The University of Iowa | Office of Outreach and Engagement

FINAL DELIVERABLE

Title	Treynor Pedestrian Infrastructure
Completed By	Rachel Beckler, Elizabeth Fischer, and Geumchan Noh.
Date Completed	May 2019
UI Department	Civil and Environmental Engineering
Course Name	Senior Design - CEE:4850:0001
Instructor	Paul Hanley
Community Partners	City of Treynor, National Parks Service, Trees Forever, KKAD25

This project was supported by the Provost's Office of Outreach and Engagement at the University of Iowa. The Office of Outreach and Engagement partners with rural and urban communities across the state to develop projects that university students and faculty complete through research and coursework. Through supporting these projects, the Office of Outreach and Engagement pursues a dual mission of enhancing quality of life in Iowa while transforming teaching and learning at the University of Iowa.

Research conducted by faculty, staff, and students of The University of Iowa exists in the public domain. When referencing, implementing, or otherwise making use of the contents in this report, the following citation style is recommended:

> [Student names], led by [Professor's name]. [Year]. [Title of report]. Research report produced through the Office of Outreach and Engagement at the University of Iowa.

This publication may be available in alternative formats upon request.

Provost's Office of Outreach and Engagement
The University of Iowa
111 Jessup Hall
Iowa City, IA, 52241
Phone: 319.335.0684
Email: outreach-engagement@uiowa.edu
Website: http://outreach.uiowa.edu/

The University of Iowa prohibits discrimination in employment, educational programs, and activities on the basis of race, creed, color, religion, national origin, age, sex, pregnancy, disability, genetic information, status as a U.S. veteran, service in the U.S. military, sexual orientation, gender identity, associational preferences, or any other classification that deprives the person of consideration as an individual. The University also affirms its commitment to providing equal opportunities and equal access to University facilities. For additional information contact the Office of Equal Opportunity and Diversity, (319) 335-0705.

City of Treynor: Pedestrian Infrastructure

May 10, 2019

Prepared for: City of Treynor

Prepared by: CLR Engineers

Table of Contents

Section I - Executive Summary

CLR Engineers has provided design services to update Route 92 and its intersection with L55 in the City of Treynor, Iowa. This report showcases those designs. CLR is a small team of three civil engineering students, all with internship experience in the field of civil engineering. Each team member has completed the proper coursework to graduate this upcoming May. The diverse group has gained expertise in transportation, hydrology, environmental, and structural engineering. This experience aided in the designs described in this report.

Utilizing concepts outlined by Smart Growth America, designed improvements to Route 92 and L55 place a focus on a connected community. These improvements were supported by traffic studies done through two different highway capacity programs: HCS and Sycnrho. The designs and streetscape include increased on-street parking, new and improved pedestrian crosswalks, and features to tighten up the corridor. These site improvements were designed with pedestrian safety and walkability in mind. As an integral part of these efforts, the team relied on standards set forth by the Iowa DOT, the City of Treynor, the American Disabilities Act, and Smart Growth America Complete Street Design Guidelines.

With safety in mind, the crosswalk near the high school was relocated and placed between bump-outs. This allows for shorter crossing times for pedestrians. Also, once they cross, they are no longer walking into a drive. The crosswalk is now designed to connect to an existing sidewalk stub to the north of Route 92 and cross the route. It connects to an existing sidewalk at the high school entrance drive.

One of the major outcomes of this design was a meandered alignment. By realigning Route 92, parallel parking was able to be added. Parking locations were designated on either side of the route with a focus on maintaining drive access and access to local businesses. The estimated cost for the project is $612,000. This number was calculated using standards from RSMeans Heavy Construction Cost Data.

Section II - Organization, Qualification, and Experience

Name of Organization

CLR Engineers

Organization Location and Contact Information

CLR Engineers is an undergraduate student group based out of the Department of Civil and Environmental Engineering in the College of Engineering at the University of Iowa.

4105 Seamans Center for the Engineering Arts and Sciences

Iowa City, IA 52242

Project Manager: Rachel Beckler

rachel-beckler@uiowa.edu

(319) 330-4373

Organization and Design Team Description

CLR Engineers is a group of students at the University of Iowa in their final semester working towards a Bachelor of Science in Engineering. Key members of the team include Rachel Beckler (Project Manager), Elizabeth Fischer, and Geumchan Noh.

Rachel Beckler served as the project manager for the project. Through her coursework, she has demonstrated competencies in transportation and water resources design, as well as environmental engineering. Additionally, she has been employed as an engineering intern for a local land development consulting firm for the past six years. Through this position, Beckler was familiarized with Iowa Statewide Urban Design and Specifications (SUDAS) as well as other various codes and regulations. She has also received extensive informal training in AutoCAD Civil3D and has successfully completed the NCEES Fundamentals of Engineering Exam in Civil Engineering.

Elizabeth Fischer has completed design courses in transportation, structures, hydrology, and environmental engineering. Additionally, she was employed this past summer as an engineering intern at a land development consulting firm in the Chicago area. At her internship, she gained knowledge in AutoCAD Civil3D where she graded and planned parking lots and worked on site plans. She assisted in SWPPP inspections regularly and has extensive knowledge of surveying. She has over two years of experience assisting a professor in hydraulic research for the University of Iowa where she also has spent lots of time surveying. She also recently passed the NCEES Fundamentals of Engineering Exam.

Geumchan Noh has taken engineering courses such as Water Resource Design, Design of Transportation Systems, Surveying and Remote Sensing, and Sustainable Systems. He has worked in the asphalt research lab for Professor Lee.

Description of Experience with Similar Projects

Members of the team have accumulated experience with similar projects through various avenues. Experience with projects of similar scope will be described in further detail for each team member.

Through her internship, Rachel has been the lead on ADA Accessible designs for both cities and private developers. She has had the opportunity to perform stormwater calculations and design parking lots, site grading plans, basins, and trails. Her area of focus is land development, and she has worked on projects in many different sectors, including public entities.

Elizbeth has also been exposed to designing for ADA accessibility. She worked on updating ramps and sidewalks to bring them up to ADA code for private developers. She also has had experience in AutoCAD with grading to create site plans. She has used ArcGIS to design roads for a bypass and has performed calculations to design culverts based on stormwater data.

Geumchan has earned experience with AutoCAD Civil 3D, ArchMap, Site-Development skills. He has worked in a summer internship at the Iowa DOT in the construction group. Geumchan spent time in the construction field and inspected small to moderately complex construction projects such as grading and paving, bridge culverts, erosion control, fencing, guardrails, and weatherization projects.

Section III - Design Services

Project Scope

The primary outcome of our design is a concept that adequately meets the transportation needs of the City of Treynor while prioritizing the safety of its residents and visitors. The City of Treynor expressed a desire to improve walkability within their city and promote safety to both drivers and pedestrians. The main areas focused on to complete this were the intersection of Route 92 and L55 and the crosswalk on Route 92. Another improvement made was on the current parking on Route 92 near the high school and near the local businesses. To accomplish these, the tasks listed below were performed:

- Redesigned existing crosswalk at the intersection of Volkens Avenue and State Highway 92
- Traffic studies for the intersection of Route 92 and L55
- Maintained usability of main street corridors for large vehicles crucial to local agriculture.
- Proposed parking alternatives for Main Street to provide more parking for local businesses while increasing road safety and discouraging unnecessary, unsafe parking practices already in place.
- Increased walkability for the City by developing designs that serve to meet long-term goals and plans set by the City and its residents.
- Explored Complete Street Redesign, excepting aspects involved with transit.

Work Plan

The completion of tasks was evaluated on a weekly basis. An estimated plan for the work that was done by CLR Engineers is shown in Figure 1.

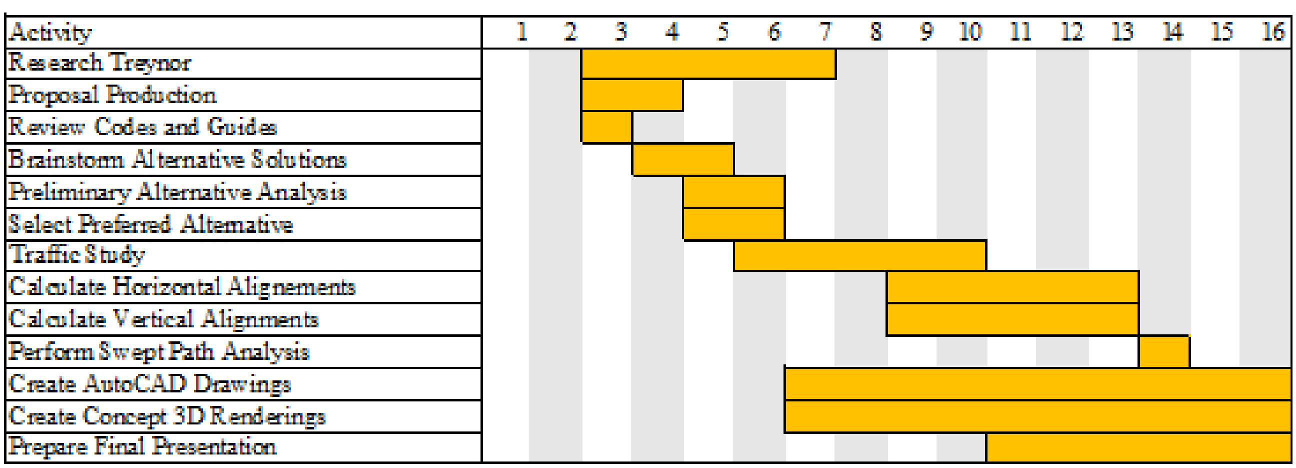


*Figure 1***.** Gantt chart displaying detailed work plan.

