# Downtown Parking Lot Redesign

City of Clinton, IA

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Section 1: Executive Summary (Alex)

The purpose of this document is to explain the scope of work, design alternatives, and cost of design for a redesign of five public parking lots in downtown Clinton IA. The project team is a group of four civil engineering students in their senior year at the University of Iowa: project manager Ryan Bartling, Alex Underwood, Christopher Van Horn, and Derek Gansebom. All members of the group had their own unique experiences and expertise that contributed to a resilient design for this project

The project is an improvement of 5 parking areas in downtown Clinton. This included redesigning and reconstructing pavement, grading, lighting, and drainage. In doing this the team explored options to resize the lots to better use the area they are in and improve the aesthetic quality of the downtown area. In addition to updating the lots themselves, a rest area building was designed on the corner of 2nd street and 6th avenue for transit workers. The rest area building contains a bathroom for the workers and a break room to rest and relax. It also has a connected enclosed bus stop for transit riders to use.

The design was carried out over the course of 3 months between February 11$^{th}$ and May 10$^{th}$, 2022. The design tasks were split amongst the group members with input coming from everyone to establish the best possible design. For this project, the group used several design guides including the Clinton City Code, Statewide Urban Design and Specifications, and the IBC code as well as designing the structure using the LRFD method and National Concrete Masonry Association design guides. These guides, along with correspondence with Karen Rowell, the Director of the Downtown Clinton Alliance and the City of Clinton's engineering staff were the primary resources directing our design.

There were several challenges and constraints that arose as we redesigned the existing parking lots and designed the new rest structure. The primary constraints were the building codes, the inability to expand the size of any of the lots and maintaining the current parking availability and downtown theming of the lots. The main challenges the team faced were improving the aesthetics of the lots without sacrificing usability, incorporating elements of green design to allow for a more sustainable downtown setting, and making the lots more visible.

The expected impacts of this project on the city are primarily improving the community vision and making people's lives easier in the city. There are not expected to be major impacts on the surrounding businesses or the overall population of the city. However, it is expected that the aesthetic improvements will make the downtown area of the city more attractive and inviting to residents and visitors. There are also several factors that will add new features to the areas around the lots such as the rest area and expansion of nearby parks. While there may be some minor inconveniences in the area during the construction, these impacts are significantly outweighed by the positive changes brought about by the revision of the lots.

As far as specific design alternatives are concerned, the team is offering the options of a traditional repaving with asphalt or concrete, a green permeable pavers option, or the most ecological option of incorporating both bio-cells and permeable pavers to help improve drainage on the lots. The inclusion of these green alternatives may have higher initial costs but could allow for grants to be awarded for the construction of the project, leading to a reduced cost to the city as well as the benefit of a more sustainable design.

After completing our design process, we recommend the bio cell design for all the parking lots. This will allow for the greenest design and best environmental outcome for drainage while still providing excellent aesthetic value to the lots and maintaining an adequate number of parking spaces. This alternative will cost $19,250,049.01 to construct; however, it is possible that the inclusion of the greener design could open an opportunity for added federal funding.

In summary, the team is excited to present our design to the City of Clinton and begin implementation of this project to help improve the look and feel of downtown Clinton while hopefully instituting a more sustainable design and providing the ease of use and practicality that citizens are used to getting out of their city.

## Section 2: Organization Qualifications and Experience (Alex)

Our project manager for this project, Ryan Bartling, can be contacted at ryan-bartling@uiowa.edu. We were senior civil engineering students at the University of Iowa who completed the project for our capstone design class. Our team was made up of 4 members: Ryan Bartling, Alexander Underwood, Christopher Van Horn, and Derek Gansebom.

Ryan was the project manager and specializes in transportation engineering. He took the lead on the design of the parking lot pavement and layout. Alex is the text editor for the project and has a specialization in structures. He led the rest-stop design and the budgeting for that part of the project. Christopher is the graphics editor and specializes in water resource engineering. He took the lead on drainage design for the lots along with the exploration of green design alternatives. Finally, Derek is our tech specialist and specializes in traffic engineering. He took the lead on the traffic design aspects of the lots as well as the lighting.

The members of our team each have project experience in the past four years which has prepared us for this project. All members of the team have experience through class projects designing parking lot layout and dimensions while adjusting for drainage and usability. Ryan has worked in the asphalt industry as an engineering tech intern for 3 summers where he would go out to project sites, survey the existing lots or roadways, redesign a surface that either maintained or improved the drainage, and conveyed the information to the construction crews. Alex has worked as an engineering consultant inspecting concrete pours and grading while working with detailed site design drawings.

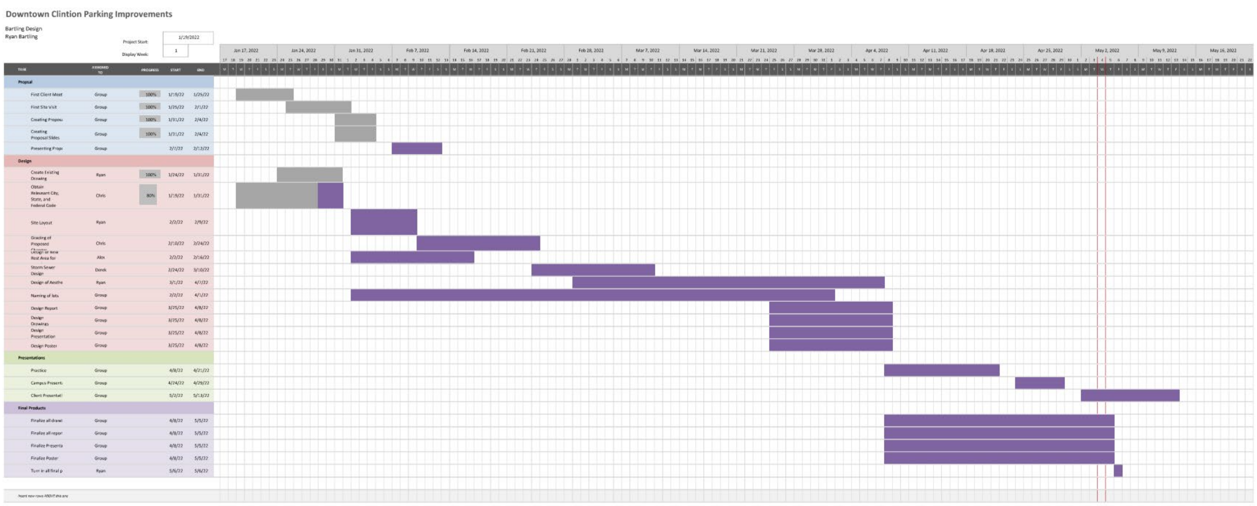
## Section 3: Proposed Services (Derek)

### 1. Project Scope

The project involved improving 5 parking areas in downtown Clinton, Iowa. The main goals of the project included bringing all parking areas up to current applicable codes and standards, improving the overall aesthetic of the parking areas, improving the drainage, improving the capacity and functionality of the lots, resizing, and using the excess space to improve public spaces, producing a naming system for the lots, and designing bio-cells for outside funding. The project also added a rest area building at the lot at South 2nd street and 6th street for the transit workers which includes bathrooms and a break area.

### 2. Work Plan

Gantt Chart

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### 3. Methods and Design Guides

Parking Lots

As for the design of the parking lot, we used the Clinton city code, SUDAS standards, and the International Building Code (IBC). We spoke with Karen Rowell, the Director of the Downtown Clinton Alliance, along with the Transit Director and engineering staff at the City of Clinton, to get a greater understanding of Clinton's needs and desires for the design of all aspects of the five parking lots and the public that they service.

The design included:

1) Green design
    a) Alternative water retention/filtration methods
        i) Bio cells

   b) Alternative finished surfaces
      i) PCC
      ii) HMA
      iii) Permeable Pavers
   c) Alternative landscaping
      i) Shade trees
      ii) Historic foliage
      iii) Foliage known to remove toxins from water
2) Public Needs
   a) Parking space equivalent to area needs
      i) Alternative Park and Ride locations
      ii) Cut of street section to parking space conversions.
   b) Pedestrian Safety
      i) Lighting
      ii) Sidewalks
      iii) Bus stop location
      iv) Crosswalks
   c) Traffic safety
      i) Sight distance
      ii) Setbacks
      iii) Traffic delineation
3) Aesthetic Functionality
   a) Multi seasonal use surfaces
   b) Attract the community to come outside
   c) Attract other people to Clinton, Iowa

Rest Area Building

As for the design of the MTA rest area building, we used the LRFD method to determine the design and ultimate loads, the International Building Code (IBC), and the minimum design load standards of the American Society of Civil Engineers (ASCE). The main contact within the City of Clinton for the design of this building was Dennis Hart. Along with Dennis, the other engineering staff for the City of Clinton and the Director of the Downtown Clinton Alliance helped with giving us an understanding of the needs for this part of the project.

The design included:

1) Transit Worker Functionality
   a) Restroom
   b) Common Lounge
2) Public Functionality
   a) Enclosed bus stop
   b) Glass Windows
   c) Benches

3) Aesthetic Functionality
    a) Congruent with Downtown theme

## Section 4: Constraints, Challenges, and Impacts

### 1. Constraints

The constraints of the project are that the lots cannot be made larger, the functionality of the lots must be maintained or improved, the city has a downtown color theme, and the lots must adhere to all applicable codes. As for the MTA building, the main constraint was providing all the rooms that the city had requested while remaining of an appropriate size in the Oriole lot.

Another constraint was finding a way to add funding from outside the city budget. The way we chose was to include catchments that retarded the first inch of water or first wash to improve stormwater return to the watershed. The constraints to do this were a deep enough water table and a native soil with poor absorption.

### 2. Challenges

The challenges of the project are improving aesthetics while maintaining the functionality of the lots, adding a new building to one of the lots, and making the lots more accessible and well known to the public. The MTA building presented its own challenges of matching surrounding architecture while incorporating a combination of construction materials. To include catchments without adding major infrastructure and to still allow snow storage.

