downtown revitalization is substantial. By integrating green spaces, improving accessibility, and fostering business-friendly enhancements, the redesign aims to make downtown West Burlington a more inviting, walkable, and economically vibrant space. The improvements are expected to increase pedestrian activity, attract businesses, and encourage community events, such as the annual 4th of July parade and regular farmer's markets. Once the senior design project is finalized, the City of West Burlington will evaluate the next steps in moving forward with implementation. The detailed plans and recommendations provided by the engineering team will serve as a strong foundation for future development, offering a well-researched and carefully planned strategy for transforming the downtown district into an engaging and thriving space for both residents and visitors.

A cost estimation was performed using data from RS Means and available information for specific items like plantings, lightings, etc. A 15% contingency fee and a 10% engineering fee was also applied. The project is estimated to cost \$1,549,287. For a full cost estimate breakdown, see Table 2 in the Appendix.

Section II Organization Qualifications and Experience

Organization and Design Team Description:

We are a team of fourth-year civil engineering students from the University of Iowa, each bringing a specialized skillset to the project. The University of Iowa's curriculum emphasizes real-world applications, problem-solving, and innovative infrastructure solutions, equipping us with expertise in sustainable design, transportation engineering, and urban planning.

- a. Dylan Freeman: Serving as the lead of creative work, Dylan specializes in 3D rendering and has experience in traffic engineering and transportation.
- b. Aaron Begy: As the project editor, Aaron will also work with 3D rendering, Civil3D, and engineering calculations.
- c. Brandon Draper: Leading the layout design and providing technical support, Brandon's expertise in business administration will be crucial for the project's success.

Description of Experience with Similar Projects:

- a. Dylan Freeman: Has extensive experience in roadway design, traffic engineering, and 3D rendering, ensuring efficient and effective project execution.
- b. Aaron Begy: Specializes in drainage design and transportation engineering, contributing to sustainable and efficient water management solutions, along with expertise in 3D rendering and Civil3D.
- c. Brandon Draper: Brings expertise in business administration, having worked on various projects that required detailed planning and layout design, and will lead the layout design and technical support.

Section III Proposed Services

1. Project Scope

The City of West Burlington sought an evaluation and redesign of its downtown area to enhance functionality and visual appeal, facilitating public events and attracting visitors. For our capstone project, a group of engineering students focused on improving the durability and accessibility of

roads and enhancing walkability through streetscape development. The project incorporates plantings and lighting around the streets near City Hall to create a more attractive and accessible environment.

This comprehensive undertaking includes planning for road improvements, stormwater management enhancements, and streetscape development. The site design, completed in Civil 3D, details the site location, construction boundaries, existing and proposed utility locations, and infrastructure such as new roadways and sidewalks. The stormwater management design includes plan views of permeable pavement systems and green medians, specifying materials, sizes, and locations. Streetscape designs present renderings to showcase the aesthetic improvements, including plan views, elevation views, and architectural renderings of plantings and lighting installations.

This project aims to provide a vibrant and functional downtown area that attracts visitors and supports community activities, ensuring that the redesign not only meets but exceeds the client's expectations.

2.Work Plan

The project commenced with a site visit and discussions with the client to understand their vision and requirements for the downtown redesign. After agreeing on the project parameters, our team developed a comprehensive proposal outlining the scope and objectives.

We proceeded with the median designs, the parking overhang structure, permeable parking and intersection, and began laying out the design in Civil3D. This phase, which included finalizing layouts for the changes along Broadway Street and Wheeler Street, the lot development plan, and minor roadway improvement designs, took approximately five weeks.

Following the completion of the layout, the team created a 3D rendering of the design to provide the client with a clear visual representation of our vision. During this period, we also performed several critical tasks, including calculating runoff using the rational method, conducting vehicle tracking with Civil3D, and performing area measurements to determine material and demolition volumes.