The Gantt chart featured in Figure 1 outlines the amount of time it took the group to complete individual tasks. For a more detailed look at the breakdown of allocated time by team member, see Table 1.

Table 1. Allocated time grouped by team member and task.

Task	Hours		
	Geumchan	Elizabeth	Rachel
Research and Data Collection	10	10	10
Traffic Study	0	20	0
Alternative Development and Selection	10	10	10
Drainage Analysis and Design	0	0	10
Pavement Specification and Highway Design	0	0	10
Poster Production	5	0	0
Plan Production	0	0	50
3D Artistic Rendering	40	0	0
Report Production	10	20	10
Miscellaneous	10	10	10
Total	85	70	110

Methods and Design Guides

The methodology of the design of all crosswalks, sidewalks, and parking was conformed to the regulations put in place by the Americans with Disabilities Act (ADA) and Iowa Statewide Urban Design and Specifications (SUDAS). Roadway design was completed in compliance with the AASHTO Policy on the Geometric Design of Highways and Streets (the Green Book) and the Iowa DOT Design Manual. Additional design guidance was sought from the Complete Street Design Guide by Smart Growth America.

Section IV - Constraints, Challenges and Impacts

Constraints

There were a few constraints with this project, the main being time. Time is a limitation because the project needs to be completed by the second week of May. Another constraint was the right-of-way width. On the site visit, the right of way width visibly varies. A stretch of the narrower portion is shown in Figure 2. This was further confirmed using ArcGIS data provided by Pottawattamie County. Right-of-way widths along Route 92 vary from under 50 feet to over 100 feet. This inconsistency was a constraint rather unique to the City of Treynor.

Figure 2. A depiction of inconsistently narrow right-of-way along the highway.

As an Iowa town, Treynor is subject to snow and ice in the winter. Because improvements are on state roads, they must remain accessible for snow plows. This limits what can and cannot be put within the right-of-way and how far away from the curb street furniture must be placed.

Challenges

The main challenge faced was figuring out what to do with adding, removing, and relocating parking. As mentioned above, work had to stay within the right-of-way or more right-of-way would need to be purchased. Another challenge was designing for safety. A lot of what was being redesigned is to keep younger drivers, specifically high school drivers, safe. CLR Engineers wanted to make sure designs were directed toward keeping young students and young drivers safe as they go about the town. Additionally, Treynor is driven through by a lot of people that are passing through. Because of this, designs are also cognizant of drivers that are unfamiliar with the area. Figure 3 is an image of the main crosswalk of focus for the project.

Figure 3. The crosswalk nearest to the high school was a main area of focus.

This existing crosswalk has limited visibility as it is approached from the west, since the town is quite hilly. Designed crosswalks are as visible as possible, especially the one in front of the high school. Redesigns were created to eliminate visual clutter caused by too many signs and clearly mark pedestrian crossing for both citizens of Treynor and people passing through.

Impact in the Treynor Community

In our meeting, we were told that parts of the town don’t meet ADA compliance, which is something we wanted to change. The senior citizens of Treynor need to be able to travel through their town with ease. CLR Engineers ensured that designs allow everyone to do that. All site improvements are up to ADA standards. The designs cater to what needs to be fixed in order to make Treynor a more drivable and walkable town for everyone from young children going to school, to senior citizens running errands. This improved ability to navigate town not only allows the people of Treynor to get where they need to go, but it further connects a growing community.

Section V - Alternative Solutions

Throughout the design process, there were many different concepts and ideas discussed about various portions of the project. Some of these included underground solutions to pedestrian traffic, elevated pedestrian walkways, reduction of oversized shoulders, and many more. The existing crosswalk at Volkens Ave and Route 92 currently ends in the driveway of a church. The obvious safety issue here made the improvements or relocation of this crosswalk a top priority.

Negative aspects of the elevated walkway and the pedestrian tunnel were self-evident from the start. This stretch of Route 92 does not have deep ditches. This is an issue for the pedestrian tunnel, specifically. As the surface of the surrounding area is relatively flat, flooding would be a major, unavoidable part of placing a tunnel under the road. Both of those projects would require structural work, which CLR engineers estimate would cost a lot more than other alternatives.

With the implausibility of tunneling or overpassing the highway, more conventional crosswalk options were considered. Solutions explored included hiring a designated crossing guard, moving the crosswalk to mid-block between Volkens Ave and the entrance to Treynor High School, and moving the crosswalk to the entrance of the high school. It was decided that while a crossing guard may be a good idea to implement regardless of infrastructure, it would not solve the issue of the low visibility and safety of the crosswalk. The mid-block option would have solved the safety issues presented by crossing into a driveway, yet this is considered the least safe location for a crosswalk. The third option brings pedestrians closer to where the high school drive is while removing the danger of the church driveway and taking advantage of existing infrastructure. Other options brought up in the early stages consisted of adding the crosswalk near the elementary school which is farther east on route 92. This option was ruled out for multiple reasons. The design that CLR Engineers created moved the crosswalk from where it currently exists by only about half a block; less than 100 feet. The advantage of keeping the crosswalk near where it currently exists is that the current pedestrian flow will not be disrupted. The community is already used to crossing Route 92 near that intersection, and if the crosswalk gets moved significantly farther away it might not get used at all. It also would disrupt the existing traffic pattern of Treynor if the crosswalk were moved a signifigant distance. Another motive behind the design chosen is that it is at a location with an acceptable sight distance. If the crosswalk gets moved farther east near the elementary school, the sight distance of cars approaching from the east is not as vast. Because of the aforementioned advantages and disadvantages that the final design features a crosswalk at the intersection of the high school entrance and Route 92.

Another major issue the City of Treynor wants to address is the lack of order surrounding the use of the City's shoulders. Presently, the shoulders improperly function as passing lanes and parking lanes. CLR Engineers explored different approaches to improve the situation. Some examples of solutions explored include meandered alignments and street-parking angle options.

A combination of solutions was determined to be the best option in this situation. A meandered alignment addressed more issues than one. It allows for more space on one side of the corridor in areas where the right-of-way is narrow. Also, it provides a visual and physical cue to drivers that this stretch of the route is slower, and they should proceed more cautiously. Finally, it provided areas to make the road appear narrower and remove some of the dangerous shoulder space.

In addition to the meandered alignment, bump-outs were designed to help designated parking areas, drives, and cut off access to the shoulder. Within the parking areas, angled, parallel, and perpendicular options were explored. Perpendicular parking stalls were ruled out almost immediately as they require the widest amount of the available right-of-way and do not solve the safety issues presented by pulling in to spots and backing onto the road. Next, angled spots were looked at. While they require less space within the width-of the right-of-way, they still require more space than would be acceptable. This left parallel parking, which allows for enough parking spaces while maintaining comfortable space between right-of-way elements.

An important decision that was also considered was whether to increase the number of stop signs at the intersection of Route 92 and L55, signalize the intersection, or to keep the existing two-way stop while still improving intersection visibility. Before a decision could be made, it was decided a Traffic Study would be conducted in order to properly evaluate the intersection's eligibility for different levels of signalization via warrants from the Highway Capacity Manual.

Section VI - Final Design Details

After considering alternative solutions, a combination of aspects from multiple solutions was selected to best suit the needs of the City of Treynor. This included a meandering centerline alignment, sporadic on-street parallel parking, curb bump-outs to designate drives and parking, and updates to sidewalks and the overall aesthetic appeal of Main Street. As the City of Treynor expressed concerns for safety at the intersection of L55 and Route 92, as well as at the crosswalk, a traffic study was conducted first to determine the best course of action for City.

Traffic Study

L55 is a North - South two-lane county road. Route 92 is a two-lane, East - West state highway. Route 92 is the major road and the intersection of the two roads is an unsignalized two way stop with the stop signs being on L55. It was expressed to us that this intersection is a concern because during peak hour traffic volume times cars back up on the side streets and during school hours it’s hard for young drivers and school buses to travel safely without delays. Another motive for this traffic study was to examine how to make the town safer for the elderly community.

A configuration of the intersection with the daily volumes is shown below in *Figure 4* and the peak hour volumes are shown in *Table 4.* These figures are from the Iowa DOT website.

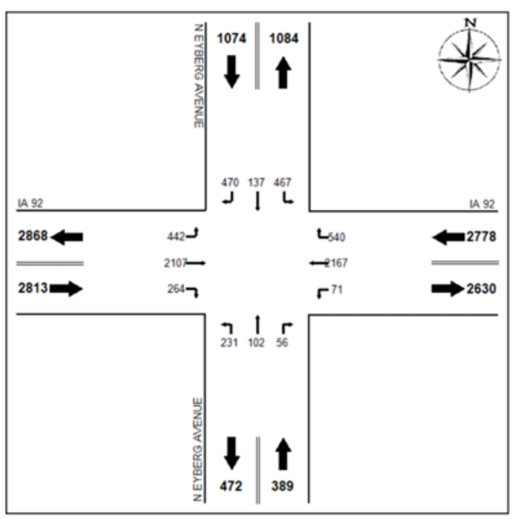


Figure 4. Annualized Daily Traffic for All Vehicles.

Table 2. Peak Hour Traffic for All Vehicles.

