FLASHING BEACON INSTALLATION APPLICATION/PERMIT

Wisconsin Department of Transportation

DT1877 6/2010 s.86.19(3) Wis. Stats.

Submit application in triplicate to Wisconsin Department of Transportation, Regional office.
Make separate application for each flasher or associated pair of flashers desired.
See conditions for installation of flashing beacon on next page(s).

Applicant - Municipality	Unit of Government (County, Town, City, Village)
Gays Mills	Village

Mailing Address	Date
16381 State Highway 131, Suite 1 Gays Mils, WI 54631	

Name of 24/7 Emergency Contact	Contact Area Code – Telephone Number	Cell or Pager Number
Jim Chellevold	608-735-4341	608-553-1664

Description of Beacon				Mounting Height	Lateral Setback
	Incandescent	LED *		7' min. Feet	3 Feet From
Red	☐ 165 w	☐	☒ Single ☐ Pair-as separate installation		☐ Edge of Pavement
Yellow	☐ 116 w	☒	☐ Pair-as same installation for school speed limit signs only		☒ Face or Top of Curb
RRFB Yellow	☒ Solar LED 17 w ☐ Hardware LED w		Single RRFB Indication X Dual RRFB Indication		

* If LED indications are used, they shall have an equivalent output to incandescent indications.

Location of Beacon	Facing		Reference to intersection, corporate limit, etc.
STH 131 and Misty Valley Intersection	☒ N ☒ S	☐ E ☐ W	Located at crosswalk on south side of intersection

Associated Sign

☐ Stop ☒ Warning ☐ Speed Limit ☐ School ☐ Other

Reason for Erecting Beacon

To accommodate new trail crossing of STH 131 at Misty Valley Avenue.

Application is made for permission to install a flashing beacon as described above. It is understood and agreed that the design, installation and operation of the flashing beacon will comply with the regulations of the Wisconsin Department of Transportation, the State Electrical Code, local ordinances and regulations, as well as specific conditions stated on the next page(s).

The undersigned certifies that he/she is authorized to sign this application on behalf of the named unit of government.

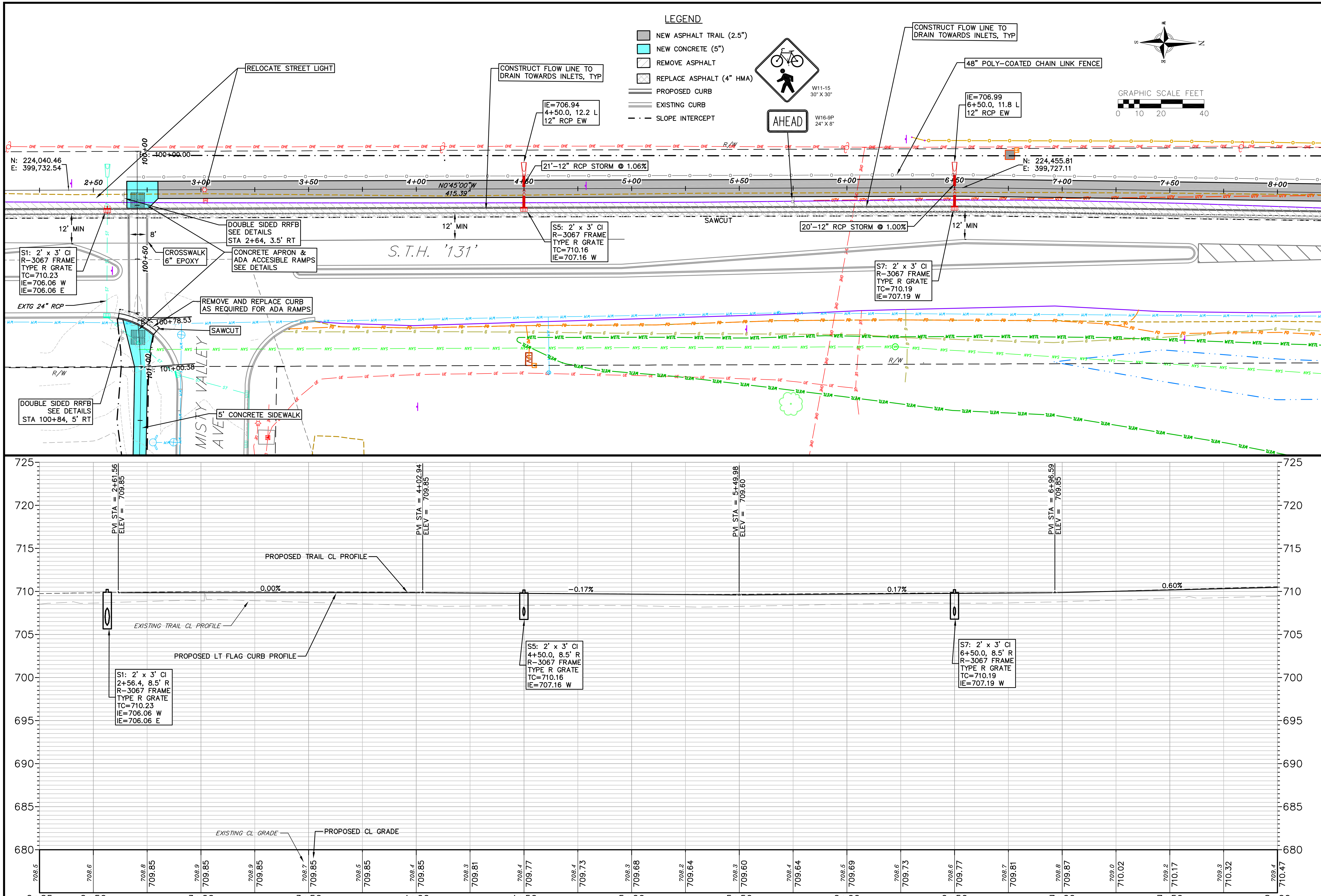
Harvey Gehring — (Authorized Representative) — 7/2/2019 (Date)

