

# Roads Asset Management Plan

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February 2024



5395 Lakeshore Drive  
Bow Mar, CO 80123

Phone 303-795-2063

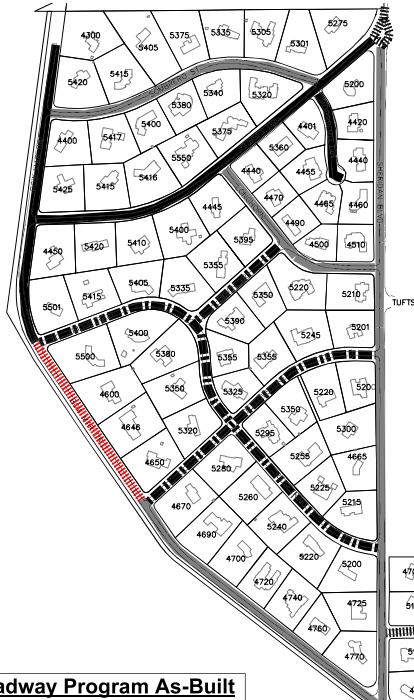
## Table of Contents

- An Inventory of Bow Mar's Roads
- Citizen Approved Funding in 2014 – Expiring in 2024
- Side Street Paving
- Main Arterial Paving
- Traffic Calming
- Pavement Maintenance Guidelines
- Proposed Funding for the Roads Asset Management Plan

## An Inventory of Bow Mar's Roads

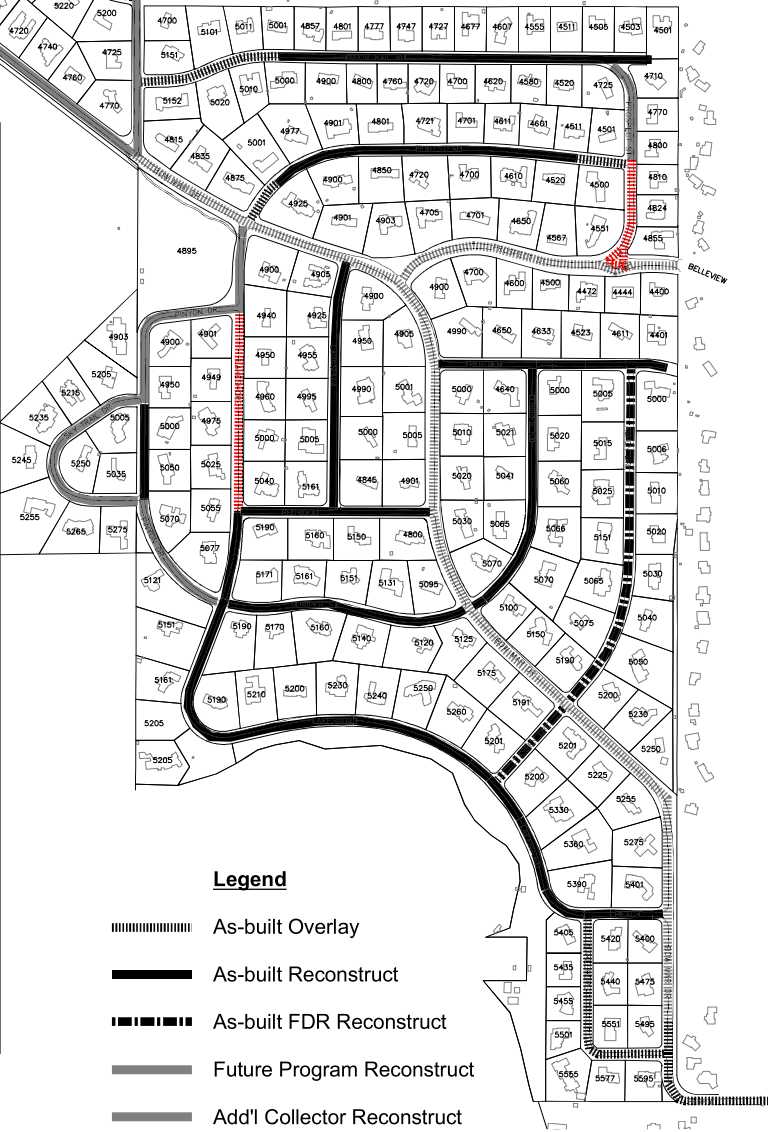
Beginning in the summer of 2023, the Town of Bow Mar ("Town") began a comprehensive analysis of the existing roadways, including techniques used to replace and maintain pavement throughout the Town to date. Miner & Company Ltd was engaged to create an overview of each road and the type of pavement that had been used, including the year of reconstruction or overlay. In addition to the type of roadway reconstruction implemented since 2014, the Town asked Miner & Company to also provide the number of lineal feet of each section of road within the community. The roadway pavement history compiled from 2014 by Miner & Company provides a base of information for which a future paving and maintenance plan has been created. The following exhibit provides the findings provided by Miner & Company for both the total lineal footage of road, pavement rehabilitation technique used, along with the identification of future roadway reconstructions not completed under the voter approved 2014 roadway plan.