	N Leg			E Leg			S Leg			W Leg		
	L	*T*	*R*	*L*	*T*	*R*	*L*	*T*	*R*	*L*	*T*	*R*
07:00	37	19	34	5	252	38	18	2	3	28	121	19
08:00	50	24	37	4	227	49	19	9	5	32	151	42
11:00	18	10	29	5	105	24	11	5	3	20	97	12
12:00	17	3	29	6	112	18	17	4	3	25	122	8
15:00	44	5	28	6	171	59	26	16	8	25	191	21
16:00	43	9	48	9	167	49	17	10	6	57	247	14
17:00	48	6	56	4	174	61	19	10	3	58	247	30

The Iowa DOT data was put into HCS which is a computerized highway capacity program that is based on the Highway Capacity Manual that standardizes the evaluation of intersection performance. The first report generated data based on the existing conditions using shown in Figure 4. After generating a report for the existing data, the level of service for each peak hour was at C or higher, which means the current conditions are sufficient. To go a step further, each peak hour flow was increased by 10% and compared to the existing data. A report was generated for each of the 7 peak hour flow times and the data was summarized in the Tables below.

Table 3. Existing Levels of Service.

Existing Levels of Service with 10% Population Increase				
Time	Eastbound	Westbound	Northbound	Southbound
7 A.M.	A	A	B	C
8 A.M.	A	A	C	C
11 A.M.	A	A	B	B
12 P.M.	A	A	B	B
5 P.M.	A	A	C	C
6 P.M.	A	A	C	C
7 P.M.	A	A	C	C

Table 4. 10% Increased Traffic Volume Levels of Service.

	N Leg			E Leg			S Leg			W Leg		
	L	*T*	*R*	*L*	*T*	*R*	*L*	*T*	*R*	*L*	*T*	*R*
07:00	37	19	34	5	252	38	18	2	3	28	121	19
08:00	50	24	37	4	227	49	19	9	5	32	151	42
11:00	18	10	29	5	105	24	11	5	3	20	97	12
12:00	17	3	29	6	112	18	17	4	3	25	122	8
15:00	44	5	28	6	171	59	26	16	8	25	191	21
16:00	43	9	48	9	167	49	17	10	6	57	247	14
17:00	48	6	56	4	174	61	19	10	3	58	247	30

When the traffic volumes were increased by 10%, only the Southbound lane at 7 A.M. had a level of service increase from B to C, highlighted in red in the tables above. Shown below in Table 5 is a description of the levels of service. Levels of service C and above are all constituted as acceptable with free – stable flow. The maximum delay that could happen from a level of service C is 35 seconds which is considered acceptable with stable flows.

Table 5. Level of Service Description

Level of Service	Average Control Delay (seconds/vehicle)	General Description
A	≤10	Free Flow
B	>10 – 20	Stable Flow (slight delays)
C	>20 – 35	Stable flow (acceptable delays)
D	>35 – 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 – 80	Unstable flow (intolerable delay)
F[1]	>80	Forced flow (congested and queues fail to clear)

Source: *Highway Capacity Manual 2010*, Transportation Research Board, 2010.
1. If the volume-to-capacity (v/c) ratio for a lane group exceeds 1.0 LOS F is assigned to the individual lane group. LOS for overall approach or intersection is determined solely by the control delay.

Crash Data

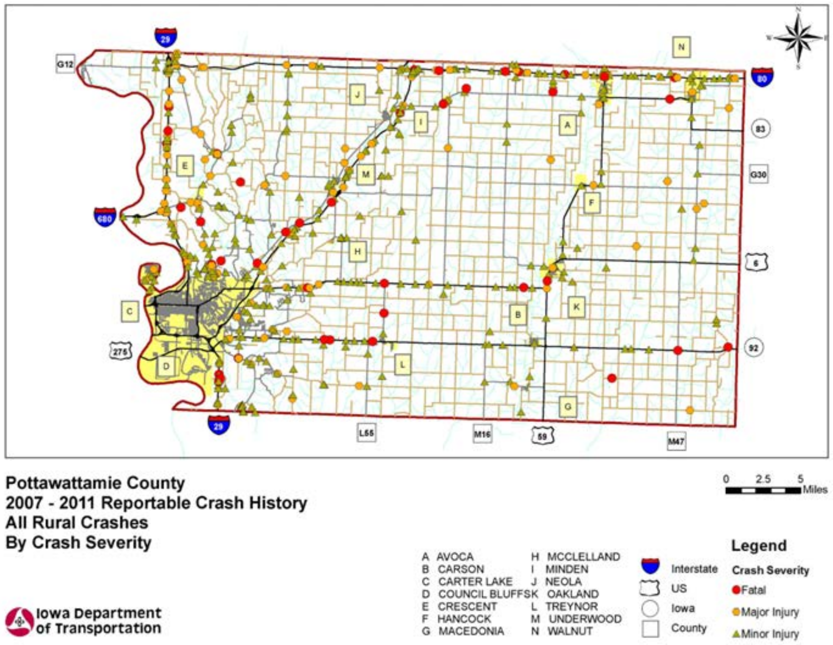
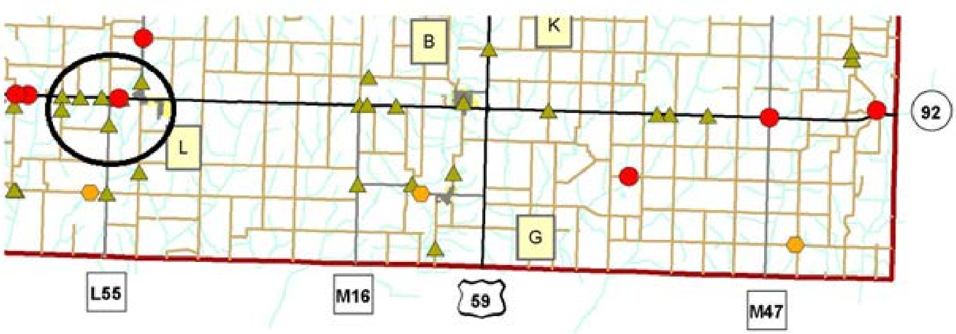


Figure 6. Pottawattamie County Crash Data

The Iowa DOT crash data for Pottawattamie County from 2007 to 2011 is shown below in Figure 5. The legend shows where fatal, major injury and minor injuries happened. Figure 6 is an enlarged image to show the intersection of L55 and Route 92.

Figure 7. Intersection of L55 and Route 92 crash data.



This data shows that only one fatal crash occurred at that intersection between the years 2007 – 2011 and all the other crashes that happened near the intersection resulted in minor injuries only.

Results and Recommendations

Level of service C is an acceptable level of service, and each lane at the peak hours is at C or above C, even with a 10% increase. Also, only one fatal accident occurred in within the 4 years of data that is given by the DOT. With this information, CLR Engineers design suggestion is to keep the intersection as a two way stop. The data shows that no improvements need to be made right now or in the future, assuming the population only grows by 10% in the recent future.

Crosswalk at Volkens Avenue and Route 92

The designed crosswalk crossing Route 92 near Volkens Ave was relocated next to the drive immediately east of the existing crosswalk. A benefit of this design is that it capitalizes on the existing sidewalk stub on the north side of Route 92. This existing stub is shown in Figure 8.

Figure 8. Proposed location for the relocation of the pedestrian crossing.

The location outlined in Figure 8 is the design location for the relocated crosswalk. The final design of the crosswalk, complete with bump-outs is shown in Figure 9.

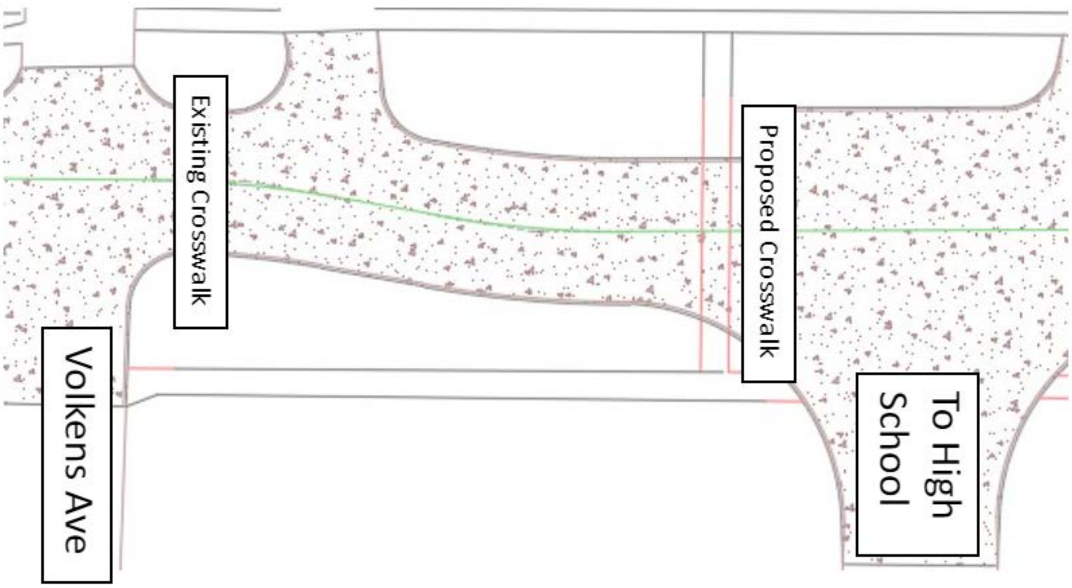


Figure 9. Final design of the pedestrian crossing near the high school.