Village President — (Title)

PERMIT APPROVAL

Permission is granted for the installation described above in compliance with the conditions specified.

Permit Number	Date Issued	Approved for Wisconsin Department of Transportation
FB- 12-20-01	5/19/2020	X (Traffic Engineer) — 5/19/2020 (Date)



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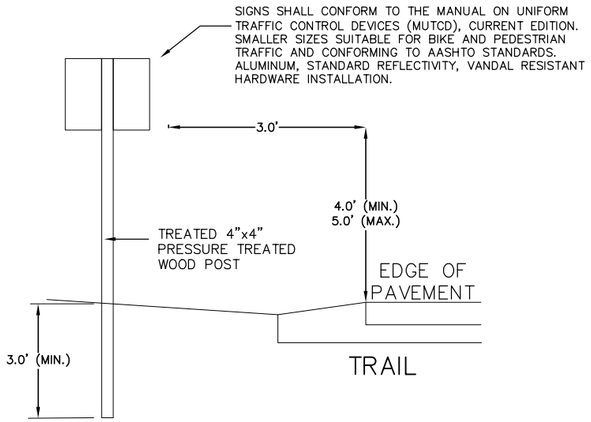
PLAN & PROFILE

2018 TID NO. 1 INFRASTRUCTURE TRAIL IMPROVEMENTS
GAYS MILLS, WISCONSIN

REVISIONS		
NO.	DATE	REMARKS

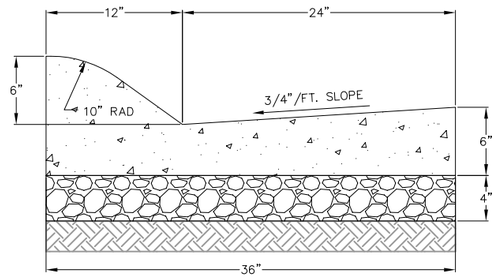
REVISIONS		
NO.	DATE	REMARKS

SCALE: AS SHOWN
DATE: JULY 2018
DRAFTER: PJUN
CHECKED: MMUC
PROJECT NO.: 180089
SHEET: 4 OF 29
DWG. NO.



TYPICAL SIGN PLACEMENT

(NOT TO SCALE)

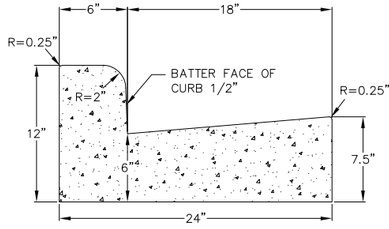


TIE BARS ARE REQUIRED FOR CURB & GUTTER TYPES A, G, AND K.

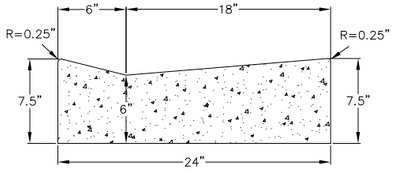
THE BOTTOM OF CURB AND GUTTER MAY BE CONSTRUCTED EITHER LEVEL OR PARALLEL TO THE SLOPE OF THE SUBGRADE OR BASE COURSE PROVIDED A 6" MINIMUM GUTTER THICKNESS IS MAINTAINED.