This structured approach ensured that each phase of the project was planned and executed, meeting deadlines and allowing us to deliver a comprehensive design that meets the client's expectations

Section IV Constraints, Challenges, and Impacts

Constraints

The downtown redesign project for the City of West Burlington was shaped by several significant constraints. One of the primary constraints was the limited space available for the redesign. We had to work around existing buildings and infrastructure, which required careful planning and optimization to ensure that all design elements could be effectively integrated without encroaching on private property or existing structures. Additionally, the project was restricted to developing only city-owned property. This limitation meant the team could not make any changes to privately-owned property boundaries and regulations. Another critical constraint was respecting the privacy of residents and businesses adjacent to the project sites. The team had to ensure its design did not infringe on the privacy of these stakeholders, which involved careful placement of new structures and amenities to minimize any potential disruptions or intrusions. Furthermore, the team had to maintain existing access to buildings along the site, ensuring that its redesign did not impede the functionality and accessibility of these structures. These constraints guided design decisions and ensured delivery of a functional and aesthetically pleasing downtown area within the given limitations.

Challenges

The downtown street redesign project in West Burlington faces several challenges that need to be addressed for successful implementation. The region's harsh winter conditions make it difficult for plants and trees to survive, requiring thoughtful landscaping choices to ensure year-round greenery. Parking relocation is another concern, as removing spots from the main street will require identifying alternative locations to maintain convenience for visitors. Gaining public and business support is crucial, particularly since construction in front of businesses could temporarily disrupt operations. Managing traffic flow during construction is also essential, given that the affected street carries the heaviest traffic in the town. Finally, the project must strike a design balance, incorporating walkability, green elements, and aesthetics without compromising the area's functionality and appeal.

Societal Impact within the Community

The downtown redesign project is poised to have a significant positive impact on the community. By enhancing the functionality and visual appeal of the downtown area, the project aims to create a more vibrant and attractive environment that will draw visitors and support local

businesses. The introduction of green medians, permeable pavement, and improved streetscape will not only beautify the area but also contribute to sustainable urban development.

The development of the vacant lot east of City Hall into a community space for farmer's markets and events will foster a sense of community and provide a venue for social gatherings, promoting local culture and commerce. The addition of a parking overhang equipped with solar panels underscores the city's commitment to sustainability and renewable energy, setting a positive example for other communities.

Improving pedestrian safety and accessibility through the installation of new crosswalks and back-in parking will make the downtown area more walkable and user-friendly, encouraging residents and visitors to explore and enjoy the space. The movable wooden patio for Broadway Bar and Grill will enhance the dining experience, offering outdoor seating during warm months and additional parking during colder months, thus supporting local businesses year-round.

Overall, the project is expected to boost economic activity, enhance the quality of life for residents, and create a welcoming atmosphere that reflects the community's values and aspirations. By addressing both aesthetic and functional aspects, the redesign will ensure that the downtown area remains a central and cherished part of West Burlington.

Section V Alternative Design Options

During the design process, the team considered several alternative design concepts. One of these was to develop a one-story building on the vacant lot east of City Hall, which could provide flexible space for various city uses. While this option offers versatile space for community activities and city functions, it would be costly and may limit the flexibility of the space for outdoor events and farmer's markets. We also considered implementing regular angled parking and parallel parking in certain locations along Broadway and Wheeler Streets. Although these configurations are familiar to drivers and can be easier to navigate, they do not offer the same safety benefits as back-in parking and may not optimize the available space as efficiently.

Another alternative was to develop a small park in the vacant lot south of the fire department. This park could provide a dedicated area for the Sunday pancake breakfast, enhancing community engagement. However, we ultimately decided not to develop this park as it was not immediately adjacent to the rest of our work, which would have made it less integrated with the overall project. Additionally, we considered closing off the alley between the gas station and Wheeler Street and removing some of the gas station entrances. This could reduce traffic congestion and improve pedestrian safety, but it could inconvenience the gas station's customers and impact its business operations.