As shown in Figure 9, the crosswalk redesign features a shorter crossing distance for pedestrians than the current crosswalk at Volkens Avenue. Not only does it take advantage of the existing sidewalk stub on the north side of R92, but it also ties into the existing walk on the south side. This will provide citizens young and old with an added level of safety by reducing the amount of time it takes for them to cross the street. Another visible element depicted in Figure 9 is the meandered alignment. This design feature is discussed further below.

Meandered Alignment

As was mentioned in the discussion of design alternatives, a meandered alignment provided solutions to a couple of different problems within the corridor. An overview of the final redesign of the Route 92 alignment is shown in Figure 10.

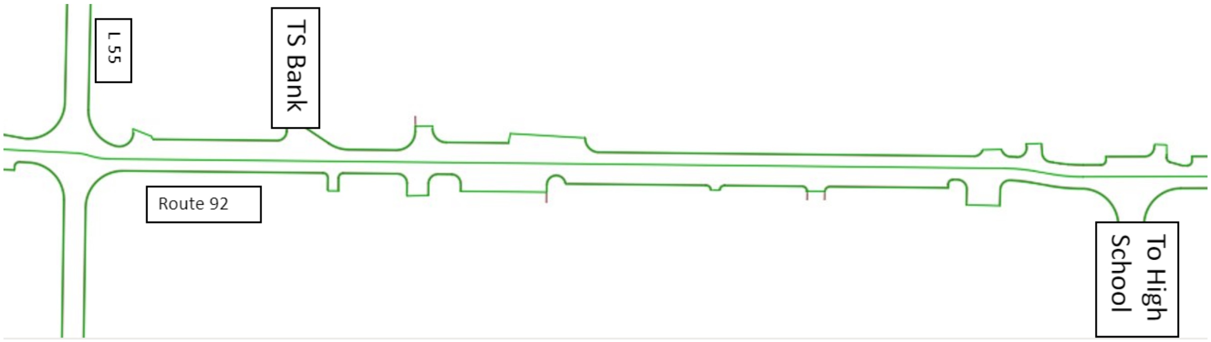


Figure 10. The final proposed design for the realignment of Highway 92.

The existing alignment is relatively straight while the proposed design feature three curves which provide room for parking on one side of the corridor while maximizing opportunities for parking and bump-outs. These combined techniques were designed using guidelines from AASHTO, the Iowa DOT Design Manual, and the Smart Growth America Complete Street Design Guide.

A swept-path analysis was done on the intersection of Route 92 and L55 to simulate the design vehicle turning. For this intersection, the DOT defines the design vehicle as an S-Bus-36 which is a conventional school bus shown below. A swept-path analysis was conducted four times. Each analysis shows the vehicle turning right from each possible direction and proves that the design vehicle does fit in the intersection.

Table 6. DOT Design Vehicles

from	onto	design vehicle
freeway ramps	other facilities	WB-67 (Interstate semitrailer)
other facilities	freeway ramps	
state highways	state highways	WB-67
collectors ADT ≥ 400		WB-67
collectors ADT < 400		S-Bus-36 (conventional school bus)
local (gravel roads)		