1/24 MOUNTABLE 36" CURB SECTION (TYPES A & D)

NOT TO SCALE



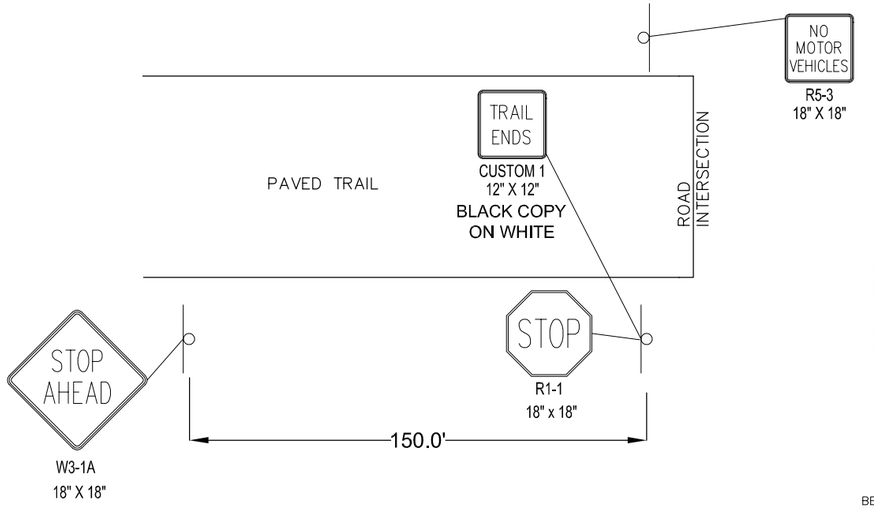
CURB AND GUTTER CROSS SECTION



DRIVEWAY AND HANDICAP RAMP GUTTER CROSS SECTION

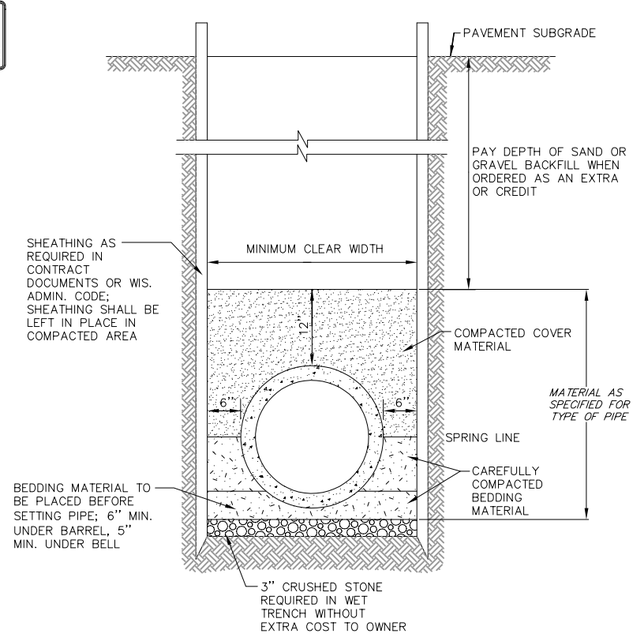
4/24 24" CONCRETE CURB AND GUTTER

NOT TO SCALE



2/24 TYPICAL TRAIL SIGN LOCATIONS (SEE PLAN)