### 3. Societal Impact

**Population Characteristics:** We believe our improvements to the 5 parking lots in downtown Clinton will have no impact on the characteristics of the population since there will not be any dimensional changes of the lots requiring additional land use.

**Community and Institutional Structures:** We believe our improvements to the 5 parking lots in downtown Clinton will have no impact on the patterns of employment or industrial diversity since we are not changing the dimensions or land use of the parking lots. There may be a temporary impact during construction.

**Individual and Family Changes:** We believe that our improvements to the 5 parking lots in downtown Clinton will have an impact on individuals and families living in the Clinton area. The impacts are as follows: improved downtown aesthetics making it more enjoyable for the public, improved lighting to make the parking lots safer at night, improved working conditions for the city transit workers, as well as a more enjoyable parking experience. The only negative impact will be temporary and during construction of the lots.

**Personal and Property rights:** We believe that our improvements to the 5 parking lots in downtown Clinton will have an overall good impact on people since it will make the parking areas and the downtown of Clinton more aesthetically pleasing and useful to the public. However, during construction, there will be a temporary negative impact.

**Community Resources:** We believe our improvements to the 5 parking lots in downtown Clinton will have an overall good impact since it will make the parking lots more usable and appealing to the public. During construction there will be a temporary negative impact since people will not be able to use the lots until they are complete.

## Section 5: Proffer of Alternative Solutions

During the overview of the site and the scope of the project, our team envisioned a few different alternatives. To start we designed the lots for both use of hot mix asphalt pavement (HMA) and Portland Cement Concrete pavements (PCC). After meeting with the client, they made it apparent that they were looking for outside funding for the lots. This led us to produce a design of the lots using "green" materials and systems. There is a large amount of funding available to projects using more eco-friendly materials and technologies. We offered a design of each lot based on the following: PCC pavement, HMA pavement, HMA pavement with permeable pavers, PCC pavement with permeable pavers, PCC pavement with permeable pavers around a bio cell, and finally ACC pavement with permeable pavers around a bio cell to help reduce runoff and give a design for traditional lighting. In the design of the MTA building, there were less explicit alternatives available for construction as the city was clear that they wanted the main structural material to be CMU blocks. However, there were several iterations of the architectural layout of the building that were changed to match the vision and goals for the building's use.

## **Section 6: Final Design Details**

Rest Area and Bus Stop Building Design

One of the main parts of the project was to design a structure at one of the lots that could be used as a rest area for the city transit workers and feature an enclosed bus stop for transit riders to use during cold or rainy weather. The following are the steps taken to complete the design.

First, the design loads for the structure were calculated according to ASCE 7-16 standards and ASD load combinations. This gave us the design loads that would be used for the structural design of the building. Detailed calculations and the full load list can be found in appendix A-1

The next task was to design a strip foundation to support the walls of the building. Using Terzaghi's method for bearing capacity as laid out in *Foundation Design – Principles and Practices*, it was determined that a one-foot thick and 18-inch-wide strip foundation would be sufficient. Based on previous designs of similar public structures and boring logs from the surrounding area, a depth of 5ft for the foundation base was considered adequate. A floor slab was also designed to function as the structural hold for the first floor with a depth of 8.5 inches and #4 rebar at 9" OC each way. Detailed calculations for this slab can be found in Appendix A-1 and a section view can be found on sheet G5 of the design plans.

Next, the Concrete Masonry Unit (CMU) wall was designed based on the National Concrete Masonry Association design guides and tables. It was determined that a 1500 psi 8"x8"x16" CMU block with #4 rebar placed every 120" OC would be adequate for the vertical and horizontal loads on the structure. The walls would also use Type S mortar and the cells will be filled at each location where rebar is placed. Detailed calculations for the wall ca be found in appendix A-1 and a section view can be seen on sheet G5.

The final structural element of the design was the roof trusses. This design was based primarily on the *Encyclopedia of Trusses* handbook and design guide. The geometry of the roof was designed as a hip roof, so terminal hip framing was decided – due to the small spans- for the ends of the roof. While several different span lengths will be required for the full construction of the roof, a simple Fink truss configuration would be used for each, and spans ranging from 16' to 24' will be utilized in the roof at 2' OC spacing. A TBE6 truss connector would be used to anchor the trusses to the wall to prevent uplift. The full truss design calculations can be found in Appendix A-1 and a view of the truss can be seen on sheet G3 with a detailed view of the truss-to-wall connection on sheet G5.

With these structural elements set, the next issue to solve was the layout for the interior of the building. There were several potential layouts suggested over the course of the design, but the final design attributes the largest areas to the rest area room for the transit workers and the enclosed bus stop. The bathroom was sized and oriented I order to meet the ADA requirements for a single-user bathroom, and this led to one challenge of how to orient doors, the sink, the toilet, etc. In the end, the best layout for the bathroom placed the plumbing onto exterior facing walls, so those walls were designed with added insulation to protect the pipes from freezing. Finally, the sizing of the AC and heating units was based on the RS means recommendations based on the square footage of the area to be heated and cooled. The final layout of the structure can be seen on sheet G3 of the plan sheets.

Goldfinch Parking Lot

For the design of the Goldfinch Lot, we started out by creating three two dimensional layouts of the parking lot. This included a design for 90-, 60-, and 45-degree parking stalls. After reviewing with the client, they decided they liked the 60-degree layout with the removal of small island areas to make snow removal easier. Overall, the new layout includes the new MTA building in the SW corner of the lot, a 5-foot sidewalk that surrounds the building, 1 large island in the center of the lot, two medium islands in the NW and NE corner of the lot, 48 nine by eighteen parking stalls, 2 van handicap accessible stalls, and an 8-foot landing between the handicap stalls. Before we made changes, the lot was totally paved without any island areas with 48 parking stalls and 4 handicap stalls. We have also improved the lighting of the parking lot by designing the lights to be brighter than before to enhance security within the lot itself.

For the materials and grading of the lot there were 3 different alternatives offered. The first was a traditional material and grading scheme. For this design, the lot was to be covered in either 6 inches of PCC or HMA on top of 12 inches of granular subbase. For the grading there are two area intakes proposed to the north and south of the large central island. These intakes are in the center of the drive lanes to keep cars from running over them causing unnecessary wear to the vehicles and intakes. The grades going to the intakes are approximately 1.4% and that satisfies all SUDAS and ADA requirements for the parking lot.

For the permeable design, the parking stalls will be covered in permeable pavers. This helps with storm water runoff and opens the opportunity for additional funding. The drive lanes will match the traditional designs thickness for PCC or HMA. The grading of this lot was a bit trickier since the water was going to not only the center of the lot, but the four outer edges as well. Eventually we produced a scheme that had the center of the parking lot match the 1.4% grades of the traditional design, but the very westerly and easterly edge have grades of approximately 2.7%. The ADA stalls are in the center of the lot so overall the parking lot still meets the SUDAS and ADA grading requirements.

Finally, the bio cell design, the center island was converted from a traditional island to an engineered bio cell and the curb surrounding it was also removed. We decided to leave permeable pavers around the bio cell to help absorb the parking lot runoff. The rest of the parking lot will match the PCC or HMA thicknesses of the traditional design. The grading was simple on this lot as well since the water only goes to the very center of the lot. These grades are about 1.4% meeting all SUDAS and ADA requirements.

For the design of the storm sewer systems, we referenced SUDAS chapter 2. Using the hydro analysis tools on Civil3D and a 5-year design storm, we calculated the peak flow rates per drainage area on the parking lot designs. Since this is a preliminary design, we are sizing the pipes based off the minimum flow velocity of 3 fps as stated in SUDAS chapter 2. This will have to be reevaluated once the connection points and inverts of the cities existed storm sewer are known.

For the design of the lighting, we are going to use 25-foot-tall poles and using SUDAS chapter 11 we choose factors based on the materials and level of security we wanted. Using the provided equation, we found the rough lumens needed to illuminate the area. We then went to a light manufacturer (Cree Lighting) and found a light that about matched the required lumens. Using more specific data about the light offered by the manufacturer we reentered the information into the equation to get the light spacing. After a few iterations of changing types of lights, we got the final spacing.

Oriole Parking Lot

For the design of the Oriole Lot, we started out by creating three two dimensional layouts of the parking lot. This included one design for 90-degree stalls and two designs with 45-degree parking stalls. All three of the designs incorporated different amounts of green space. After reviewing with the client, they decided for the western portion of the lot that they liked the 45-degree layout with a long and narrow island down the center of the lot and the removal of small island areas to make snow removal easier. For the portion of the lot east of the railroad tracks, they decided they like the design with 45-degree angled spots with a long and narrow island along the eastern edge of the lot. Overall, the new layout includes 1 large island in the center of the lot for the portion of the lot on the western side of the railroad and an island along the eastern edge of the portion of the lot east of the railroad. The lot contains a total of 147 nine by eighteen parking stalls, 4 van handicap accessible stalls, and an 8-foot landing between the handicap stalls. Before we made changes, the lot was totally paved with 146 regular parking stalls and 4 handicap stalls. We have also improved the lighting of the parking lot by designing the lights to be brighter than before to enhance security within the lot itself.

For the materials and grading of the lot there were 3 different alternatives offered. The first was a traditional material and grading scheme. For this design, the lot was to be covered in either 6 inches of PCC or HMA on top of 12 inches of granular subbase. For the traditional design there are four area intakes proposed on both sides of the large central island for the portion of the lot west of the railroad. The traditional design for the portion of the lot east of the railroad includes an additional 2 area intakes west of the island that runs along the eastern edge of the lot. These intakes are in the center of the drive lanes to keep cars from running over them causing unnecessary wear to the vehicles and intakes. The grades going to the intakes are approximately 1.4% and that satisfies all SUDAS and ADA requirements for the parking lot.

For the permeable design, the parking stalls will be covered in permeable pavers. This helps with storm water runoff and opens the opportunity for additional funding. The drive lanes will match the traditional designs thickness for PCC or HMA. The grading of this lot was a bit trickier since the water was not going towards intakes but rather, the 7 different parking spot areas. Eventually we produced a scheme for both portions of the lot that has a maximum grade of 1.4%, which matches the maximum of the traditional design. The ADA stalls are in the northwestern corner of the lot, so the parking lot meets the SUDAS and ADA grading requirements.