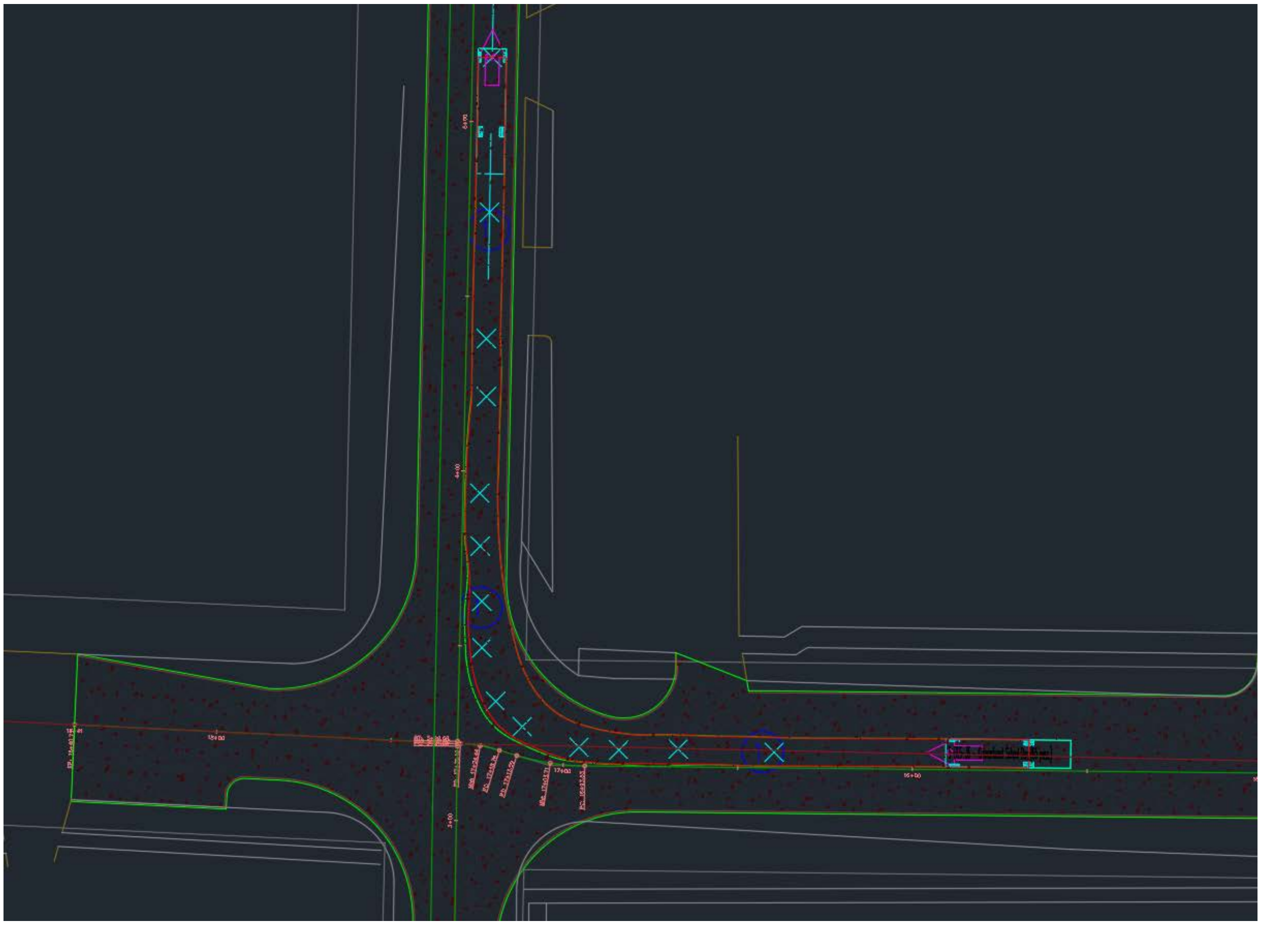


Figure 11. East Lane Swept-Path Analysis

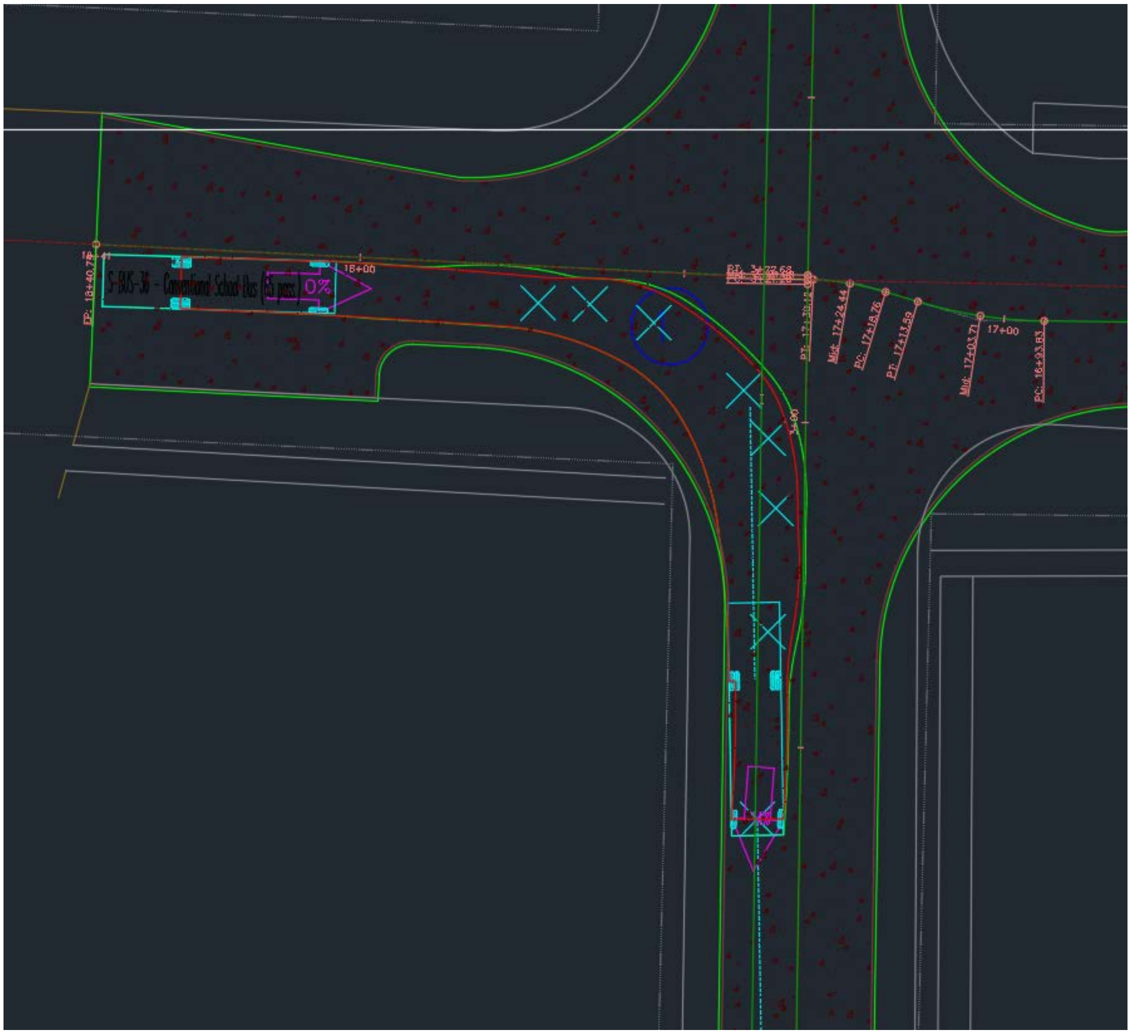


Figure 12. West Lane Swept-Path Analysis

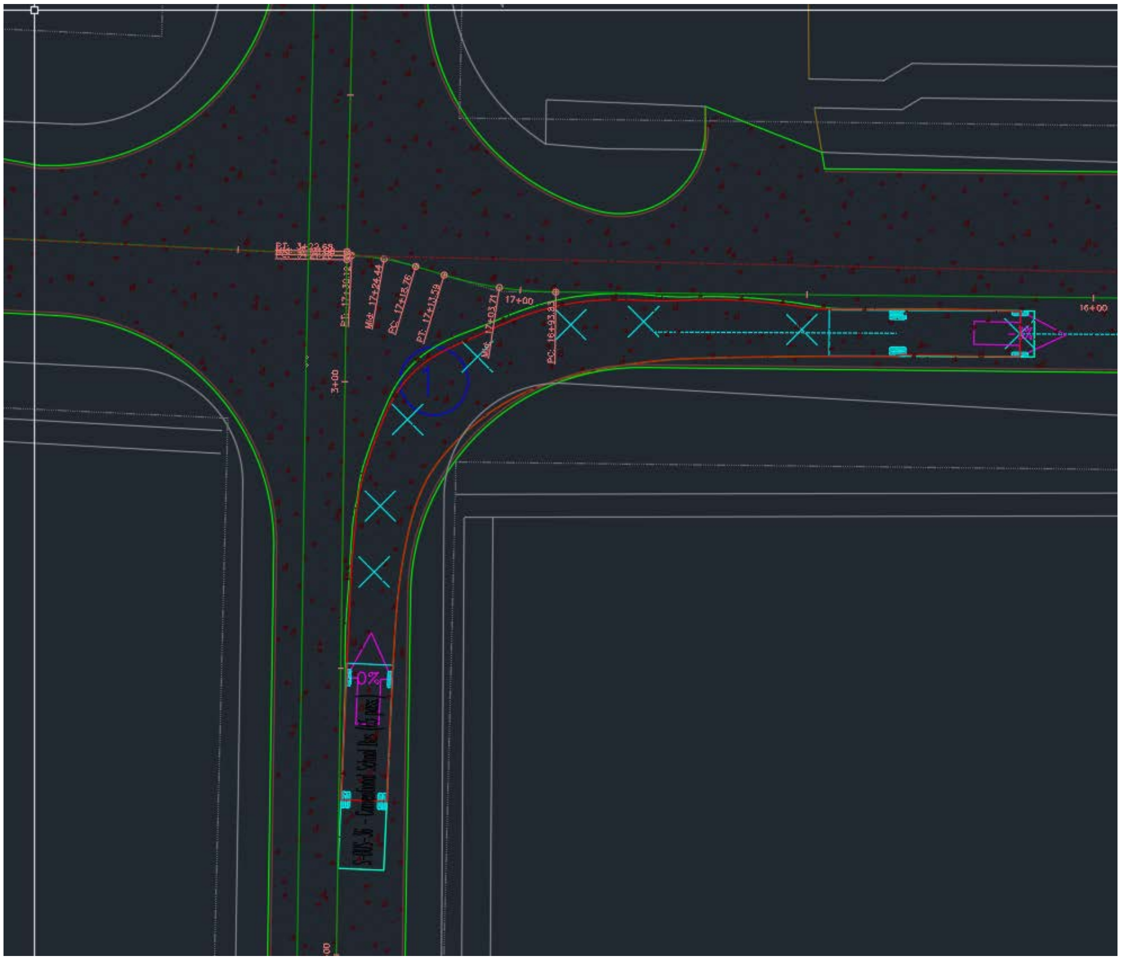


Figure 13. South Lane Swept-Path Analysis

*Figure 14. Nor*th Lane Swept-Path Analysis

Parallel Parking Locations

The corridor redesign provided ample opportunity for parking for the businesses along the route. These locations are shown in Figure 11.

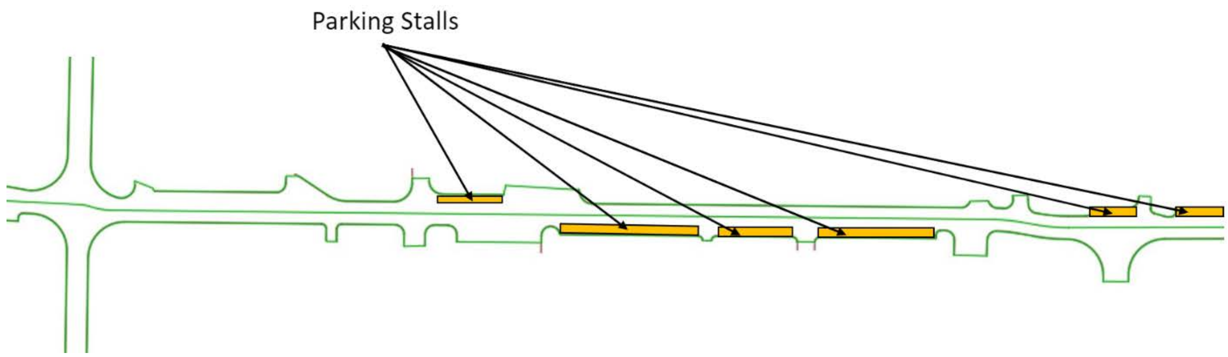


Figure 15. Parking locations along Route 92.

The parallel parking locations in Figure 11 are designated with yellow blocks and call-outs.

Bump-Out Locations

In addition to parking locations, there are many locations where bump-outs have been adding. These are to provide the illusion of a narrower road while making clear barriers for parking to maintain access to drives. These bump-out locations are highlighted in Figure 12.

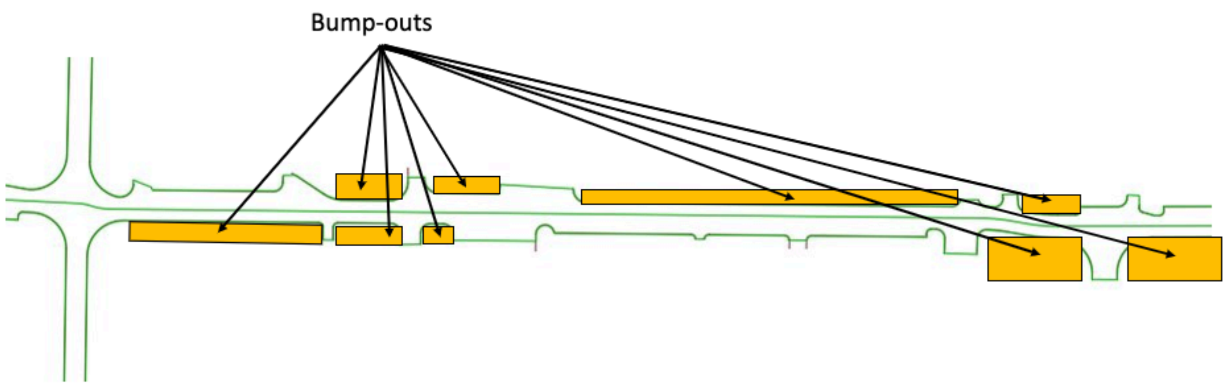


Figure 16. Bump-out Locations along the Highway 92 Corridor.

The aforementioned design elements provide improved safety and functionality for the City of Treynor and its citizens. They decrease crossing times while discouraging the use of shoulders as passing lanes. While bump-outs often act as a block to the overland flow, this can be avoided by implementing curb cuts at the side of each bum-out. Additionally, the proposed design features a higher percentage of pervious areas than the existing conditions. In other words, there are more areas for the water to get into the ground than there were before.

General Cross-Section and Aesthetic Improvements

In an attempt to improve the aesthetics along the 92 Corridor, a typical cross-section design for the project was compiled using inspiration from guides for Complete Street Redesign by Smart Growth America. The cross-section captures the character of the City of Treynor and elevates the Main Street Experience of the corridor. This typical cross-section is depicted in Figure 13.