We also considered the use of permeable interlocking pavers in both the parking stalls and at the intersection. This option would have increased stormwater infiltration and supported sustainability goals. However, we ultimately selected a hybrid approach: using permeable pavers in the parking stalls and impermeable decorative pavers at the intersection. This decision was based on several factors. First, the difference in runoff reduction between the two options— calculated using the Rational Method—was minimal, with an 8.3% reduction for the fully permeable option compared to 7.7% for the hybrid approach. Second, the estimated cost was nearly identical for both designs. Most importantly, the impermeable decorative pavers offer greater durability, which is a key consideration for the traveled way where heavy vehicles and turning movements will occur regularly.

After careful evaluation, the preferred design was selected based on its ability to meet the project's goals while addressing the identified constraints and challenges.

Section VI Final Design Details

Green Medians

Green medians equipped with plantings and lighting fixtures will be placed along Broadway Street between Mt Pleasant Street and Glasgow Street, and Wheeler Street east of Broadway Street. These green medians will enhance the visual appeal of the downtown area and increase pedestrian and vehicle safety. Vehicle tracking software in Civil3D was used to confirm that the turn radii were adequate for emergency vehicles. See Design Sheets 8 and 10 for site location and plan/section drawings. See Figure 1 in the Appendix for the 3D rendering.

Permeable Pavement

The intersection of Broadway Street with Wheeler Street is designed with permeable pavement to enhance visual appeal and improve stormwater management. Permeable pavers were also installed in the parking areas along Broadway and Wheeler Street. See Design Sheets 8 and 9 for site location and plan/section drawings. See Figure 2 in the Appendix for the 3D Rendering.

Back-in Parking

Along Broadway Street and Wheeler Street, parking will be restriped to back-in parking at a 45degree angle, as requested by the City Administrator. This method has been proven to be the safest way of parking. The new parking has also resulted in an additional 6 parking spaces in the downtown area. See Design Sheet 7 for site location and plan/section drawings. See Figure 3 in the Appendix for the 3D Rendering.

Parking Overhang

A new parking overhang structure will be constructed east of the City Hall building to provide parking for city vehicles and event parking when necessary. The structure will be equipped with solar panels to enhance the city's energy efficiency. See Design Sheet 9 for site location and plan/section drawings. See Figure 4 in the Appendix for the 3D Rendering.

Community Event Space

A new gazebo-like structure will be built next to the parking overhang to host city events. It will include benches, tables, and a flexible mixed-use building at the north end with restrooms, office space, and storage. See Design Sheets 9 for site location and plan/section drawings. See Figure 5 in the Appendix for the 3D Rendering.

Retractable Iron Bollards

Retractable iron bollards will be installed at the south leg of the intersection of Broadway Street and Mt Pleasant Street. These bollards will allow the city to close off Broadway Street from the north during city events like the 4th of July festival. See Design Sheet 5 for site location and plan/section drawings. See Figure 6 in the Appendix for the 3D Rendering.

Broadway Bar & Grill Patio

A wood patio will be installed in front of Broadway Bar & Grill, extending into the parking section directly in front of the restaurant. This patio is not permanent and can be removed during cold weather to return the four parking spaces it will cover. See Design Sheet 8 for site location and plan/section drawings. See Figure 7 in the Appendix for the 3D Rendering.

Broadway Street Crosswalk

A crosswalk will be built on Broadway Street in front of the Broadway Bar & Grill restaurant to improve downtown walkability. Pedestrian signage will be provided to signal drivers of the crosswalk. See Design Sheet 8 for site location and plan/section drawings. See Figure 8 in the Appendix for the 3D Rendering.

Section VII Cost Estimate

Using information from the Iowa DOT and Public Works Service Bureau, we obtained a final cost estimate of \$1,549,287 including a 15% contingency fee to account for unexpected changes that may be needed during construction and a 10% engineering fee to cover design development, construction management, and permitting as needed.

See Table 2 in the Appendix.