Finally, for the bio cell design, the center island was converted from a traditional island to an engineered bio cell and the curb surrounding it was also removed. Two islands were added to the southern corners of the lot on the western side of the railroad; these islands will be bio cells. The island for the lot east of the railroad will also be converted from a traditional design to an engineered bio cell. We decided to keep the permeable pavers in the locations surrounding the bio cells to help absorb the parking lot runoff. The rest of the parking lot will match the PCC or HMA thicknesses of the traditional design. The grading was simple on this lot as well since the water only goes to the islands of the lot. These grades are about 1.4% meeting all SUDAS and ADA requirements.

For the design of the storm sewer systems, we referenced SUDAS chapter 2. Using the hydro analysis tools on Civil3D and a 5-year design storm, we calculated the peak flow rates per drainage area on the parking lot designs. Since this is a preliminary design, we are sizing the pipes based off the minimum flow velocity of 3 fps as stated in SUDAS chapter 2. This will have to be reevaluated once the connection points and inverts of the cities existed storm sewer are known.

For the design of the lighting, we are going to use 25-foot-tall poles and using SUDAS chapter 11 we choose factors based on the materials and level of security we wanted. Using the provided equation, we found the rough lumens needed to illuminate the area. We then went to a light manufacturer (Cree Lighting) and found a light that about matched the required lumens. Using more specific data about the light offered by the manufacturer we reentered the information into the equation to get the light spacing. After a few iterations of changing types of lights, we got the final spacing. The Oriole lot will have a combined 18 lights between the portions of the lot on both sides of the railroad.

## Chickadee Parking Lot

For the design of the Chickadee Lot, we started out by creating three two dimensional layouts of the parking lot. This included one design for 90-degree stalls and two designs with 45-degree parking stalls. All three of the designs incorporated different amounts of green space. After reviewing with the client, they decided they like the design with a large island in the center of the lot and the removal of small island areas in each of the corners. The reasoning behind removing the small corner islands is to help make snow removal easier. Overall, the new layout is a one-way and includes 1 large island in the center of the lot with entrances and exits on the northern edge of the lot. The Chickadee Lot contains a total of 34 nine by eighteen parking stalls, 2 van handicap accessible stalls, and an 8-foot landing between the handicap stalls. Before we made changes, the lot was totally paved with 48 regular parking stalls and 2 handicap stalls. The reduction in the number of parking stalls is due to a significant increase in green space within the lot. The city decided that incorporating more green space was important for this lot. We have also improved the lighting of the parking lot by designing the lights to be brighter than before to enhance security within the lot itself.

For the materials and grading of the lot there were 3 different alternatives offered. The first was a traditional material and grading scheme. For this design, the lot was to be covered in either 6 inches of PCC or HMA on top of 12 inches of granular subbase. For the traditional design there are 2 area intakes proposed on both sides of the large central island. These intakes are in the center of the drive lanes to keep cars from running over them causing unnecessary wear to the vehicles and intakes. The grades going to the intakes are approximately 1.9% and that satisfies all SUDAS and ADA requirements for the parking lot.

For the permeable design, the parking stalls will be covered in permeable pavers. This helps with storm water runoff and opens the opportunity for additional funding. The drive lanes will match the traditional designs thickness for PCC or HMA. The grading of this lot was a bit trickier since the water was not going towards intakes but rather, the 5 different parking spot areas. Eventually we produced a scheme for both portions of the lot that has a maximum grade of 1.9%, which matches the maximum of the traditional design. The ADA stalls are in the northwestern corner of the lot where the maximum grade is 1.4%, so the parking lot meets the SUDAS and ADA grading requirements.

Finally, for the bio cell design, the center island was converted from a traditional island to an engineered bio cell and the curb surrounding it was also removed. We decided to keep the permeable pavers in the locations surrounding the centrally located bio cell to help absorb the parking lot runoff. The rest of the parking lot will match the PCC or HMA thicknesses of the traditional design. The grading was simple on this lot as well since the water only goes to the central island of the lot. These grades are about 1.4% meeting all SUDAS and ADA requirements.

For the design of the storm sewer systems, we referenced SUDAS chapter 2. Using the hydro analysis tools on Civil3D and a 5-year design storm, we calculated the peak flow rates per drainage area on the parking lot designs. Since this is a preliminary design, we are sizing the pipes based off the minimum flow velocity of 3 fps as stated in SUDAS chapter 2. This will have to be reevaluated once the connection points and inverts of the cities existed storm sewer are known.

For the design of the lighting, we are going to use 25-foot-tall poles and using SUDAS chapter 11 we choose factors based on the materials and level of security we wanted. Using the provided equation, we found the rough lumens needed to illuminate the area. We then went to a light manufacturer (Cree Lighting) and found a light that about matched the required lumens. Using more specific data about the light offered by the manufacturer we reentered the information into the equation to get the light spacing. After a few iterations of changing types of lights, we got the final spacing. The Chickadee lot will have 8 lights within the lot which will significantly increase the amount of light from what is currently in place.

<u>Blue Jay Parking Lot</u>

The Blue Jay parking lot had the unique challenges of determining appropriate parking spaces, and what to do with the unused portions of the existing parking lot. During the first meeting with our Clinton representative, it was abundantly clear that extra funding ideas, greenspace, sufficient lighting, and a design to match with the rest of the city of Clinton were also important.

The original lot had over two hundred parking spaces consisting of several rows with driveways on both ends. Several methods existed to determine the correct number of spaces. The method used was to count the structural use surrounding the park and multiply that number by 2. The second method was to just divide what was there in half. The average results were around 100 spaces.

The number of spaces gives the space needed for the design. The first three designs all consisted of a north driveway and a east driveway. These designs were provided to Clinton and the aspects of the designs that they liked were transferred to the fourth design. This design consisted of only one driveway for two-way traffic on the north side of the parking lot. Two more criteria were added: the lot ran from the restrooms in the park east and the green space was smaller.

Now that the design outline was complete the next task was to find the catchment area and design permeable space, add ADA accessibility, and determine the best way to drain the lot. Storage was determined through using the ISWMM (Iowa Stormwater Management Manual) chapter 5 calculation method. The permeable pavement of brick hatch was chosen to match the rest of Clinton and given all constraints for rain gardens were met a modified rain garden was designed for the central position of the parking lot.

Drainage for this parking lot in this manner matched the existing storm water management system that the old lot utilized. Small alterations to the existing drainage system such as putting a maintenance hole on top of the south drain and raising the north drain, saving the city a lot of money. Initial designs capped both drains, but after a micro storm dropped over 13 inches in a spot in less than an hour it became apparent that with current weather trends, that a overflow was needed to prevent lot flooding.

Alternative designs using different pavements were redundant as the slope of the lot and the location makes the change in materials a mathematical change and not a design one. These figures are provided with the blueprints for this lot. The change in size of the lot returned 0.12 acres of land to the parks department.

For the design of the lighting, the use of 25-foot-tall poles and using SUDAS chapter 11 to choose factors based on the materials and level of security desired. Using the provided equation, we found the rough lumens needed to illuminate the area. We then went to a light manufacturer (Cree Lighting) and found a light that about matched the required lumens. Using more specific data about the light offered by the manufacturer we reentered the information into the equation to get the light spacing. After a few iterations of changing types of lights, we got the final spacing. The lot will have ten lights within the lot which will significantly increase the amount of light from what is currently in place.

## Grackle Parking Lot

The design of this lot was based on water flow and parking angle. The city of Clinton wanted the lot to have 90-degree parking stalls and a matching stormwater management system to the rest of the city. The removal of the crumbling existing lot and sidewalks was necessary but creates a unique situation. The lot is small and buts up against a structure with open businesses, has two power poles in the northwest corner and connects to concrete sidewalks on the south side that must be preserved.

The design choice of permeable pavement in a brick hatch comes from matching the same materials used in other lots and it allows for the removal of the chemicals in the first inch of rain. This catchment unlike the other designs above has a French drain at the bottom that runs north to the existing storm water management system in the alley providing a lot drain that does not require costly new infrastructure.

The final design was PCC with a 5 ft sidewalk running along with the existing structure for business access. The permeable pavement is designed (see sheet F4) for a 2-year storm based on NOAA rain rates for the Clinton area.

For the design of the lighting, the use of 25-foot-tall poles and using SUDAS chapter 11 to choose factors based on the materials and level of security desired. Using the provided equation, we found the rough lumens needed to illuminate the area. We then went to a light manufacturer (Cree Lighting) and found a light that about matched the required lumens. Using more specific data about the light offered by the manufacturer we reentered the information into the equation to get the light spacing. After a few iterations of changing types of lights, we got the final spacing. The lot will have three lights within the lot which will significantly increase the amount of light from what is currently in place.

## Sidewalk Design

For the sidewalk we referenced SUDAS chapter 12. From this we found the minimum required thickness was 4 inches. The minimum cross slope is 0.5% and the maximum cross slope is 5% while the maximum running slope is 8.3%. We also found the minimum width had to be at least 5 foot wide for the sidewalks.

For the storm runoff calculations, we used chapter 5 of the ISWMM. The formulas used parking lot area, 100-year design storm, concentration time, and surface permeability. These parameters that we used will be attached in the appendices.

## Bio cell and Permeable Paver Design

See ISWMM chapter 5.