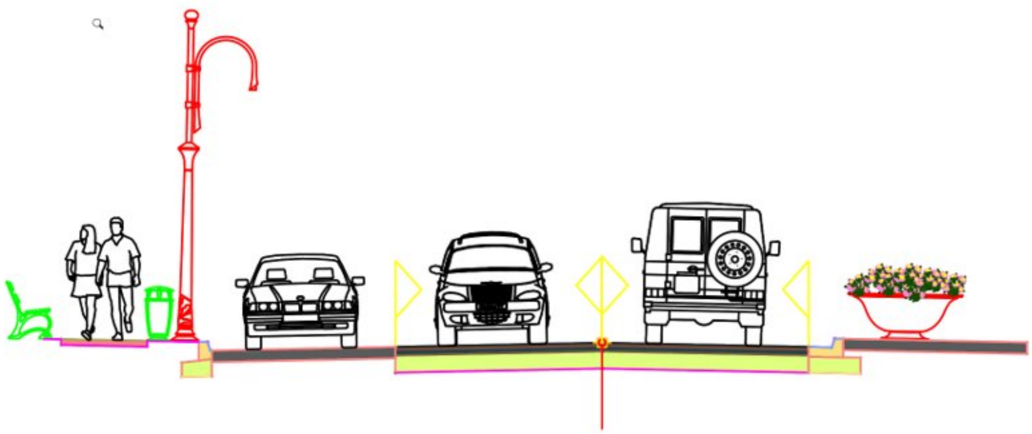


Figure 17. A typical cross-section for the corridor.

There are a few notable elements in this cross-section. These are the various street furniture. For more information on the specified fixtures, see Appendix C. Imagery of design concepts can be viewed at: [https://youtu.be/ataPzk6DQvs.](https://youtu.be/ataPzk6DQvs)

This cross-section also adheres to the Iowa DOT Design Manual in addition to its aesthetic appeal. The pavement cross-section is shown in Figure 14.

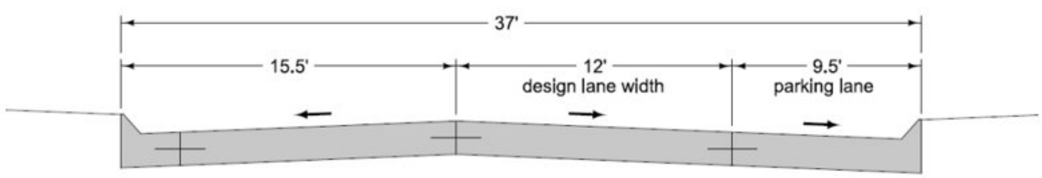


Figure 14. A typical pavement cross-section from Iowa DOT Design Manual Chapter 3A-1

The design cross-section also provides proper setbacks and clearance per Iowa SUDAS.

Section VII - Engineer's Cost Estimate

There are three phase subdivision development in this project. Phase 1 yellow, Phase 2 purple, and Phase 3 green. It is shown in Figure 18.

Figure 18. Cost Estimated Each Phase

Phase 1. Yellow (Intersection R-92 & L55) [4,071SF]

Demolition ($5,000) + Intersection ($62,400) =

$67,400

Phase 2. Purple (road) [49,960 SF]

Demolition ($41,000) + Street Redesign ($193,000) + Aesthetics ($33,300) =

$267,000

Phase 3. Green (road+cross walk) [43,152 SF]

Demolition ($41,000) + Street Redesign ($193,000) + Aesthetics ($33,300) + Traffic system ($42,000) =

$309,300

To estimate the cost of the City of Treynor Pedestrian Infrastructure Project, CLR used RSMeans standards. The primary book used to calculate estimated values was 2019 Heavy Constructions Cost published by RSMeans.

Table 7. Estimated Quantities

Estimated Quantities				
Item Number	Item Name	Unit	Total	Note
1	Concrete (Lot)	SY	12600	Including joints, finishing and curing Fix form, 12' pass, unreinforced, 6" thick
2	Brick Paving	SF	500	4" x 8" x 1-1/2", without joints (4.5 bricks/SF)
3	Concrete (Curb)	LF	3660	Machine formed, 6"x18", radius
4	Demolition	SY	12600	Pavement removal, bituminous road, 4"-6" thick
5	Planter flower	EA	20	short planter cast iron & steel sheet
6	Light Poles	EA	25	Anchor base not including concrete base Aluminum pole, 20' high
7	Bench	EA	20	cast-iron/brown wooden
8	Litter Bin	EA	20	circular base, lateral uprights and upper lid cast-rion/black
9	Paint Pvmt. (Road)	LF	65600	Acrylic waterborne, white or yellow, 4" wide, 3,000-16,000 L.F.
10	Paint Pvmt. (Parking)	LF	250	Lines on pvmt., parking stall, paint, 4" wide
11	Structure Moving	TON	11500	Reset on existing foundation Solid pickup
12	Pedestrian Hybrid Beacon	EA	42000	Reset on existing foundation Solid pickup

Table 8. Total Project Cost of Pedestrian Infrastructure

Total Project Cost					
Proejct item	Material	Labor	Equipment	Total	Total Including Overhead & Profit
Concrete (Lot)	$321,500	$16,500	$12,600	$350,600	$386,000
Brick Paving	$1,275	$3,250		$4,525	$4,975
Concrete (Curb)	$13,500	$8,525	$4,875	$26,900	$29,600
Demolition		$54,500	$33,800	$88,300	$97,000
Planter flower	$8,000			$8,000	$8,800
Light Poles	$21,000	$10,000	$890	$31,890	$35,000
Bench	$9,000			$9,000	$9,900
Litter Bin	$7,200			$7,200	$7,920
Paint Pvmt. (Road)	$6,550	$6,550	$1,975	$15,075	$16,600
Paint Pvmt. (Parking)	$1,200	$465	$220	$1,885	$2,075
HAWK Beacon	$42,000			$42,000	$46,200
Shipping Cost		$11,000		$11,000	$12,100
Total					**$656,000**

The total project cost is calculated by quantities, appropriate unit and unit price from RSMeans data table. This is shown in tables in Appendix C.

Appendix A - Traffic Study Reports

RESULTS

	Major Street						Minor Street					
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume (vph)	32			5				26			65	
Movement Capacity	1208			1408				443			428	
Shared Lane Capacity								443			428	
Movement v/c Ratio	0.03			0.00				0.06			0.15	
95% Queue Length	0.08			0.01				0.19			0.54	
Control Delay (sec/veh)	8.1			7.6				13.6			14.9	
Movement Level of Service	A			A				B			B	
Approach Delay (sec/veh)								13.6			14.9	
Approach Level of Service								B			B	

Figure 19. HCS Report for Traffic at 7 a.m.

RESULTS

	Major Street						Minor Street					
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume (vph)	37			63				37			86	
Movement Capacity	1225			1337				337			317	
Shared Lane Capacity								337			317	
Movement v/c Ratio	0.03			0.05				0.11			0.27	
95% Queue Length	0.09			0.15				0.37			1.11	
Control Delay (sec/veh)	8.0			7.8				17.0			20.6	
Movement Level of Service	A			A				C			C	
Approach Delay (sec/veh)								17.0			20.6	
Approach Level of Service								C			C	

Figure 20. HCS Report for Traffic at 8 a.m.

RESULTS

	Major Street						Minor Street					
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume (vph)	23			5				20			32	
Movement Capacity	1418			1452				639			603	
Shared Lane Capacity								639			603	
Movement v/c Ratio	0.02			0.00				0.03			0.05	
95% Queue Length	0.05			0.01				0.10			0.17	
Control Delay (sec/veh)	7.6			7.5				10.8			11.3	
Movement Level of Service	A			A				B			B	
Approach Delay (sec/veh)								10.8			11.3	
Approach Level of Service								B			B	

Figure 21. HCS Report for Traffic at 11 a.m.

RESULTS

	Major Street						Minor Street					
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume (vph)	29			7				57			56	
Movement Capacity	1282			1312				461			408	
Shared Lane Capacity								461			408	
Movement v/c Ratio	0.02			0.01				0.12			0.14	
95% Queue Length	0.07			0.02				0.42			0.48	
Control Delay (sec/veh)	7.9			7.8				13.9			15.2	
Movement Level of Service	A			A				B			C	
Approach Delay (sec/veh)								13.9			15.2	
Approach Level of Service								B			C	

Figure 22. HCS Report for Traffic at 12 p.m.

RESULTS

	Major Street						Minor Street					
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume (vph)	29			7				57			56	
Movement Capacity	1282			1312				461			408	
Shared Lane Capacity								461			408	
Movement v/c Ratio	0.02			0.01				0.12			0.14	
95% Queue Length	0.07			0.02				0.42			0.48	
Control Delay (sec/veh)	7.9			7.8				13.9			15.2	
Movement Level of Service	A			A				B			C	
Approach Delay (sec/veh)								13.9			15.2	
Approach Level of Service								B			C	

Figure 23. HCS Report for Traffic at 3 p.m.

RESULTS

	Major Street						Minor Street					
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume (vph)	67			10				37			60	
Movement Capacity	1301			1249				376			331	
Shared Lane Capacity								376			331	
Movement v/c Ratio	0.05			0.01				0.10			0.18	
95% Queue Length	0.16			0.02				0.33			0.66	
Control Delay (sec/veh)	7.9			7.9				15.6			18.3	
Movement Level of Service	A			A				C			C	
Approach Delay (sec/veh)								15.6			18.3	
Approach Level of Service								C			C	

Figure 24. HCS Report for Traffic at 4 p.m.