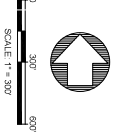
Maintenance Activity	Frequency (Years)
Reconstruct	0
Crack Fill	4
Slurry Seal	8
Mill & Overlay	16

2023.12 Roadway Program As-Built		
Year	Label	Quantity Unit
2015	Homestead	1,491 ft
2015	Homestead	461 ft
2015	Prospect Dr	682 ft
2015	Sheridan - N Entry	360 ft
2016	Bow Mar Dr	1,457 ft
2016	Bow Mar Dr	926 ft
2016	Lakeshore Dr	432 ft
2016	Lakeshore Dr	957 ft
2017	Lakeshore Dr	993 ft
2017	Wagontrail Rd	1,801 ft
2017	Wagontrail Rd	688 ft
2018	Larkspur Dr	1,203 ft
2018	Pinyon Dr	462 ft
2018	Redwood Dr	916 ft
2019	Beach Rd	381 ft
2019	Frontier St	1,108 ft
2019	Lakeshore Dr	237 ft
2019	Sombrero Cir	453 ft
2019	Sunset Dr	1,914 ft
2020	Lakeshore Dr	2,779 ft
2021	Bison Trail	545 ft
2021	Ridge Trail	2,259 ft
2021	Yellowstone St	1,357 ft
2022	Aspen Dr	2,144 ft
2022	Berry Ave	822 ft
2023	Juniper St	2,415 ft
2024	Longhorn Dr	940 ft
2024	Pinyon Dr	647 ft
2024	Sky Trail Dr	1,073 ft
2024	Sombrero St	1,353 ft
Future	Bow Mar Dr	1,513 ft
Future	Lakeshore Dr	419 ft
Future	Pinyon Dr	821 ft
Future	Prospect Dr	497 ft
Other	Bow Mar Dr	5,503 ft
Other	Prospect Dr	1,401 ft
Other	Sheridan Blvd	3,192 ft



**Legend**

- As-built Overlay
- As-built Reconstruct
- As-built FDR Reconstruct
- Future Program Reconstruct
- Add'l Collector Reconstruct
- Add'l Collector Resurface
- Maintenance Reconstruct



SCALE: 1" = 300'	DATE: 11/15/2023	DRAWN BY: JMM	<b>TOWN OF BOW MAR</b> <b>MAP EXHIBIT</b> <b>BOW MAR, COLORADO</b> Prepared for: <b>TOWN OF BOW MAR</b>
DATE: 11/15/2023	DESIGNED BY: JMM	DRAWING NAME: Bow Mar MASTER GIS MAP	
DATE: 11/15/2023	APPROVED BY: JMM	PROJECT NO.: EX.	

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SCALE VERIFICATION  
DATE: 11/15/2023  
BY: JMM

### Citizen Approved Funding in 2014 - Expiring in 2024

Ten years ago, the then current Bow Mar trustees presented a ballot option to residents to provide for a “pay as you go” road improvement program for 10 years. The ballot initiative was passed by the citizens of Bow Mar and 10 mills were assessed as part of property taxes to pay for an annual road rehabilitation program. The 10 mills will provide approximately \$465,000 to be used for road repair in 2024. 2024 is also the last year of the program before it sunsets later this year on December 31st. Property valuations can go both up and down and as a result, the annual funding for the road program based on the 2014 ballot initiative has varied by year since initiation.

Over the past 10 years, the trustees have used the bulk of the funding to do as much road rehabilitation and paving as possible. The 2014 streets rehabilitation program has been successful in achieving the pavement and rehabilitation of many of our Town’s roads. Despite the success of the last ten years, more work needs to be done but revenue for that work will expire this year.



## Side Street Paving

Currently, the following side streets that are still in need of rehabilitation and paving are as follows:

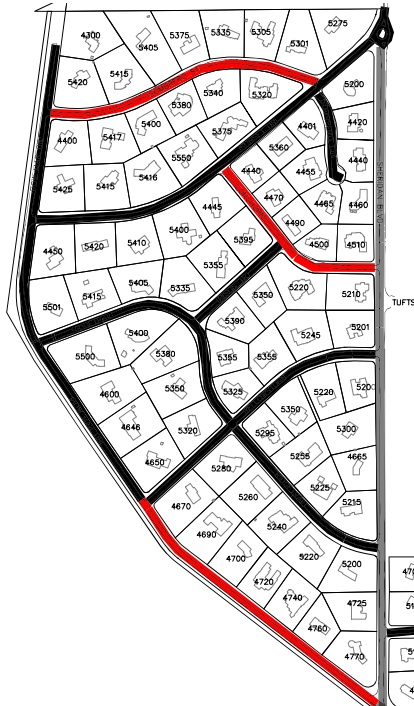
- Bow Mar Drive from Yellowstone to Sheridan
- Prospect from Homestead to Wagon Trail
- Lakeshore from Pinyon to Redwood
- Longhorn from Sunset to Sheridan
- Pinyon from Lakeshore to Juniper
- Sky Trail
- Sombrero from Bow Mar Drive to Sunset