**Section 7: Engineers Cost Estimate (RYAN)**

The cost estimate for this project is complex. There are 5 separate lots, each with 3 separate designs, each with 2 alternatives for the pavement. This gives us 30 different cost breakdowns. I am going to start by doing the overall project cost based on the recommended design. The total per lot does contain a 10% contingency amount (see detailed cost breakdown per lot). The building total does contain a 20% contingency as shown (see detailed cost breakdown for building) After those 6 tables are done there will be each individual table per lot, design, and alternative to look at as well as the building cost breakdown in the appendices. We used the Iowa DOT Bid letting of April 2022 and January 2022 for the cost estimation of the parking lot materials. We used the RS Means data from 2011 for the building cost estimation. This data was converted to reflect the current construction costs by using inflation. The unit costs include furnishing the materials, installing them, labor, and equipment used in construction. There will also be a 20% engineering and administrative fee as can be seen in the recommended design table.

| Overall Costs for Project | Biocell Design with PCC - Grackle Permeable PCC | | |
|---|---|---|---|
| Item | Unit | Qty | Cost |
| Mobilization | LS | 1 | $ 7,500.00 |
| Erosion Control | LS | 1 | $ 500.00 |
| Traffic Control | LS | 1 | $ 500.00 |
| Pavement Striping | LS | 1 | $ 3,000.00 |
| Goldfinch Lot | LS | 1 | $ 256,000.00 |
| Chickadee Lot | LS | 1 | $ 261,000.00 |
| Oriole Lot | LS | 1 | $ 820,500.00 |
| Bluejay Lot | LS | 1 | $ 620,000.00 |
| Grackle | LS | | $ 73,000.00 |
| New MTA Building (Golfinch Lot) | LS | 1 | $ 134,000.00 |
| Subtotal with contingency | | | $ 2,176,000.00 |
| Engineering / Administrative Fees | | 20% | $ 435,200.00 |
| Total Project Cost | | | $ 2,611,200.00 |

**Section 8: Appendices:**

# Appendix A Rest Area/Bus Stop Design

## A.1 Design Calculations

**Building Load Calculations:**

First Floor DL:
6in conc slab= 48psf
3/4in subfloor= 3psf
1/2in linoleum= 2psf
**53psf**

First Floor LL: 50psf in breakroom, 40psf in bathroom

Upper Roof DL:
framing= 5psf
1/2" OSB= 1.7psf
waterproof membrane= 0.7psf
asphalt shingles= 2psf
**10psf**

Roof LL: 20psf

Lower Roof DL:
20" blown-in insulation= 2.8psf
5/8in gypsum board= 2.8psf
MEP= 4psf
**10psf**

Wind load: risk category 2, and exposure B

$V := 115\ \mathbf{mph}$ $kd := 0.85$ $ke := 1$ $kzt := 1$ $kz := 0.575$ $GCpi := 0.18$ $G := 0.85$

$cpww := 0.8$ $cplw := -0.5$ $cpside := -0.7$

$qh := 0.00256 \cdot kz \cdot kzt \cdot ke \cdot kd \cdot (115)^2 \cdot \mathbf{psf} = 16.547\ \mathbf{psf}$

$pww := qh \cdot G \cdot cpww - qh \cdot GCpi = 8.274\ \mathbf{psf}$

$plw := qh \cdot G \cdot cplw - qh \cdot GCpi = -10.011\ \mathbf{psf}$

$pside := qh \cdot G \cdot cpside - qh \cdot GCpi = -12.824\ \mathbf{psf}$

$cproof1p := -0.9$ $cproof2p := -0.5$ $cproofnww := -0.9$ $cproofnlw := -0.18$

Neg internal:

$proofnww := qh \cdot G \cdot cproofnww + qh \cdot GCpi = -9.68\ \mathbf{psf}$

$proofnlw := qh \cdot G \cdot cproofnlw + qh \cdot GCpi = 0.447\ \mathbf{psf}$

$proofp1 := qh \cdot G \cdot cproof1p + qh \cdot GCpi = -9.68\ \mathbf{psf}$

$proofp2 := qh \cdot G \cdot cproof2p + qh \cdot GCpi = -4.054\ \mathbf{psf}$

Pos internal:

$proofnww := qh \cdot G \cdot cproofnww - qh \cdot GCpi = -15.637\ \mathbf{psf}$

$proofnlw := qh \cdot G \cdot cproofnlw - qh \cdot GCpi = -5.51\ \mathbf{psf}$

$proofp1 := qh \cdot G \cdot cproof1p - qh \cdot GCpi = -15.637\ \mathbf{psf}$

$proofp2 := qh \cdot G \cdot cproof2p - qh \cdot GCpi = -10.011\ \mathbf{psf}$

$cpoverhang := -0.8$

$poverhang := qh \cdot G \cdot cpoverhang = -11.252\ \mathbf{psf}$

Snow Load:

$Pg := 26\ \mathbf{psf}$ $Ce := 1$ $Ct := 1$ $Is := 1$ $Cs := 1$ $Ps := 0.7 \cdot Ce \cdot Ct \cdot Is \cdot Pg \cdot Cs = 18.2\ \mathbf{psf}$

Using Vesic's method for bearing capacity and the information provided by the city, it was calculated that a strip footing of width 1'6" and depth of 5ft would be sufficient for our structure. The in situ unit weight of the soil was estimated at 100pcf based on engineering judgement and conservative estimation.

$N1 := 3 \cdot 0.55 \cdot 1 \cdot 1 \cdot \frac{1}{0.6} = 2.75$ $B := 1.5\ ft$ $yfill := 120\ pcf$ $D := 5\ ft$ $ysitu := 100\ pcf$

$wd := 125\ pcf \cdot 8\ in \cdot 10\ ft + 53\ psf \cdot 7.5\ ft + 20\ psf \cdot 7.5\ ft + 150\ pcf \cdot 4\ ft \cdot 1\ ft + 150\ pcf \cdot B \cdot 1\ ft$

$wl := 50\ psf \cdot 7.5\ ft$ $wrl := 20\ psf \cdot 7.5\ ft$

$w := wd + wl + wrl = 2.731\ klf$ $q := \frac{w}{B} + 4\ ft \cdot yfill = 15.976\ psi$

$N160 := 2.75 \cdot \sqrt{\frac{2000\ psf}{ysitu \cdot D}} = 5.5$ $phi' := \sqrt{20 \cdot N160}\ deg + 20\ deg = 30.488\ deg$

$Nq := 2.718^{\pi \cdot \tan(phi')} \cdot 4.356 = 27.689$ $k := \operatorname{atan}\left(\frac{D}{(B)}\right) = 1.279$

$Ny := 2 \cdot (Nq + 1) \cdot \tan(phi') = 33.782$ $dq := 1 + 2 \cdot k \cdot \tan(phi') \cdot (1 - \sin(phi')) = 1.742$

$dy := 1$ $iq := 1$ $iy := 1$ $sq := 1$ $sy := 1$ $y := ysitu - 62.4\ pcf$ $\sigma zd := ysitu \cdot D = 500\ psf$

$$qall := \sigma zd \cdot Nq \cdot sq \cdot dq \cdot iq + 0.5 \cdot y \cdot B \cdot Ny \cdot sy \cdot dy \cdot iy = 174.107\ psi$$

**Calculations for selection of CMU block:**

Using standard dimensions of CMU blocks and the calculations below, I was able to decide on a block 16" long, 8" tall, and 8" wide with #4 rebar spaced every 120" on center. Type S mortar will be used in the blocks only in the blocks where the rebar is placed. This design was based on the NCMA design guide for CMU small-rise buildings.

$p\_wind\_max := 13\ psf$

Using table 1 in section 14-19B of the NCMA CMU design guide, I was able to interpolate for our wall height of 10ft and a block width of 8 inches a maximum shear force and moment:

$Vmax := 65\ plf$ $Mmax := 2030\ lb \cdot \frac{in}{ft}$

Using table 3A in the same section, it was determined that #4 rebar at 120" O.C. was sufficient

From these calcs and the dimensions given in section 14-01B table 3b of the design guide I was able to determine the following allowable bearing pressure:

$As := 0.02\ in^2$ $h := 8\ in$ $r := 2.76\ in$ $An := 1\ in \cdot 7.625\ in = 7.625\ in^2$ $Fs := 32000\ psi$

$fm' := 1500\ psi$

$Pa := (0.25 \cdot fm' \cdot An + 0.65 \cdot As \cdot Fs) \cdot \left(1 - \left(\frac{h}{140 \cdot r}\right)^2\right) = 3.274\ kip$

$P := (20\ psf + Ps \cdot 0.75 + 20\ psf \cdot 0.75) \cdot 2.5\ ft \cdot 7.5\ ft = 0.912\ kip$

**Calculations for Roof Truss:**

The load on the roof truss will be calculated using DL+0.75*LL and using a 2ft truss spacing:

$wroof := (20\ psf + 20\ psf \cdot 0.75) = 35\ psf$  $span := 16\ ft$

Basic Alpine fink truss with 2"x4" top and bottom chords with 2 ft OC spacing and our slope of 4"/12" are rated for 40psf at a span of 46 ft., more than enough for our 16ft span. These can also be made with a 2' overhang.
Total needs:
3 standard 16' trusses with overhang on both ends
4 standard 16' trusses clipped on one end.
2 terminal hip set 16' span, overhang both ends
1 terminal hip set 16' span, overhang one end
1 set of 4 valley frames
1 16' girder.

$Uplift := proofp1 + 0.6 \cdot (10\ psf + 10\ psf) = -3.637\ psf$

$anchor\_force := Uplift \cdot 2\ ft \cdot \frac{span}{2} = -58.192\ lbf$  $bearing := wroof \cdot 2\ ft \cdot \frac{span}{2} = 560\ lbf$

Using the Simpson Strong-Tie Wood Construction Connectors Catalogue, two TBE6 connector will be sufficient for resisting uplift and bearing failure.