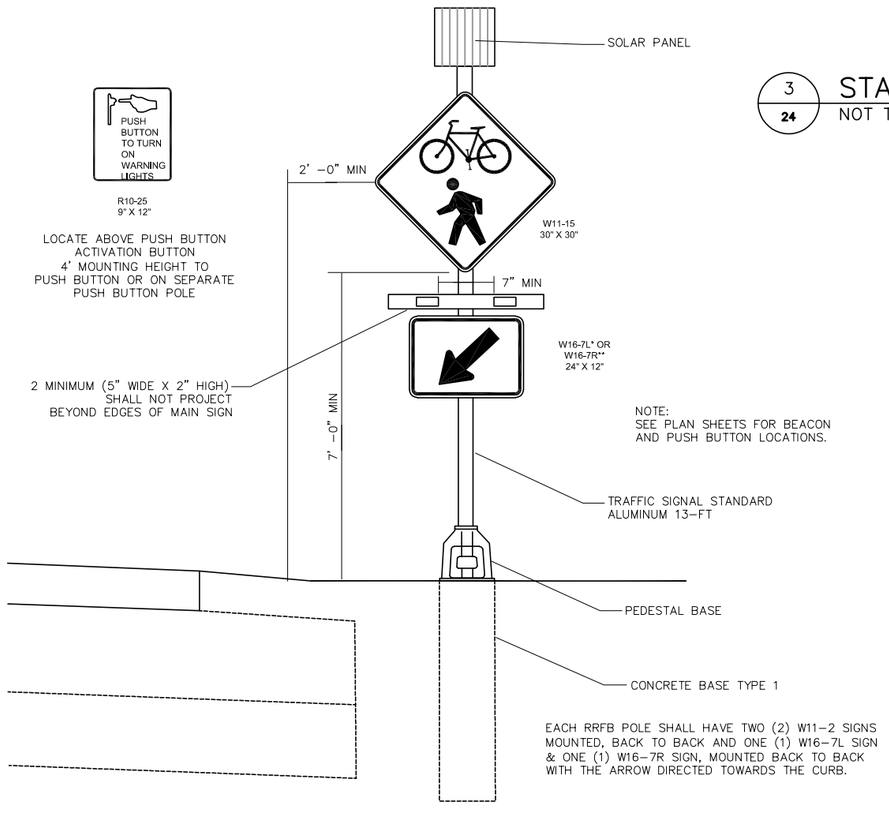
NOT TO SCALE



STORM SEWER (CLASS 'B' BEDDING):
BEDDING: CLASS 1: ⅜" TO 1½" CLEAR STONE
COVER: NATIVE OR GRANULAR BACKFILL AS REQ'D

3/24 STANDARD TRENCH SECTION

NOT TO SCALE



5/24 RECTANGULAR RAPID FLASHING BEACON DETAIL

NOT TO SCALE

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DETAILS

2018 TID NO. 1 INFRASTRUCTURE
TRAIL IMPROVEMENTS
GAYS MILLS, WISCONSIN

REVISIONS

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DATE
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PROJECT NO.
180089

SHEET
24 OF 25

DWG. NO.

21 May 2020 - 3:34p R:\Gays Mills, Village of\180089 - Gays Mills TID No. 1 2018 Infrastructure\CADD\2018 Gay Mills Details.dwg by: thal

MISTY VALLEY AVE

100+00

100+50

100+13.9, 9.7'L
EOP ELEV=709.81

100+21.9, 9.7'L
EOP ELEV=709.93

100+26.4, 9.2'L
TOC ELEV=710.32

100+21.9, 4.2'L
TOC ELEV=709.75

100+26.4, 4.2'L
TOC ELEV=709.77

100+13.9, 4.2'L
EOC ELEV=709.73

1.5%
1.5%
3.3%
0.3%
0.3%
8.0'

100+13.9, 3.8'R
EOC ELEV=709.73

100+21.9, 3.8'R
TOC ELEV=709.75

100+26.4, 3.8'R
TOC ELEV=709.77

100+26.4, 5.8'R
TOC ELEV=710.26

DOUBLE SIDED RRFB
SEE DETAILS

100+86.0, 6.8'L
TOC ELEV=710.20

100+85.7, 3.7'L
EOC ELEV=709.97

100+93.6, 3.0'L
EOC ELEV=710.10

101+00.4, 3.0'L
EOC ELEV=710.44

100+83.4, 3.9'L
TOC ELEV=709.83

2.3'
6.0%
1.5%
5.0%
101+00
1.5%
1.5%
1.5%
1.5%
5.3%
1.0%
3.1%

100+78.7, 4.0'R
TOC ELEV=709.93

100+84.1, 4.0'R
EOC ELEV=710.10

100+94.0, 3.4'R
EOC ELEV=710.20

101+00.5, 3.0'R
EOC ELEV=710.53

5.4'

100+77.7, 7.7'R
TOC ELEV=710.40

S.T.H. '131'

N
W E
S

GRAPHIC SCALE FEET
0 2 4 8

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CURB RAMP DETAILS - MISTY VALLEY AVENUE

2018 TID NO. 1 INFRASTRUCTURE
TRAIL IMPROVEMENTS
GAYS MILLS, WISCONSIN

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180089

SHEET
26 OF 29

DWG. NO.

Energy Balance Report

RECOMMENDED SYSTEM:

To meet the performance requirements at STH 131 and Misty Valley Road, Gays Mills, WI Carmanah recommends the R920-E system.

Key Parameters Considered:

- Maximum number of expected pedestrian activations (day and night, constant across months)
- The duration of the flashing signals following an activation
- Worst month** (month with least sunlight, coldest temp, and highest RRFB load over 24 hours)

***See glossary of terms on page 4 for clarification*

Recommended System:	**R920-E**
Location: STH 131 and Misty Valley Road, Gays Mills, WI	
System Configuration:	
Solar Panel (Watts)	12.8
Solar Panel Orientation	South
Battery Capacity (Amp-Hours)	14
Fixture Color and Type	Yellow Lightbar
Number of Fixtures	2
Per-Fixture Current	130mA
Number of Push Buttons	1
Flash Duration Setting (s)	7
Flash Pattern	RRFB WW+S
Push Button Model	Polara Bulldog
Passive Detection	No
Weather Data:	
Worst Month	December
Peak Sun Hours (during month)	2.90
Minimum Temperature	21.72°F / -5.71°C
Additional Notes:	
Adjusted Battery Capacity due to Cold Temperature	76%
Sunlight Available after Shading is Applied	70%