RESULTS

	Major Street						Minor Street					
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume (vph)	68			4				36			63	
Movement Capacity	1277			1229				348			325	
Shared Lane Capacity								348			325	
Movement v/c Ratio	0.05			0.00				0.10			0.19	
95% Queue Length	0.17			0.01				0.35			0.72	
Control Delay (sec/veh)	8.0			7.9				16.5			18.7	
Movement Level of Service	A			A				C			C	
Approach Delay (sec/veh)								16.5			18.7	
Approach Level of Service								C			C	

Figure 25. HCS Report for Traffic at 5 p.m.

*A*ppendix B – Cost Estimate Tables

Table 8. RSMeans rounding standards.

Prices From	To	Rounded to Nearest
$0.01	$5.00	$0.01
5.01	20.00	0.05
20.01	100.00	1.00
100.01	1,000.00	5.00
1,000.01	10,000.00	25.00
10,000.01	50,000.00	100.00
50,000.01	Up	500.00

An abbreviations table has been provided to quantity units used to calculate the cost estimate.

Table 9. Abbreviations table

Unit Symbol	Description
EA	Each
CY	Cubic Yard
EA	Each
FT	Feet
LF	Linear Foot
SF	Sqaure Foot
SY	Square Yard

Table 10. Estimated Quantities

Estimated Quantites

Line Number	Name	Crew	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Total	Total Incl Q&P
	HAWK Beacon Hybrid solar-powered 8'tall				EA	20000			20000	21000
32 13 13.25 0020	**Concrete pavement, highways** Including joints, finishing and curing Fix form, 12' pass, unreinforced, 6" thick	B-26	3000	0.029	SY	25.5	1.31	1	27.81	31
32 14 16.10 0012	**Brick Paving** 4" x 8" x 1-1/2", without joints (4.5 bricks/SF)	D-1	110	0.145	SF	2.57	6.5		9.07	12.8
32 16 13.13 0416	**Cast-in-Place Concrete Curb and Gutter** Machine formed, 6"x18", radius	B-69A	900	0.053	LF	3.69	2.33	1.33	7.32	9
32 11 12.23 0010	**Planting** Flower **Bench** cast-iron/brown wooden **Litter Bin** cast-rion/bk				EA EA EA	250 450 360			250	275 500
02 41 13.17 5050	**Demolition & Clean up** Pavement removal, bituminous road, 4"-6" thick	B-38	420	0.095	SY		4.32	2.68	7	9.5
26 56 13.10 3000	**Light Poles** anchor base not including concrete base Aluminum pole, 20' high	1 Elec	2.9	6.897	EA	1050	400	44.5	1494.5	1800
32 17 23.13 0030	**Paint Pavement Marking (Road)** Acrylic waterborne, white or yellow, 4"wide, 3,000-16,000 L.F.	B-78	20000	0.002	LF	0.1	0.1	0.03	0.23	0.29
32 17 23.14 0800	**Paint Pavement Marking (Parking)** Lines on pvmt., parking stall, paint, 4"wide	B78B	400	0.045	LF	4.82	1.85	0.87	7.54	9.05
02 43 13.13 0040	**Structure Moving** Reset on existing foundation Solid pickup				TON				11500	11500

Table 11. Estimated Quantities

Appendix C – Street Furniture Specifications

NERI

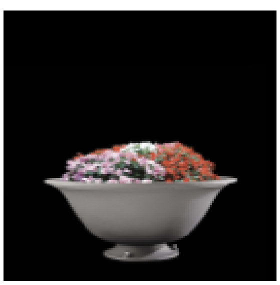
PLANTERS
ARTICLE: 2203.000
DATA SHEET
SCALE 1:20

Planter
Series: Salix - Heritage
Fixing: Fixing with anchor bolts

REV 01 - 2018/03/28 1 / 2

Product description
Short planter made of cast iron and steel sheet. Truncated conical pedestal with holes for draining water and upper tank with wave-shaped side.

Series description
All products in this series feature a smooth and essential design, which enables a wide range of use and easy combinations, regardless of the archirtectural context. The Salix series matches the Alcor lighting system.



Dimensions

Length	1000 mm [3' 3 1/4"]
Width	1000 mm [3' 3 1/4"]
Height	400 mm [1' 3 3/4"]
Capacity	115 l [30.38 gal]
Weight	135 kg [297.62 lb]

Measurements in millimetres are rounded to the nearest quarter of the closest inch.

Components
The base is constituted of a pedestal in a truncated conical shape (lower diameter: 410mm [1' 4 1/4"]; upper diameter: 260 [10 1/4"]) with the side in the shape of waves, with a hole (diameter: 20mm [3/4"]) for draining water. The pedestal is fixed to the tank with three stainless steel M10 screws.

The cast iron vase is a truncated cone in shape (lower diameter: 285mm [11 1/4"]; upper diameter: 1000mm [3' 3 1/4"]) with the side in the shape of a wave, with a border 50mm [2"] thick in the upper part.

Materials
- Cast iron UNI EN 1561
- S235J steel UNI EN 10219-1

See the specific descriptions on the painting cycles of the materials that make up the product.

Finishes
The standard colours are:
- Neri Grey

Other colours are available upon request.

Installation
See product installation guides.

Figure 22. Planter

NERI | Posts Alcor | Art. 8102.001 Mounting with flange | Technical sheet Rev. A - 04/2016

DESCRIPTION

Compliance
- CE certificated post, compliant with standard UNI EN 40-5.
- Calculated in according to UNI EN 40-3-3 (wind speed 31 m/s).

Predispositions
- Tops with brackets for upright or suspended luminaires.
- Tops with pastoral brackets for suspended luminaires.

Mounting
- Circular flange (Ø 216 mm) with 4 slots (22 X 35 mm) for mounting with anchors bolts, to the foundation plinth (P). The anchor bolts are not supplied.
  Fixing material information
  Use bolts size M18, made of hot galvanized steel, conform to EN 10025, (Minimum grade S235JR) as specified in the standard EN 40-5 at point 4.2.
  Anchor bolts hook shaped are recommended, and must be in hot galvanized steel, with the part that protrudes M18 threaded, over the final floor level of 50 mm (± 5 mm).
  The characteristics and dimensioning in length of the anchors bolts, are under the responsibility of designer.

Materials
- Steel tube (UNI EN 10219-1) (S355JR), hot galvanized (UNI EN ISO 1461).
- Cast iron (UNI EN 1561 - UNI EN 1563).

Structural elements
- Post (A) in hot galvanized steel, tapered wth circular section, composed with 3 pipes welded together (diam. 102 X 300 mm - diam. 76 X 1200 mm - diam. 60 X 700 mm). The top is equipped with a threaded bushing G1' 1/4 (Z) and a threaded pipe (lenght 150 mm) in hot galvanized steel with bolts in stainless inox, for tighten all parts of post (Base, column and terminal).
- Total eight included root: 2800 mm.
- Weight: Kg 23.

Decorative elements
- Base (1°) in cast iron (height 575 mm), with a circular base Ø 340 mm, decorated with a large leaf, wound in a spiral (E) ended a inclinated cut of 30°.
- Conical column (2°) (height (1600 mm, diam. 135/90 mm) in hot-galvanized steel. The lower end of the column also has a slanted plane at an angle of 30°.
  The column at the bottom, has an internal flange, that ensures correct angular and axial position with respect to the base (1°).
  When the column and the base are assembled, there is a gap of around 10 mm between the slanted planes.
- Terminal element (3°) in cast iron (height 250 mm, (Ø. 90/230 mm), euipped with 2 grains (C) M10 and a screw (F) M8 for the correct tightening wit column.
- Weight of base: Kg 26.
- Weight of column: Kg 21.
- Weight of terminal: Kg 10.

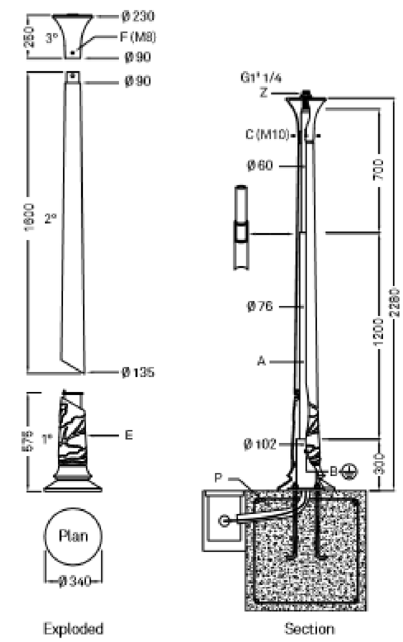
Standard equipment
- Hole (Ø 90 mm) at the centre of flange for entrance of cables.
- Grounding terminal (B) (screw M10).

General dimensions and weight
- Diameter of base: 340 mm
- Useful height: 2280 mm
- Weight: Kg 80

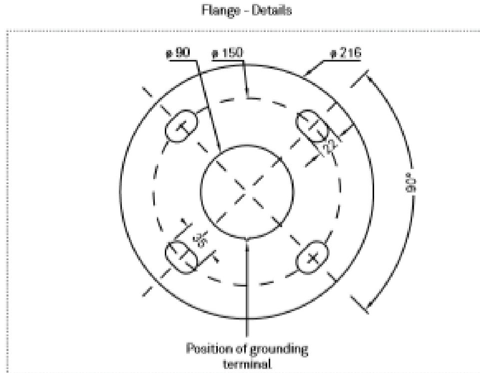
Painting
- Standard colour is dark grey matt metalized tyte Neri.
- Please refer to the specification on painting procedures of the materials.

Note
- In the drawing, the foundation plinth is not dimensioned, since the element to be calculated by the designer, as required by the regulations.
  The purpose is to highlight the dimensions of the flange and the cable entry position, for prepare the necessary canalizations.