**First Floor Slab:**
Longest span size is 15'x20'8". Use #4 rebar at 9" O.C. both ways with 1.5" clear cover. Use 4000psi strength concrete and grade 60 rebar

$L1 := 15\ ft$  $L2 := 20.667\ ft$  $treq := \frac{L2}{30} = 8.267\ in$  $t := 8.5\ in$  $wu := 53\ psf + 50 \cdot 0.75\ psf$

$Vc := 2 \cdot \sqrt{4000}\ psi \cdot 12\ in \cdot t = 12.902\ kip$  $dbar := 0.5\ in$  $abar := 0.2\ in^2$

$Vu := wu \cdot \left(\frac{L1}{2} - (t + 6\ in)\right) \cdot 1\ ft = 0.569\ kip$  $Mo := wu \cdot L1 \cdot \frac{L2^2}{8} = 72.478\ kip \cdot ft$

$fy := 60\ ksi$  $cc := 1.5\ in$

$smin := 15\ in \cdot \frac{40000\ psi}{\frac{2}{3} \cdot fy} - 2.5 \cdot cc = 11.25\ in$

$Asmin := \frac{200\ psi}{fy} \cdot 12\ in \cdot (t - cc - dbar) = 0.26\ in^2$  $s := 12\ in \cdot \frac{abar}{Asmin} = 9.231\ in$

# Appendix B Detailed Cost Estimation Parking Lots

| Lot | Design | Alternative |
| --- | --- | --- |
| Grackle | Permeable | HMA |

| Item | Unit | Unit Cost | Qty | Cost |
| --- | --- | --- | --- | --- |
| Commerical HMA 6 in | Ton | $ 186.51 | 195.46 | $ 36,455.24 |
| Sidewalk 4in | SY | $ 50.28 | 27.1555556 | $ 1,365.38 |
| Topsoil | CY | $ 25.11 | 0 | $ - |
| 6 in Curb & Gutter | LF | $ 40.01 | 200 | $ 8,002.00 |
| Removal of Pavement | SY | $ 8.90 | 945 | $ 8,410.50 |
| Excavation Class 10 | CY | $ 6.95 | 418.89 | $ 2,911.29 |
| Seeding and Fertilization | AC | $ 3,439.47 | 0 | $ - |
| ADA Parking Sign | EA | $ 200.00 | 1 | $ 200.00 |
| Perforated Subdrain 6 in | LF | $ 14.65 | 0 | $ - |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 10 | $ 192.00 |
| Storm Sewer 24 in PVC | LF | $ 72.73 | 0 | $ - |
| Permeable Pavement | SY | $ 102.15 | 25.9222222 | $ 2,647.96 |
| Materials & Labor | | | | $ 60,184.37 |
| Contingency | | | 10% | $ 6,018.44 |
| Total | | | | $ 66,000.00 |

| Lot | Design | Alternative |
| --- | --- | --- |
| Grackle | Permeable | PCC |

| Item | Unit | Unit Cost | Qty | Cost |
| --- | --- | --- | --- | --- |
| Driveway PC Concrete 6 in | SY | $ 60.72 | 700 | $ 42,504.00 |
| Sidewalk 4in | SY | $ 50.28 | 27.1555556 | $ 1,365.38 |
| Topsoil | CY | $ 25.11 | | $ - |
| 6 in Curb & Gutter | LF | $ 40.01 | 200 | $ 8,002.00 |
| Removal of Pavement | SY | $ 8.90 | 945 | $ 8,410.50 |
| Excavation Class 10 | CY | $ 6.95 | 418.89 | $ 2,911.29 |
| Seeding and Fertilization | AC | $ 3,439.47 | 0 | $ - |
| ADA Parking Sign | EA | $ 200.00 | 1 | $ 200.00 |
| Perforated Subdrain 6 in | LF | $ 14.65 | 0 | $ - |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 10 | $ 192.00 |
| Storm Sewer 24 in PVC | LF | $ 72.73 | 0 | $ - |
| Permeable Pavement | SY | $ 102.15 | 25.9222222 | $ 2,647.96 |
| Materials & Labor | | | | $ 66,233.12 |
| Contingency | | | 10% | $ 6,623.31 |
| Total | | | | $ 73,000.00 |

| Lot | Design | Alternative | | |
|---|---|---|---|---|
| Bluejay | Biocell | HMA | | |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Commerical HMA 5 in | Ton | $ 186.51 | 889.11 | $ 165,827.91 |
| Sidewalk 4in | SY | $ 50.28 | 2455.55556 | $ 123,465.33 |
| Topsoil | CY | $ 25.11 | 0 | $ - |
| 6 in Curb & Gutter | LF | $ 40.01 | 2289 | $ 91,582.89 |
| Removal of Pavement | SY | $ 8.90 | 10994 | $ 97,846.60 |
| Excavation Class 10 | CY | $ 6.95 | 780.15 | $ 5,422.04 |
| Seeding and Fertilization | AC | $ 3,439.47 | 0 | $ - |
| ADA Parking Sign | EA | $ 200.00 | 6 | $ 1,200.00 |
| Perforated Subdrain 6 in | LF | $ 14.65 | 0 | $ - |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 90 | $ 1,728.00 |
| Storm Sewer 24 in PVC | LF | $ 72.73 | 0 | $ - |
| Biocell | SY | $ 180.00 | 204.666667 | $ 36,840.00 |
| Materials & Labor | | | | $ 523,912.77 |
| Contingency | | | 10% | $ 52,391.28 |
| Total | | | | $ 576,500.00 |

| Lot | Design | Alternative | | |
|---|---|---|---|---|
| Bluejay | Biocell | PCC | | |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Driveway PC Concrete 6 in | SY | $ 60.72 | 3384 | $ 205,476.48 |
| Sidewalk 4in | SY | $ 50.28 | 2455.55556 | $ 123,465.33 |
| Topsoil | CY | $ 25.11 | 0 | $ - |
| 6 in Curb & Gutter | LF | $ 40.01 | 2289 | $ 91,582.89 |
| Removal of Pavement | SY | $ 8.90 | 10994 | $ 97,846.60 |
| Excavation Class 10 | CY | $ 6.95 | 780.15 | $ 5,422.04 |
| Seeding and Fertilization | AC | $ 3,439.47 | 0 | $ - |
| ADA Parking Sign | EA | $ 200.00 | 6 | $ 1,200.00 |
| Perforated Subdrain 6 in | LF | $ 14.65 | 0 | $ - |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 90 | $ 1,728.00 |
| Storm Sewer 24 in PVC | LF | $ 72.73 | 0 | $ - |
| Biocell | SY | $ 180.00 | 204.666667 | $ 36,840.00 |
| Materials & Labor | | | | $ 563,561.35 |
| Contingency | | | 10% | $ 56,356.13 |
| Total | | | | $ 620,000.00 |

| Lot | Design | Alternative |
|---|---|---|
| Oriole | Biocell | HMA |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Commerical HMA 6in | Ton | $ 186.51 | 1189.89 | $221,926.38 |
| Topsoil | CY | $ 25.11 | 0 | $ - |
| 6 in Curb & Gutter | LF | $ 40.01 | 1207.4 | $ 48,308.07 |
| Removal of Pavement | SY | $ 8.90 | 8243 | $ 73,362.70 |
| Excavation Class 10 | CY | $ 6.95 | 1163.45 | $ 8,085.96 |
| Granular Subbase | SY | $ 8.06 | 3525.6 | $ 28,416.34 |
| Green Fencing | LF | $ 40.00 | 1476 | $ 59,040.00 |
| Light Pole | EA | $ 1,200.00 | 18 | $ 21,600.00 |
| Light Fixture | EA | $ 400.00 | 18 | $ 7,200.00 |
| Intake | EA | $ 3,388.61 | 0 | $ - |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.1447 | $ 497.69 |
| Permeable Pavers | SY | $ 102.15 | 1401 | $143,112.15 |
| Biocell | SY | $ 180.00 | 700.3 | $126,054.00 |
| ADA Parking Sign | EA | $ 200.00 | 4 | $ 800.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 244.1 | $ 14,426.31 |
| Materials & Labor | | | | $753,829.61 |
| Contingency | | | 10% | $ 75,382.96 |
| Total | | | | $829,000.00 |

| Lot | Design | Alternative |
|---|---|---|
| Oriole | Biocell | PCC |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Driveway PC Concrete 6 in | SY | $ 60.72 | 3525.6 | $214,074.43 |
| Topsoil | CY | $ 25.11 | 0 | $ - |
| 6 in Curb & Gutter | LF | $ 40.01 | 1207.4 | $ 48,308.07 |
| Removal of Pavement | SY | $ 8.90 | 8243 | $ 73,362.70 |
| Excavation Class 10 | CY | $ 6.95 | 1163.45 | $ 8,085.96 |
| Granular Subbase | SY | $ 8.06 | 3525.6 | $ 28,416.34 |
| Green Fencing | LF | $ 40.00 | 1476 | $ 59,040.00 |
| Light Pole | EA | $ 1,200.00 | 18 | $ 21,600.00 |
| Light Fixture | EA | $ 400.00 | 18 | $ 7,200.00 |
| Intake | EA | $ 3,388.61 | 0 | $ - |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.1447 | $ 497.69 |
| Permeable Pavers | SY | $ 102.15 | 1401 | $143,112.15 |
| Biocell | SY | $ 180.00 | 700.3 | $126,054.00 |
| ADA Parking Sign | EA | $ 200.00 | 4 | $ 800.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 244.1 | $ 14,426.31 |
| Materials & Labor | | | | $745,977.66 |
| Contingency | | | 10% | $ 74,597.77 |
| Total | | | | $820,500.00 |

| Lot | Design | Alternative |
|---|---|---|
| Oriole | Permeable | HMA |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Commerical HMA 6in | Ton | $ 186.51 | 760.489 | $141,838.76 |
| Topsoil | CY | $ 25.11 | 116.8 | $ 2,932.85 |
| 6 in Curb & Gutter | LF | $ 40.01 | 2095.4 | $ 83,836.95 |
| Removal of Pavement | SY | $ 8.90 | 8243 | $ 73,362.70 |
| Excavation Class 10 | CY | $ 6.95 | 743.589 | $ 5,167.94 |
| Granular Subbase | SY | $ 8.06 | 2253.3 | $ 18,161.60 |
| Green Fencing | LF | $ 40.00 | 1476 | $ 59,040.00 |
| Light Pole | EA | $ 1,200.00 | 18 | $ 21,600.00 |
| Light Fixture | EA | $ 400.00 | 18 | $ 7,200.00 |
| Intake | EA | $ 3,388.61 | 0 | $ - |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.1448 | $ 498.04 |
| Permeable Pavers | SY | $ 102.15 | 2632.1 | $268,869.02 |
| ADA Parking Sign | EA | $ 200.00 | 4 | $ 800.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Perforated Subdrain 6 in | LF | $ 14.65 | 1085.3 | $ 15,899.65 |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 430.2 | $ 8,259.84 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 22 | $ 1,300.20 |
| Materials & Labor | | | | $709,767.54 |
| Contingency | | | 10% | $ 70,976.75 |
| Total | | | | $780,500.00 |