Performance Summary for Worst Month

Energy In (Watt-Hours)	17.2
Activations Per Day	50.0
Energy Out (Watt-Hours)	2.72
Autonomy (Days)	42.5
Array-to-load Ratio (ALR)	6.3
24-Hour Battery Usage - Depth of Cycle (%)	0.9%

See page 3 for in-depth system details

Minimum Recommended ALR	1.2
Maximum Daily Activations in Worst Month	1779

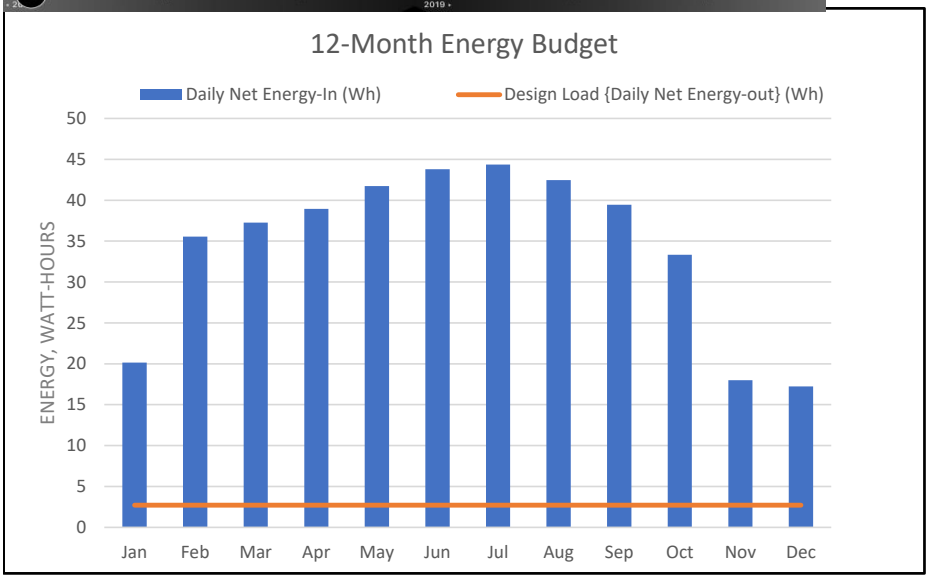
Energy Balance Report

Sun Path and Shading

The image on the left depicts the sun's path during the worst month*. Both the sun's path and shading affect the amount of available energy and determines the size and performance of the system.

Solid objects such as buildings block most light, while the effect of other objects – like trees, depending on their type and time of year– varies.

Location Shade De-rating: 30%

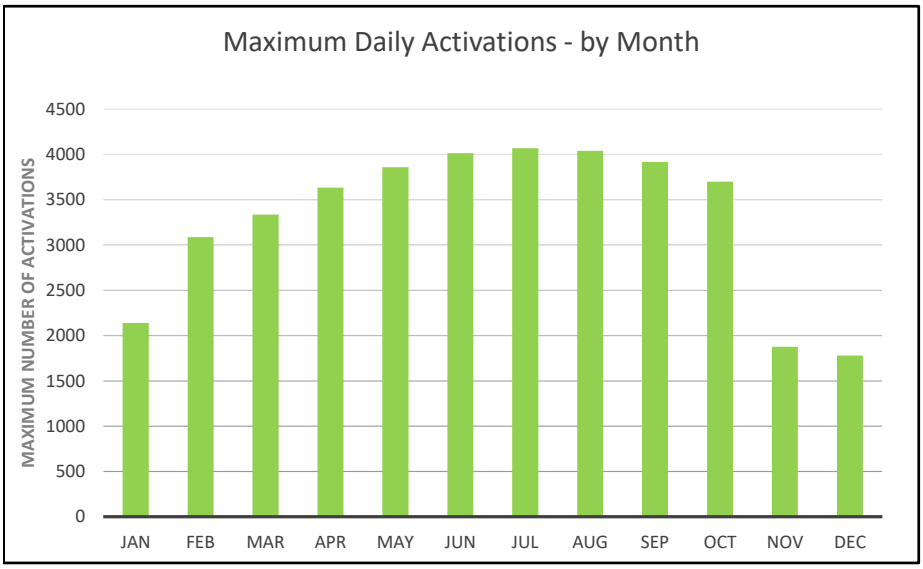


12-Month Energy Budget

Blue bars: Energy available to run the system and charge the batteries (energy-in*).

Red line: system load (energy-out*) due to pedestrian activations.

Minimum Array-to-Load Ratio:	6.3
System:	R920-E
Activations Per Day	50
Flash Duration Setting (s)	7



Maximum Daily System Activations

Green bars: Maximum number of daily activations the system can support per month.