DRAWING - MEASURES (mm)



Flange - Details



Property of Neri S.p.A. - Any use and reproduction for personal purposes is prohibited. Company shall reserve the right at any time to modify the specification or features without notice.

Figure 23. Light Pole (post)

TOP SECTIONS FOR POSTS SERIES 8100 NERI SIGNS FOR THE FUTURE

ARTICLE: **4102.175** TECHNICAL DESCRIPTION - Rev. A - June 2005

Description

The top section is made from elements in UNI EN 1561 cast iron, UNI EN 1563 nodular cast iron and FE 360-FE 510 UNI EN 10219-1 steel, hot-galvanized to UNI EN ISO 1461 standards and corresponds in shape, size and ornamentation to the diagrams, which are an integral part of the specifications.

The top section is composed as follows:

1°) A cast iron element, smooth and tapered, height 8 cm and base diam. 23 cm.

2°) A support tube for the suspension bracket in hot-galvanized steel, height 95 cm. At the bottom the support tube has a flange (C) by which it is fixed with three M10 stainless steel screws to the capital (B) of the post beneath it.

3°) An upper tube in hot-galvanized steel, height 55.5 cm, fixed to element 5° with four M6 stainless steel screws.

4°) A lower support ring for the suspension bracket in hot-galvanized steel; it is secured to the support tube (element 2) with two M8 stainless steel grubscrews.

5°) An upper support ring for the suspension bracket in hot-galvanized steel. The ring has a hole (diam. 1.8 cm) for the passage of the power cable. It is secured to the support tube (element 2) with two M8 stainless steel grubscrews.

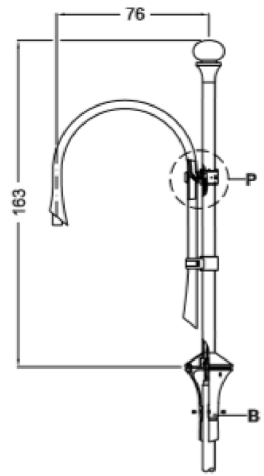
6°) A suspension bracket with a height of 116 cm and a protrusion of 68 cm. Structurally the bracket is composed of an steel tube (diam. 4.2 cm) and decorations (G, F) and support attachments (D) in nodular cast iron. The entire assembly is hot-galvanized. The bracket is secured to the lower and upper support rings (elements 4 and 5) with four M8 stainless steel screws, and at the outer extremity it has a junction (E) in nodular cast iron with a 3/4" GAS thread for attaching the light fixture. The power cable (P) passes out of the top of the support tube (element 2) and enters the bracket through the upper support attachment (D), passing inside element 5.

7°) A cast iron finial (height 21 cm), with a tapered lower section and an oval upper section (diam. 15 cm). The finial is fitted onto element 3 and is secured with three M6 stainless steel grubscrews.

The total height of the assembled top section is 163 cm, with a protrusion of 76 cm.

Protection of surfaces

Please refer to the specification on painting procedures of the materials



Front view - Detail section

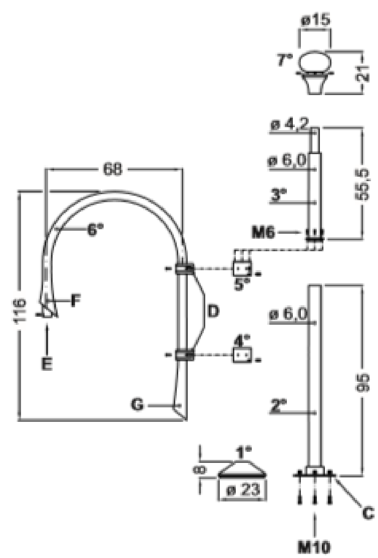


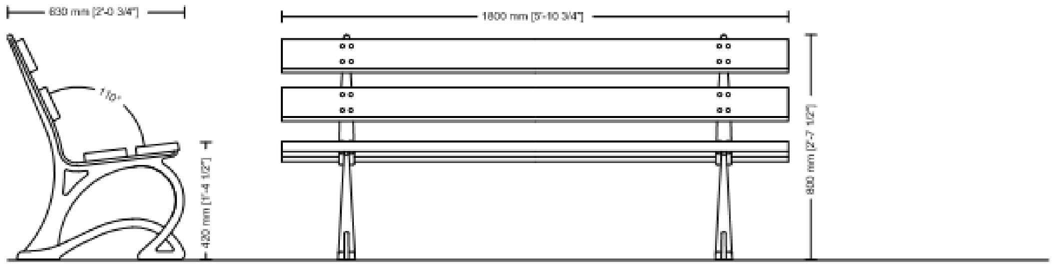
Figure 24. Light Pole (top)

NERI

BENCHES
ARTICLE: 2142.002
DATA SHEET
SCALE 1:20

Bench
Series: Salix - Heritage
Category: Wood
Fixing: Fixed type with root

REV 01 - 2018/03/28 1 / 2



Product description
Bench composed of cast iron supports in Neri Grey. Seat and backrest both made with two brown Iroko-like wooden slats.

Series description
All products in this series feature a smooth and essential design, which enables a wide range of use and easy combinations, regardless of the archirtectural context. The Salix series matches the Alcor lighting system.

Dimensions

Length	1800 mm [5' 10 3/4"]
Width	630 mm [2' 3/4"]
Height	800 mm [2' 7 2/4"]
Weight	54 kg [119.05 lb]

Measurements in millimetres are rounded to the nearest quarter of the closest inch.

Components
The bench support is composed of two cast iron components with entries for the wooden slats of the seat and the backrest.

The seat is composed of two Iroko-like wooden slats 1800mm [5' 10 3/4"] long. Each panel is fixed to the supports with eight stainless steel M6 screws.

The backrest is composed of two Iroko-like wooden slats 1800mm [5' 10 3/4"] long. Each panel is fixed to the supports with eight stainless steel M6 screws.

Materials
- Cast iron UNI EN 1561
- Iroko-like wood
See the specific descriptions on the painting cycles of the materials that make up the product.

Finishes
The standard colours are:
- Neri Grey
- Mahogany brown
Other colours are available upon request.

Installation
See product installation guides.

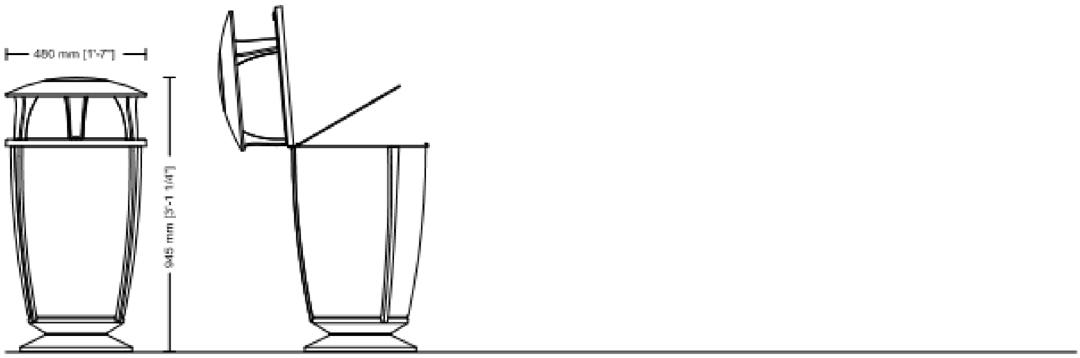
Figure 25. Bench

NERI

LITTER BINS
ARTICLE: 2277.001
DATA SHEET
SCALE 1:20

Litter bin with lid
Series: Idesia - Contemporary
Fixing: Fixed type with root

REV 01 - 2018/03/28 1 / 2



Product description
Litter bin with circular base, lateral uprights and upper lid in cast aluminium. Litter bin in deep-drawn hot-dip galvanised steel sheet; stainless steel bag-securing ring. The lid is hinged onto the bin and has a key locking system.

Series description
The Idesia series includes a litter bin, planter, bicycle rack and bench. The soft lines of these products match those in the Saiph lighting system. The undulating shaped bench has a LED light at the base, thus distinguishing it and making it visible at night.

Dimensions

Length	480 mm [1' 7"]
Width	480 mm [1' 7"]
Height	945 mm [3' 1 1/4"]
Capacity	75 l [19.81 gal]
Weight	21 kg [46.3 lb]

Measurements in millimetres are rounded to the nearest quarter of the closest inch.

Components
The support is constituted of three cast aluminium lateral uprights. Each upright is attached to the bin with three stainless steel M6 screws.

The cast aluminium component at the base is circular and 120mm [4 3/4"] high with a 386mm [1' 3 1/4"] diameter.

The end component is made of cast aluminium, is 235mm [9 1/4"] high and is composed of a ring, three uprights and a lid, all hinged to the bin. The component has a key locking system.

The bin is made of deep-drawn hot-dip galvanised steel sheet, 20mm [3/4"]/10mm [2/4"] thick. The bin is fixed to the base with four stainless steel M6 screws and has three holes (diameter: 30mm [11/4"]) at the bottom to allow water to drain away. The bin contains a stainless steel ring to secure the bag.

Materials
- Cast aluminium UNI EN 1706
- Hot-dip galvanised steel UNI EN ISO 1461
See the specific descriptions on the painting cycles of the materials that make up the product.

Finishes
The standard colours are:
- Neri Grey
Other colours are available upon request.

Installation
See product installation guides.

Figure 26. Litter Bin