| Lot | Design | Alternative |
|---|---|---|
| Oriole | Permeable | PCC |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Driveway PC Concrete 6 in | SY | $ 60.72 | 2253.3 | $136,820.38 |
| Topsoil | CY | $ 25.11 | 116.8 | $ 2,932.85 |
| 6 in Curb & Gutter | LF | $ 40.01 | 2095.4 | $ 83,836.95 |
| Removal of Pavement | SY | $ 8.90 | 8243 | $ 73,362.70 |
| Excavation Class 10 | CY | $ 6.95 | 743.589 | $ 5,167.94 |
| Granular Subbase | SY | $ 8.06 | 2253.3 | $ 18,161.60 |
| Green Fencing | LF | $ 40.00 | 1476 | $ 59,040.00 |
| Light Pole | EA | $ 1,200.00 | 18 | $ 21,600.00 |
| Light Fixture | EA | $ 400.00 | 18 | $ 7,200.00 |
| Intake | EA | $ 3,388.61 | 0 | $ - |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.1448 | $ 498.04 |
| Permeable Pavers | SY | $ 102.15 | 2632.1 | $268,869.02 |
| ADA Parking Sign | EA | $ 200.00 | 4 | $ 800.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Perforated Subdrain 6 in | LF | $ 14.65 | 1085.3 | $ 15,899.65 |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 430.2 | $ 8,259.84 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 22 | $ 1,300.20 |
| Materials & Labor | | | | $704,749.15 |
| Contingency | | | 10% | $ 70,474.92 |
| Total | | | | $775,000.00 |

| Lot | Design | Alternative | | |
|---|---|---|---|---|
| Oriole | Traditional | HMA | | |
| | | | | |
| Item | Unit | Unit Cost | Qty | Cost |
| Commerical HMA 6in | Ton | $ 186.51 | 1625.94 | $303,254.07 |
| Topsoil | CY | $ 25.11 | 116.8 | $ 2,932.85 |
| 6 in Curb & Gutter | LF | $ 40.01 | 2095.4 | $ 83,836.95 |
| Removal of Pavement | SY | $ 8.90 | 8243 | $ 73,362.70 |
| Excavation Class 10 | CY | $ 6.95 | 1589.81 | $ 11,049.17 |
| Granular Subbase | SY | $ 8.06 | 1625.94 | $ 13,105.08 |
| Green Fencing | LF | $ 40.00 | 1476 | $ 59,040.00 |
| Light Pole | EA | $ 1,200.00 | 18 | $ 21,600.00 |
| Light Fixture | EA | $ 400.00 | 18 | $ 7,200.00 |
| Intake | EA | $ 3,388.61 | 6 | $ 20,331.66 |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.1448 | $ 498.04 |
| ADA Parking Sign | EA | $ 200.00 | 4 | $ 800.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 561.4 | $ 10,778.88 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 99 | $ 5,850.90 |
| Materials & Labor | | | | $614,640.29 |
| Contingency | | | 10% | $ 61,464.03 |
| Total | | | | $676,000.00 |

| Lot | Design | Alternative | | |
|---|---|---|---|---|
| Oriole | Traditional | PCC | | |
| | | | | |
| Item | Unit | Unit Cost | Qty | Cost |
| Driveway PC Concrete 6 in | SY | $ 60.72 | 4817.6 | $292,524.67 |
| Topsoil | CY | $ 25.11 | 116.8 | $ 2,932.85 |
| 6 in Curb & Gutter | LF | $ 40.01 | 2095.4 | $ 83,836.95 |
| Removal of Pavement | SY | $ 8.90 | 8243 | $ 73,362.70 |
| Excavation Class 10 | CY | $ 6.95 | 1589.81 | $ 11,049.17 |
| Granular Subbase | SY | $ 8.06 | 4817.6 | $ 38,829.86 |
| Green Fencing | LF | $ 40.00 | 1476 | $ 59,040.00 |
| Light Pole | EA | $ 1,200.00 | 18 | $ 21,600.00 |
| Light Fixture | EA | $ 400.00 | 18 | $ 7,200.00 |
| Intake | EA | $ 3,388.61 | 6 | $ 20,331.66 |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.1448 | $ 498.04 |
| ADA Parking Sign | EA | $ 200.00 | 4 | $ 800.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 561.4 | $ 10,778.88 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 99 | $ 5,850.90 |
| Materials & Labor | | | | $629,635.67 |
| Contingency | | | 10% | $ 62,963.57 |
| Total | | | | $692,500.00 |

| Lot | Design | Alternative |
|---|---|---|
| Chickadee | Biocell | HMA |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Commerical HMA 6in | Ton | $ 186.51 | 413.26875 | $ 77,078.75 |
| Topsoil | CY | $ 25.11 | 66.5 | $ 1,669.82 |
| 6 in Curb & Gutter | LF | $ 40.01 | 550.6 | $ 22,029.51 |
| Removal of Pavement | SY | $ 8.90 | 1929 | $ 17,168.10 |
| Excavation Class 10 | CY | $ 6.95 | 408.17 | $ 2,836.78 |
| Granular Subbase | SY | $ 8.06 | 1224.5 | $ 9,869.47 |
| Green Fencing | LF | $ 40.00 | 495.7 | $ 19,828.00 |
| Light Pole | EA | $ 1,200.00 | 8 | $ 9,600.00 |
| Light Fixture | EA | $ 400.00 | 8 | $ 3,200.00 |
| Intake | EA | $ 3,388.61 | 0 | $ - |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.0825 | $ 283.76 |
| Permeable Pavers | SY | $ 102.15 | 0 | $ - |
| Biocell | SY | $ 180.00 | 399.1 | $ 71,838.00 |
| ADA Parking Sign | EA | $ 200.00 | 2 | $ 400.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 53.3 | $ 3,150.03 |
| Materials & Labor | | | | $236,802.18 |
| Contingency | | | 10% | $ 23,680.22 |
| Total | | | | $260,500.00 |

| Lot | Design | Alternative |
|---|---|---|
| Chickadee | Biocell | PCC |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Driveway PC Concrete 6 in | SY | $ 60.72 | 1224.5 | $ 74,351.64 |
| Topsoil | CY | $ 25.11 | 66.5 | $ 1,669.82 |
| 6 in Curb & Gutter | LF | $ 40.01 | 550.6 | $ 22,029.51 |
| Removal of Pavement | SY | $ 8.90 | 1929 | $ 17,168.10 |
| Excavation Class 10 | CY | $ 6.95 | 408.17 | $ 2,836.78 |
| Granular Subbase | SY | $ 8.06 | 1224.5 | $ 9,869.47 |
| Green Fencing | LF | $ 40.00 | 495.7 | $ 19,828.00 |
| Light Pole | EA | $ 1,200.00 | 8 | $ 9,600.00 |
| Light Fixture | EA | $ 400.00 | 8 | $ 3,200.00 |
| Intake | EA | $ 3,388.61 | 0 | $ - |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.0825 | $ 283.76 |
| Permeable Pavers | SY | $ 102.15 | 0 | $ - |
| Biocell | SY | $ 180.00 | 399.1 | $ 71,838.00 |
| ADA Parking Sign | EA | $ 200.00 | 2 | $ 400.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 53.3 | $ 3,150.03 |
| Materials & Labor | | | | $237,225.10 |
| Contingency | | | 10% | $ 23,722.51 |
| Total | | | | $261,000.00 |

| Lot | Design | Alternative |
|---|---|---|
| Chickadee | Permeable | HMA |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Commerical HMA 6in | Ton | $ 186.51 | 249.71625 | $ 46,574.58 |
| Topsoil | CY | $ 25.11 | 62.4 | $ 1,566.86 |
| 6 in Curb & Gutter | LF | $ 40.01 | 777.1 | $ 31,091.77 |
| Removal of Pavement | SY | $ 8.90 | 1929 | $ 17,168.10 |
| Excavation Class 10 | CY | $ 6.95 | 246.63 | $ 1,714.08 |
| Granular Subbase | SY | $ 8.06 | 249.71625 | $ 2,012.71 |
| Green Fencing | LF | $ 40.00 | 495.7 | $ 19,828.00 |
| Light Pole | EA | $ 1,200.00 | 8 | $ 9,600.00 |
| Light Fixture | EA | $ 400.00 | 8 | $ 3,200.00 |
| Intake | EA | $ 3,388.61 | 0 | $ - |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.0774 | $ 266.21 |
| Permeable Pavers | SY | $ 102.15 | 720.7 | $ 73,619.51 |
| ADA Parking Sign | EA | $ 200.00 | 2 | $ 400.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Perforated Subdrain 6 in | LF | $ 14.65 | 474.6 | $ 6,952.89 |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 299.6 | $ 5,752.32 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 24.1 | $ 1,424.31 |
| Materials & Labor | | | | $222,171.34 |
| Contingency | | | 10% | $ 22,217.13 |
| Total | | | | $244,500.00 |

| Lot | Design | Alternative |
|---|---|---|
| Chickadee | Permeable | PCC |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Driveway PC Concrete 6 in | SY | $ 60.72 | 739.9 | $ 44,926.73 |
| Topsoil | CY | $ 25.11 | 62.4 | $ 1,566.86 |
| 6 in Curb & Gutter | LF | $ 40.01 | 777.1 | $ 31,091.77 |
| Removal of Pavement | SY | $ 8.90 | 1929 | $ 17,168.10 |
| Excavation Class 10 | CY | $ 6.95 | 246.63 | $ 1,714.08 |
| Granular Subbase | SY | $ 8.06 | 739.9 | $ 5,963.59 |
| Green Fencing | LF | $ 40.00 | 495.7 | $ 19,828.00 |
| Light Pole | EA | $ 1,200.00 | 8 | $ 9,600.00 |
| Light Fixture | EA | $ 400.00 | 8 | $ 3,200.00 |
| Intake | EA | $ 3,388.61 | 0 | $ - |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.0774 | $ 266.21 |
| Permeable Pavers | SY | $ 102.15 | 720.7 | $ 73,619.51 |
| ADA Parking Sign | EA | $ 200.00 | 2 | $ 400.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Perforated Subdrain 6 in | LF | $ 14.65 | 474.6 | $ 6,952.89 |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 299.6 | $ 5,752.32 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 24.1 | $ 1,424.31 |
| Materials & Labor | | | | $224,474.38 |
| Contingency | | | 10% | $ 22,447.44 |
| Total | | | | $247,000.00 |