The red line on the chart above shows the simulation "design load"

The maximum number activations will be capped when either the mininimum array-to-load ratio (ALR) or, the minimum allowable autonomy value has been reached. See Glossary Page 4.

Energy Balance Report

ENERGY-IN CALCULATION:

Rated Panel Wattage (W)	12.80	
Worst Month Peak Sun Hours (h)	2.90	Sun Hours at 45° tilt angle worst month = December
Effective Shading (%)	70%	100% is full sun. Based on worst month = December
Peak Sun Hours Adjusted for Shading (h)	2.03	
Solar Panel Energy Pre-Battery Charger (Wh)	26.01	
Solar Panel Charge Efficiency (%)	92%	Operating specification
Battery Charge Acceptance	72%	Value based on battery manufacturer's specifications
Energy Into the Battery (Watt-Hours)	**17.23**	

ENERGY-OUT CALCULATION:

Average Lightbar Power Day Operation (W)	1.58	Operating specification
Ambient Auto-Adjust Maximum (%)	100%	Operating specification
Night Dimming (%)	30%	User-adjustable setting
Percentage of Activations During Day (%)	100%	Input variable
Average Lightbar Power w/ Night Dim (W)	0.47	Calculated operating specification
Number of Lightbars	2	Input variable
LED Driver Efficiency (%)	95%	Lab-measured driver efficiency
Activations Every 24 Hours	**50.0**	Input variable per specification
Activation Time (Seconds)	7	Input variable per specification
Total Fixture Consumption (Wh)	0.323	Calculated operating specification
EMS Quiescent Current (Amps)	0.00796	Operating specification
24-hour Quiescent Energy Consumption (Wh)	2.29	24 hours x 12V battery voltage x sum of quiescent currents
Polara Bulldog Consumption (Wh)	0.10	
Passive Detection Consumption (Wh)	0.00	Includes Quiescent and Active Output with Button Press
Total 24-hour Energy Consumption (Wh)	**2.72**	Quiescent, Fixture(s) and Other loads

SYSTEM AUTONOMY:

Battery Capacity (Ah)	14	Operating specification - room temperature
Battery Low Voltage Disconnect (%)	10%	Operating specification
Battery Capacity (Wh)	151.2	Battery capacity (Ah) X 12 Volts X (1 - Battery LVD %)
Battery Capacity Temperature De-rate Amount	76%	Reduced capacity due to temperature effects
Temperature-Adjusted Battery Capacity (Wh)	115.5	Battery capacity X temperature de-rating factor
Total Daily Energy Consumption (Wh)	2.72	Restated from above
Autonomy (Days)	**42.5**	Adjusted battery capacity / daily energy consumption

ARRAY TO LOAD RATIO:

Energy Into the Battery (Wh)	17.23	Energy-in through the solar panel and EMS
Total Daily Energy Consumption (Wh)	2.72	Energy-out through the system
ALR (Energy In / Energy Out)	**6.3**	Recommended minimum = 1.2

DAILY DEPTH OF DISCHARGE:

Nominal Battery Capacity (Wh)	168	Battery capacity (Ah) x battery voltage (12V)
Daytime Energy drawn from Battery (Wh)	0.03	Energy-out through the system - daytime activations
Nighttime Energy drawn from Battery (Wh)	1.49	Energy-out through the system - nighttime activations
Total Energy Provided by Battery Only (Wh)	1.52	Total energy battery supplies system during a 24-hr cycle
24-Hour Battery Usage - Depth of Cycle %	**0.9%**	Daily Cyclical Battery Capacity Used

Glossary

12-Month Energy Budget: The amount of daily energy available during any month to run the system and charge the batteries plotted against the amount of daily energy used for a specified usage model - the "design load".

Hours per Day: The number of hours during the day that the beacons are flashing in response to a control signal from a time switch or other device.

Array-to-Load Ratio (ALR): Defined as the total system energy consumption (Energy-Out) divided into the net energy available to the system (Energy In) on a day during the worst month. It is an accepted industry practice to specify a minimum ALR of 1.2:1 in order to account for variability of sunlight energy over time. Providing a sufficient ALR will help ensure that the batteries will return to a full-state of charge at the end of each charging day.

Autonomy: The length of time (in days) that a system can function without sunlight (insolation). For autonomy calculations, net battery capacity is adjusted for the effect of temperature (during the worst month of sunlight) and low-voltage-disconnect (LVD) (see LVD definition below).

Battery Depth of Cycle/Depth of Discharge: The percentage of battery capacity used on a daily basis. This value considers times when sunlight can power LED fixtures directly, eliminating the need to draw from the battery. For lead-acid batteries, reducing the depth of discharge dramatically improves battery life. **Note:** For a system activated during the daytime only, the battery will power the system during dawn and dusk when insolation levels are lowest.