Appendices

Existing Conditions	n	С	Area (ac)
Finished Concrete	0.012	0.95	72310
Grass (good)	0.25	0.55	17618
		Total:	2.06446281
	Q =	8.223524059	cfs

Proposed (all permeable)	n	С	Area (ac)
Finished Concrete	0.012	0.95	49084.5
Grass (good)	0.25	0.55	24749
PICP	0.015	0.8	14568
		Total:	2.029419192
	Q =	7.542873651	cfs

Proposed (permeable parking only)	n	С	Area (ac)
Finished Concrete	0.012	0.95	52262.5
Grass (good)	0.25	0.55	24749
PICP	0.015	0.8	11390
		Total:	2.029419192
	Q =	7.592885566	cfs

Table 1 – Rational Method Calculations

Item Description	Quantity	Unit	Unit Price	Item Cost
PCC PAVEMENT, 6"	3396	SY	63	213941
MODIFIED SUBBASE, 6"	5454	SY	14	76354
PCC SIDEWALK, 4"	2058	SY	50	102900
6" CURB AND GUTTER	2706	LF	29	78474
PERMEABLE INTERLOCKING PAVERS	1619	SY	115.3	186632
2" BEDDING (ASTM #8)	90	CY	60	5396
BASE (ASTM #57)	270	CY	50	13489
SUBBASE RESERVOIR (ASTM #2/#3)	540	CY	45	24280
GEOTEXTILE	1619	SY	1.25	2023
EXCAVATION, CLASS 10, ROADWAY AND BORROW	540	CY	4.26	2299
COMPACTION WITH MOISTURE AND DENSITY CONTROL	1,474.96	CY	0.41	605
PAINTED PAVEMENT MARKINGS, WATERBORNE	17	STA	25.82	432
DETECTABLE WARNINGS	236	SF	49.34	11644
PEDESTRIAN CROSSWALK SIGN	2	EA	44	88
REMOVAL OF SIDEWALK	1653	SY	14	23136
REMOVAL OF CURB	1635	LF	22	35970
PAVEMENT REMOVAL	6382	SY	12	76583
REMOVE AND REINSTALL STOP SIGN	8	EA	300	2400
STAINLESS STEEL MANUAL RETRACTABLE BOLLARD	5	EA	1136	5680
14' LIGHT POLE, ANCHOR BASE, STAINLESS STEEL	19	EA	1535.1	29167
LED LUMINAIRE	19	EA	1728.6	32843
WIND RESISTANT POLE BANNER BRACKETS	19	EA	170	3230
WIRELESS SOUND SYSTEM	1	EA	6000	6000
PILE SUPPORTED, TREATED WOOD	574	SF	44.11	25308
ALUMINUM PIPE RAILING 3'-6"	71	LF	83.23	5868
RECREATIONAL BUILDINGS, MULTI USE	162	SF	417.3	67603
24G STEEL ROOFING PANELS	3749	SF	7.56	28340
FOOTING AND FOUNDATION	3749	SF	7	26243
STEEL FRAMING	3749	SF	18	67482
NATIVE GRASS SEEDING	0.2	AC	1946	420
CONIFEROUS TREE (WITH WARRANTY)	10	EA	600	6000
LANDSCAPING/NATIVE PLANTING	1	LSUM	20000	20000
SOLAR PANELS, 90 PANELS, 36KW SYSTEM	1	LSUM	61000	61000
			Construction cost:	1239429
			Contigency (15%)	185914
			Engineering fee (10%)	123943
			Project cost:	1549287

Table 2 – Summary of Cost Estimation



<u>Figure 1 – Green Medians</u>



Figure 2 – Intersection of Broadway Street with Wheeler Street



<u>Figure 3 – Parking</u>



FIgure 4 – Parking Overhang with Solar



Figure 5 – Community Event Space



<u>Figure 6 – Retractable Iron Bollards</u>



Figure 7 – Wooden Patio for Broadway Bar & Grill



Figure 8 – Broadway Street Crosswalk