| Lot | Design | Alternative |
|---|---|---|
| Chickadee | Traditional | HMA |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Commerical HMA 6in | Ton | $ 186.51 | 480.29625 | $ 89,580.05 |
| Topsoil | CY | $ 25.11 | 67.8 | $ 1,702.46 |
| 6 in Curb & Gutter | LF | $ 40.01 | 777.1 | $ 31,091.77 |
| Removal of Pavement | SY | $ 8.90 | 1929 | $ 17,168.10 |
| Excavation Class 10 | CY | $ 6.95 | 474.37 | $ 3,296.87 |
| Granular Subbase | SY | $ 8.06 | 1423.1 | $ 11,470.19 |
| Green Fencing | LF | $ 40.00 | 495.7 | $ 19,828.00 |
| Light Pole | EA | $ 1,200.00 | 8 | $ 9,600.00 |
| Light Fixture | EA | $ 400.00 | 8 | $ 3,200.00 |
| Intake | EA | $ 3,388.61 | 2 | $ 6,777.22 |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.084 | $ 288.92 |
| ADA Parking Sign | EA | $ 200.00 | 2 | $ 400.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 62.3 | $ 1,196.16 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 32.1 | $ 1,897.11 |
| Materials & Labor | | | | $198,496.85 |
| Contingency | | | 10% | $ 19,849.68 |
| Total | | | | $218,500.00 |

| Lot | Design | Alternative |
|---|---|---|
| Chickadee | Traditional | PCC |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Driveway PC Concrete 6 in | SY | $ 60.72 | 1423.1 | $ 86,410.63 |
| Topsoil | CY | $ 25.11 | 67.8 | $ 1,702.46 |
| 6 in Curb & Gutter | LF | $ 40.01 | 777.1 | $ 31,091.77 |
| Removal of Pavement | SY | $ 8.90 | 1929 | $ 17,168.10 |
| Excavation Class 10 | CY | $ 6.95 | 474.37 | $ 3,296.87 |
| Granular Subbase | SY | $ 8.06 | 1423.1 | $ 11,470.19 |
| Green Fencing | LF | $ 40.00 | 495.7 | $ 19,828.00 |
| Light Pole | EA | $ 1,200.00 | 8 | $ 9,600.00 |
| Light Fixture | EA | $ 400.00 | 8 | $ 3,200.00 |
| Intake | EA | $ 3,388.61 | 2 | $ 6,777.22 |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.084 | $ 288.92 |
| ADA Parking Sign | EA | $ 200.00 | 2 | $ 400.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 62.3 | $ 1,196.16 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 32.1 | $ 1,897.11 |
| Materials & Labor | | | | $195,327.42 |
| Contingency | | | 10% | $ 19,532.74 |
| Total | | | | $215,000.00 |

| Lot | Design | Alternative |
|---|---|---|
| Goldfinch | Biocell | HMA |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Commerical HMA 6in | Ton | $ 186.51 | 502.6 | $ 93,739.93 |
| Sidewalk 4in | SY | $ 50.28 | 34.67 | $ 1,743.21 |
| Topsoil | CY | $ 25.11 | 16.76 | $ 420.84 |
| 6 in Curb & Gutter | LF | $ 40.01 | 558.18 | $ 22,332.78 |
| Removal of Pavement | SY | $ 8.90 | 2245 | $ 19,980.50 |
| Excavation Class 10 | CY | $ 6.95 | 496.5 | $ 3,450.68 |
| Granular Subbase | SY | $ 8.06 | 1489.51 | $ 12,005.45 |
| Green Fencing | LF | $ 40.00 | 194.5 | $ 7,780.00 |
| Light Pole | EA | $ 1,200.00 | 2 | $ 2,400.00 |
| Light Fixture | EA | $ 400.00 | 2 | $ 800.00 |
| Intake | EA | $ 3,388.61 | 0 | $ - |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.0477 | $ 164.06 |
| Permeable Pavers | SY | $ 102.15 | 338.25 | $ 34,552.24 |
| Biocell | SY | $ 180.00 | 130.44 | $ 23,479.20 |
| ADA Parking Sign | EA | $ 200.00 | 2 | $ 400.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 200 | $ 11,820.00 |
| Materials & Labor | | | | $ 236,068.88 |
| Contingency | | | 10% | $ 23,606.89 |
| Total | | | | $ 259,500.00 |

| Lot | Design | Alternative |
|---|---|---|
| Goldfinch | Biocell | PCC |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Driveway PC Concrete 6 in | SY | $ 60.72 | 1489.51 | $ 90,443.05 |
| Sidewalk 4in | SY | $ 50.28 | 34.67 | $ 1,743.21 |
| Topsoil | CY | $ 25.11 | 16.76 | $ 420.84 |
| 6 in Curb & Gutter | LF | $ 40.01 | 558.18 | $ 22,332.78 |
| Removal of Pavement | SY | $ 8.90 | 2245 | $ 19,980.50 |
| Excavation Class 10 | CY | $ 6.95 | 496.5 | $ 3,450.68 |
| Granular Subbase | SY | $ 8.06 | 1489.51 | $ 12,005.45 |
| Green Fencing | LF | $ 40.00 | 194.5 | $ 7,780.00 |
| Light Pole | EA | $ 1,200.00 | 2 | $ 2,400.00 |
| Light Fixture | EA | $ 400.00 | 2 | $ 800.00 |
| Intake | EA | $ 3,388.61 | 0 | $ - |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.0477 | $ 164.06 |
| Permeable Pavers | SY | $ 102.15 | 338.25 | $ 34,552.24 |
| Biocell | SY | $ 180.00 | 130.44 | $ 23,479.20 |
| ADA Parking Sign | EA | $ 200.00 | 2 | $ 400.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 200 | $ 11,820.00 |
| Materials & Labor | | | | $ 232,772.01 |
| Contingency | | | 10% | $ 23,277.20 |
| Total | | | | $ 256,000.00 |

| Lot | Design | Alternative |
|---|---|---|
| Goldfinch | Permeable | HMA |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Commerical HMA 6in | Ton | $ 186.51 | 311.94 | $ 58,179.93 |
| Sidewalk 4in | SY | $ 50.28 | 34.67 | $ 1,743.21 |
| Topsoil | CY | $ 25.11 | 38.5 | $ 966.74 |
| 6 in Curb & Gutter | LF | $ 40.01 | 781.04 | $ 31,249.41 |
| Removal of Pavement | SY | $ 8.90 | 2245 | $ 19,980.50 |
| Excavation Class 10 | CY | $ 6.95 | 308.09 | $ 2,141.23 |
| Granular Subbase | SY | $ 8.06 | 924.28 | $ 7,449.70 |
| Green Fencing | LF | $ 40.00 | 194.5 | $ 7,780.00 |
| Light Pole | EA | $ 1,200.00 | 2 | $ 2,400.00 |
| Light Fixture | EA | $ 400.00 | 2 | $ 800.00 |
| Intake | EA | $ 3,388.61 | 0 | $ - |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.0477 | $ 164.06 |
| Permeable Pavers | SY | $ 102.15 | 851.88 | $ 87,019.54 |
| ADA Parking Sign | EA | $ 200.00 | 2 | $ 400.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Subdrain 6 in | LF | $ 20.70 | 279.51 | $ 5,785.86 |
| Perforated Subdrain 6 in | LF | $ 14.65 | 579.12 | $ 8,484.11 |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 89.9 | $ 1,726.08 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 100 | $ 5,910.00 |
| Materials & Labor | | | | $ 243,180.35 |
| Contingency | | | 10% | $ 24,318.04 |
| Total | | | | $ 267,500.00 |

| Lot | Design | Alternative |
|---|---|---|
| Goldfinch | Permeable | PCC |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Driveway PC Concrete 6 in | SY | $ 60.72 | 924.28 | $ 56,122.28 |
| Sidewalk 4in | SY | $ 50.28 | 34.67 | $ 1,743.21 |
| Topsoil | CY | $ 25.11 | 38.5 | $ 966.74 |
| 6 in Curb & Gutter | LF | $ 40.01 | 781.04 | $ 31,249.41 |
| Removal of Pavement | SY | $ 8.90 | 2245 | $ 19,980.50 |
| Excavation Class 10 | CY | $ 6.95 | 308.09 | $ 2,141.23 |
| Granular Subbase | SY | $ 8.06 | 924.28 | $ 7,449.70 |
| Green Fencing | LF | $ 40.00 | 194.5 | $ 7,780.00 |
| Light Pole | EA | $ 1,200.00 | 2 | $ 2,400.00 |
| Light Fixture | EA | $ 400.00 | 2 | $ 800.00 |
| Intake | EA | $ 3,388.61 | 0 | $ - |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.0477 | $ 164.06 |
| Permeable Pavers | SY | $ 102.15 | 851.88 | $ 87,019.54 |
| ADA Parking Sign | EA | $ 200.00 | 2 | $ 400.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Subdrain 6 in | LF | $ 20.70 | 279.51 | $ 5,785.86 |
| Perforated Subdrain 6 in | LF | $ 14.65 | 579.12 | $ 8,484.11 |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 89.9 | $ 1,726.08 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 100 | $ 5,910.00 |
| Materials & Labor | | | | $ 241,122.71 |
| Contingency | | | 10% | $ 24,112.27 |
| Total | | | | $ 265,000.00 |