Daily Quiescent Energy: The passive energy drawn (measured in watt-hours) by a system when it is idle. This includes the power draw of the main circuit board (EMS), LED beacon loads, and a time switch (if present).

Energy-In: The total amount of useable energy collected by the solar panel during a 24-hour period. This value accounts for efficiencies between the solar panel and the battery, as well as shade de-rating. Efficiencies related to the charge controller and battery-charge acceptance are also factors.

Energy-Out: The total energy used by a system in a 24-hour period based on the stated number of activations per day. It includes Daily Quiescent Energy (see definition above)

Low-Voltage-Disconnect (LVD): The voltage at which the system will not flash when activated. LVD is a temporary state and is the result of too little sunlight or too many activations. LVD ensures that a minimal charge is retained in the battery to enable system recovery and to protect against permanent battery damage.

Location Shade De-Rating: Percentage of available sunlight blocked by buildings, trees and other objects. This factor is specific to the end user's site, which is why a system is always optimally sized when its exact final installation location is known or can be simulated.

Worst Month: The month with the least sunlight, coldest temperatures, and highest system load over 24 hours.

Energy Management System (EMS): The control module inside the Carmanah Solar Traffic Product responsible for all aspects of energy management and system control.

Maximum Power Point Tracking (MPPT): MPPT dynamically maximizes the amount of power the solar panel can produce by allowing the solar panel voltage to operate at its optimal point independentlof the battery voltage.

R920-E
RECTANGULAR RAPID FLASHING BEACON

carmanah® Traffic

MUTCD-compliant, pedestrian-activated warning beacon for uncontrolled marked crosswalks

- The R920-E is the benchmark for Rectangular Rapid Flashing Beacons (RRFBs)
- Ultra-efficient optics and Energy Management System (EMS)
- Compact design to simplify installation
- Proven technology platform
- Meets and exceeds MUTCD requirements, including IA-21

RRFBs have been found to provide vehicle yielding rates between 72 and 96 percent for crosswalk applications, including 4 lane roadways with average daily traffic (ADT) exceeding 12,000*.

Superior Design and Technology
The R920-E utilizes a self-contained solar engine integrating the Energy Management System (EMS) with an on-board user interface, housed in a compact enclosure together with the batteries and solar panel. MUTCD interim approval IA-21 flash pattern and multiple configurations enable the R920-E to handle all crosswalk applications.

Easy Installation
With its highly efficient and compact design, installation is quick and uncomplicated, dramatically reducing installation costs. Retrofitting can be done where existing sign bases are used to enhance existing marked crosswalks in minutes, and new installations can be completed without the cost of larger poles, new bases, and trenching.

Advanced User-Interface
The R920-E comes with an on-board user interface for quick configuration and status monitoring. It allows for simple in-the-field adjustment of flash pattern, duration, intensity, ambient auto adjust, night dimming, and many more. Settings are automatically sent wirelessly to all units in the system.

Reliable
Designed with Carmanah's industry-leading solar modeling tools to provide dependable year-after-year operation.

Trusted
With thousands of installations, Carmanah's beacons are the benchmark in traffic applications and other transportation applications worldwide.

WE SIMPLIFY PLANNING.
Contact us to get your Energy Balance Report and purchase specifications.

1.844.412.8395
traffic@carmanah.com
carmanahtraffic.com

REPRESENTED IN YOUR REGION BY:

* U.S. Department of Transportation Federal Highways Administration, Publication No. FHWA-HRT-10-043 - "Effects of Yellow Rectangular Rapid-Flashing Beacons on Yielding at Multilane Uncontrolled Crosswalks"

R920-E
RECTANGULAR RAPID FLASHING BEACON

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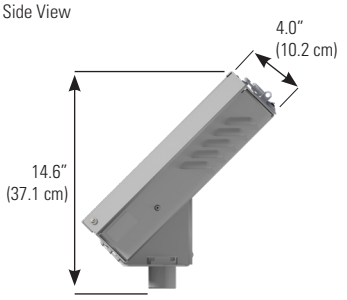
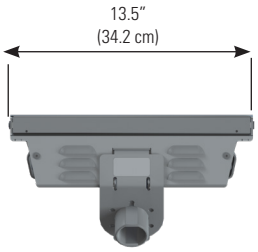
DIMENSIONS

Side View



Bottom View

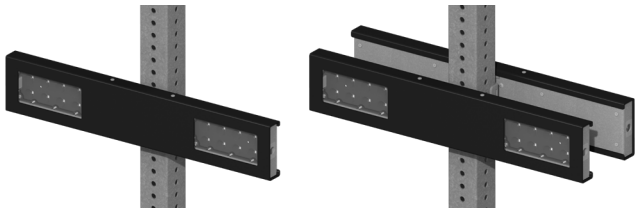


SOLAR ENGINE MOUNTING

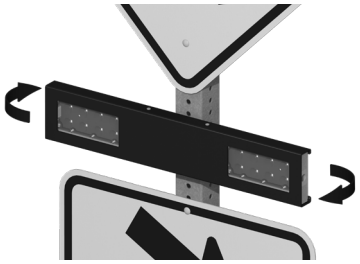
2.0"- 2.5" Perforated Square Pole Mount | 2.38" - 2.88" Diameter Round Pole Mount | 4.0" - 4.5" Diameter Round Pole Mount | Side Pole Mount

LIGHT BAR CONFIGURATION

Uni-directional Configuration | Bi-directional Configuration



IN-THE-FIELD AIMING



Rotate the light bar towards the incoming vehicle lane, independent of the wire hole location.

On-Board User Interface (OBUI)	Adjustable system settings with auto-scrolling LED display on our latest EMS
	System test, status, and fault detection: battery, solar, button, beacon, radio, day/night
	Flash patterns: RFB1 (WW+S), RFB2 (WSDOT), 0.5 sec. alternating (MUTCD), 0.5 sec. unison (MUTCD), 0.1 sec. unison, 0.25 sec. unison, 0.1 sec. x3 quick flashes unison, 0.1 sec. x3 quick flashes alternating
	Input: momentary for push button activation, normally open switch, normally closed switch
	Flash duration: 5 sec. to 1 hr.
	Intensity setting: 20 to 1400 mA for multiple RRFBs, circular beacons, or LED enhanced signs
	Nighttime dimming: 10 to 100% of daytime intensity
	Ambient Auto Adjust: increases intensity during bright daytime
	Automatic Light Control: reduces intensity if the battery is extremely low
	Temperature correction: yellow or red beacons
	Calendar: internal time clock function
	Radio settings: enable/disable, selectable channel from 1 to 14
	Output: enabled when beacons flashing daytime and nighttime, or nighttime only
	Activation counts and data reporting via OBUI or optional USB connection
Optical	MUTCD interim approval IA-21 and MUTCDC compliant
	Purpose-built light bar optics = maximum efficiency and no stray light Exceeds SAE J595 class 1 intensity by 2.5 to 3x when used as recommended Meets SAE J578 chromaticity
	3 in (76 mm) x 7 in (178 mm) clear, UV-rated polycarbonate lens with yellow LEDs
	High-power LEDs: +90% lumen maintenance (L90) based on IES LM-80
	Side-emitting pedestrian confirmation LEDs
	Independent, stainless steel mounting brackets make back-to-back installation simple and enable in-field aiming for maximum effectiveness
	Yellow, black, or green powder coated light bar covers
Connectivity	Encrypted, wireless radio with 2.4 GHz mesh technology
	Wireless update of settings from any unit to all systems on the same radio channel
	User-selectable multiple channels to group different beacons and ensure a robust wireless signal
	Communicates with all other Gen III radio-enabled systems including our R820-E, -F, and -G circular beacons
	Instantaneous wireless activation: <150 ms
	Wireless range: 1000 ft (305 m)
	Integrated, vandal-proof antenna
Energy Collection	13 W high-efficiency photovoltaic solar panel
	45 deg tilt for optimal energy collection
	Maximum Power Point Tracking with Temperature Compensation (MPPT-TC) battery charger for optimal energy collection in all solar and battery conditions
Energy Storage	12 V 14 Ahr. battery system
	Replaceable, recyclable, sealed, maintenance-free, best-in-class AGM batteries offer the widest temperature range and longest life
	Battery design life: +5 yrs.
	Tool-less battery change with quick connect terminals and strapping for easy installation
Solar Engine Construction	Weatherproof, gasketed enclosure with vents for ambient air transfer (NEMA 3R)
	Lockable, hinged lid for access to on-board user interface and batteries
	Corrosion-resistant aluminum with stainless steel hardware
	Raw aluminum finish or yellow, black, or green powder coated
	Prewired to minimize installation time
	High-efficiency optics and EMS = the most compact, lightweight system
	19 lb (8.6 kg) including batteries, excluding beacons and push button
Environmental	-40 to 165° F (-40 to 74° C) system operating temperature
	-40 to 140° F (-40 to 60° C) battery operating temperature
	150 mph (241 kph) wind speed as per AASHTO LTS-6
Activation	**Push button:** ADA-compliant, piezo-driven with visual LED and two-tone audible confirmation
Warranty	**5-year limited warranty**

Specifications subject to local environmental conditions, and may be subject to change.

All Carmanah products are manufactured in facilities that are certified to ISO quality standards.

Document: SPEC_TRA_R920-E_RevS