| Lot | Design | Alternative | | |
|---|---|---|---|---|
| Goldfinch | Traditional | HMA | | |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Commerical HMA 6in | Ton | $ 186.51 | 599.46 | $ 111,805.28 |
| Sidewalk 4in | SY | $ 50.28 | 34.67 | $ 1,743.21 |
| Topsoil | CY | $ 25.11 | 38.5 | $ 966.74 |
| 6 in Curb & Gutter | LF | $ 40.01 | 781.04 | $ 31,249.41 |
| Removal of Pavement | SY | $ 8.90 | 2245 | $ 19,980.50 |
| Excavation Class 10 | CY | $ 6.95 | 592.05 | $ 4,114.75 |
| Granular Subbase | SY | $ 8.06 | 1776.17 | $ 14,315.93 |
| Green Fencing | LF | $ 40.00 | 194.5 | $ 7,780.00 |
| Light Pole | EA | $ 1,200.00 | 2 | $ 2,400.00 |
| Light Fixture | EA | $ 400.00 | 2 | $ 800.00 |
| Intake | EA | $ 3,388.61 | 2 | $ 6,777.22 |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.0477 | $ 164.06 |
| ADA Parking Sign | EA | $ 200.00 | 2 | $ 400.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 64.5 | $ 1,238.40 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 100 | $ 5,910.00 |
| Materials & Labor | | | | $ 210,645.50 |
| Contingency | | | 10% | $ 21,064.55 |
| Total | | | | $ 231,500.00 |

| Lot | Design | Alternative | | |
|---|---|---|---|---|
| Goldfinch | Traditional | PCC | | |

| Item | Unit | Unit Cost | Qty | Cost |
|---|---|---|---|---|
| Driveway PC Concrete 6 in | SY | $ 60.72 | 1776.17 | $ 107,849.04 |
| Sidewalk 4in | SY | $ 50.28 | 34.67 | $ 1,743.21 |
| Topsoil | CY | $ 25.11 | 38.5 | $ 966.74 |
| 6 in Curb & Gutter | LF | $ 40.01 | 781.04 | $ 31,249.41 |
| Removal of Pavement | SY | $ 8.90 | 2245 | $ 19,980.50 |
| Excavation Class 10 | CY | $ 6.95 | 592.05 | $ 4,114.75 |
| Granular Subbase | SY | $ 8.06 | 1776.17 | $ 14,315.93 |
| Green Fencing | LF | $ 40.00 | 194.5 | $ 7,780.00 |
| Light Pole | EA | $ 1,200.00 | 2 | $ 2,400.00 |
| Light Fixture | EA | $ 400.00 | 2 | $ 800.00 |
| Intake | EA | $ 3,388.61 | 2 | $ 6,777.22 |
| Seeding and Fertilization | AC | $ 3,439.47 | 0.0477 | $ 164.06 |
| ADA Parking Sign | EA | $ 200.00 | 2 | $ 400.00 |
| Lot Name Sign | EA | $ 1,000.00 | 1 | $ 1,000.00 |
| Storm Sewer 8 in PVC | LF | $ 19.20 | 64.5 | $ 1,238.40 |
| Storm Sewer 12 in PVC | LF | $ 59.10 | 100 | $ 5,910.00 |
| Materials & Labor | | | | $ 206,689.26 |
| Contingency | | | 10% | $ 20,668.93 |
| Total | | | | $ 227,500.00 |

# Appendix C Detailed Cost Estimation Building

| Assembly | Count | Unit | Unit Cost (2011) | Unit Cost (current) | Total |
|---|---|---|---|---|---|
| Footing | 127.83 | ft | $32.91 | $42.39 | $5,418.47 |
| Foundation Wall | 128.2 | ft | $67.19 | $86.54 | $11,094.52 |
| First Floor Slab | 646 | sf | $12.18 | $15.69 | $10,134.34 |
| Asphalt Roof Shingle | 927.6 | sf | $1.74 | $2.24 | $2,078.86 |
| Roof Truss | 655 | sf | $5.10 | $6.57 | $4,302.56 |
| CMU Walls | 1070 | sf | $9.39 | $12.09 | $12,940.92 |
| 2x3 Window | 1 | each | $449 | $578.31 | $578.31 |
| 2x4 Window | 5 | each | 608 | $783.10 | $3,915.52 |
| 3'x7' Wood Door | 3 | each | 426 | $548.69 | $1,646.06 |
| Curtain Walls | 253 | sf | $19.55 | $25.18 | $6,370.64 |
| 2" Fiberboard Insulation | 1997.6 | sf | $1.53 | $1.97 | $3,936.55 |
| Gutter | 128 | ft | $10.66 | $13.73 | $1,757.45 |
| Interior Walls | 135 | sf | $5.05 | $6.50 | $878.09 |
| Msc. Bathroom | 1 | each | $670 | $862.96 | $862.96 |
| Tile Flooring | 380 | sf | $9.59 | $12.35 | $4,693.73 |
| Interior Painting | 1340 | sf | $0.70 | $0.90 | $1,208.14 |
| Suspended Ceiling | 655 | sf | $3.08 | $3.97 | $2,598.41 |
| Toilet | 1 | each | $2,035 | $2,621.08 | $2,621.08 |
| Bathroom Sink | 1 | each | $1,630 | $2,099.44 | $2,099.44 |
| Water Heater | 1 | each | $5,075 | $6,536.60 | $6,536.60 |
| Water Piping | 60.83 | ft | $26.80 | $34.52 | $2,099.75 |
| Heating | 380 | sf heated | $13.81 | $17.79 | $6,759.17 |
| AC | 380 | sf cooled | $15.80 | $20.35 | $7,733.15 |
| Light Switch | 2 | each | $217 | $279.50 | $558.99 |
| Outlet | 4 | each | $213 | $274.34 | $1,097.38 |
| Lighting Fixtures | 646 | sf | $7.52 | $9.69 | $6,257.00 |
| Office Furniture | 2 | person | $585 | $753.48 | $1,506.96 |
| Sanitary Sewer Piping | 20 | ft | $4.95 | $6.38 | $127.51 |
| Subtotal | | | | | $111,812.59 |
| Contingencies | | | | 20% | $22,362.52 |
| Total | | | | | $134,000.00 |

# Appendix D Design Specifications, Standards, and Guideline

## D.1 Design Specifications

| Specification | # | Source | Notes |
|---|---|---|---|
| Sidewalk Cross Slope | Max 5% | Sudas Chapter 12 | |
| Sidewalk Cross Slope | Min 0.5% | Sudas Chapter 12 | |
| Sidewalk Width | 5' | Sudas Chapter 12 | |
| Sidewalk Running Slope | Max 8.3% | Sudas Chapter 12 | |
| Parking Lot Pavement Slope | Max 5% | Sudas Chapter 8 | |
| Parking Lot Pavement Slope | Min 0.5% | Sudas Chapter 8 | |
| ADA Parking Lot Area | Max 2% | Sudas Chapter 8 | |
| PCC Pavement Depth | Min 5" | Sudas Chapter 8 | CBR 3 Medium Traffic |
| PCC Rock Depth | Min 6" | Sudas Chapter 8 | CBR 3 Medium Traffic |
| HMA Pavement Depth | Min 6" | Sudas Chapter 8 | |

| | | | |
|---|---|---|---|
| HMA Rock Depth | Min 8" | Sudas Chapter 8 | |
| Stall Width | 9' | Sudas Chapter 8 | 60 Degree stalls |
| Drive Lane Width | 20.3' | Sudas Chapter 8 | 60 Degree stalls |
| Entrance Width | 24' | Sudas Chapter 8 | |
| ADA Van Accessible Spot | 8' | Sudas Chapter 8 | |
| ADA Van Landing with Spot on Each Side | 8' | Sudas Chapter 8 | |

| Symbol | # | Definition | Source |
|---|---|---|---|
| D | 57.5 | Pole Spacing | Drawing |
| LL | 6802.984 | Initial Lamp Lumens | Equation |
| CU | 0.3 | Coefficient of Utilization | Manufacturer |
| LLD | 0.9 | Lamp Lumen Depreciation | Sudas |
| LDD | 0.9 | Luminaire Dirt Depreciation | Sudas |
| Eh | 0.5 | Average Maintained Level of Illumination | Sudas Table 8C-1.05 |
| W | 57.5 | Farthest Distance from light needing illumination | Drawing |

| | XSPSM LED Street/Area Luminaire - Small w/ BLS 8L 2700 | | |
|---|---|---|---|
| Model | 8L 2700 | Lumens - 5225 | |

| Symbol | # | Definition | Source |
|---|---|---|---|
| LL | 5225 | Lamp Lumens | Manufacturer |
| CU Update | 0.4 | Coefficient of Utilization (Manufacturer) | Manufacturer |
| LLD | 0.9 | Lamp Lumen Depreciation | Sudas |
| LDD | 0.9 | Luminaire Dirt Depreciation | Sudas |
| EH | 0.5 | Average Maintained Level of Illumination | Sudas Table 8C-1.05 |
| W | 57.5 | Farthest Distance from light needing illumination | Drawing |
| D | 58.88348 | Pole Spacing | Equation |

## D.2 Design Standards


Bhatti, Asghar. *Design of Concrete Structures - Fundamentals and Practices*. University of Iowa, 2021.

Coduto, Donald P., et al. *Foundation Design: Principles and Practices*. Pearson, 2016.

*Encyclopedia of Trusses: A Guide to Using Trusses*, Alpine Engineered Products, 2019, pp. 1–28.

International Code Council. International Building Code. Falls Church, Va.: International Code Council, 2000.

*Minimum Design Loads and Associated Criteria for Buildings and Other Structures: ASCE/SEI 7-16*. American Society of Civil Engineers, 2017.

"TEK Index." *NCMA*, 17 Nov. 2020, https://ncma.org/resource/tek-index/.

## D.3 Guidelines Used in Design Phase

Bhatti, Asghar. *Design of Concrete Structures - Fundamentals and Practices*. University of Iowa, 2021.

Coduto, Donald P., et al. *Foundation Design: Principles and Practices*. Pearson, 2016.

*Encyclopedia of Trusses: A Guide to Using Trusses*, Alpine Engineered Products, 2019, pp. 1–28.

"TEK Index." *NCMA*, 17 Nov. 2020, https://ncma.org/resource/tek-index/.