Remaining main arterials, requiring rehabilitation and paving are as follows:

- Sheridan Boulevard from the town entrance to Bow Mar Drive
- Bow Mar Drive from Sheridan to the Berry curve.
- Prospect from Bow Mar Drive to Belleview

In 2024, the Town has budgeted approximately \$465,000 received from the final year of the 10-year, 10 mill road program for road rehabilitation and paving. This is projected to provide new paving of Sombrero, Longhorn, and potentially Sky Trail depending on final bids received by contractors later this year. Without a new funding source in 2025, the main arterials along with Bow Mar Drive from Yellowstone to Sheridan, Prospect from Homestead to Wagon Trail, and Pinyon from Lakeshore to Juniper will remain unpaved and unrehabilitated. A detailed map of the remaining roads requiring pavement has been provided by Miner & Company are outlined below. Per lineal foot estimated pavement costs are based on 2023 actual paving costs incurred by the Town and have been used to estimate the future road costs for the remaining roads not completed under the 2014 program.

## 2023.12 Roadway Program Status Update

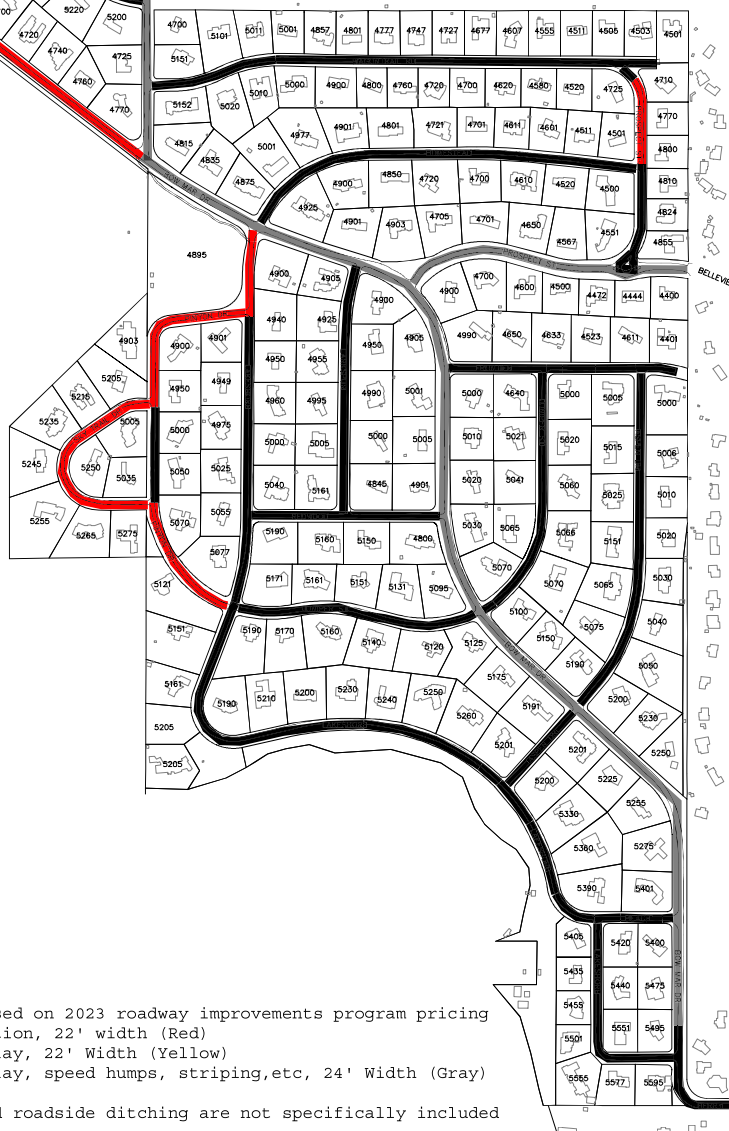


Year	Label	Quantity	Unit	Budget Estimate
Future	Bow Mar Dr	1,513	ft	\$217,872
Future	Lakeshore Dr	421	ft	\$60,624
Future	Longhorn Dr	940	ft	\$135,216
Future	Pinyon Dr	1,471	ft	\$211,824
Future	Prospect Dr	416	ft	\$59,904
Future	Sky Trail Dr	1,073	ft	\$154,512
Future	Sombrero St	1,353	ft	\$194,832

Total Estimate      7,187 LF      (\$1,034,784)

- 2024 Budget      \$ 465,827

Projected Budget Need      (\$ 568,957)



**NOTES:**

- \*Cost estimate updated based on 2023 roadway improvements program pricing
  - Full depth reconstruction, 22' width (Red)
  - Edge mill and 2" overlay, 22' Width (Yellow)
  - Edge mill and 2" overlay, speed humps, striping, etc, 24' Width (Gray)

\*Drainage improvements and roadside ditching are not specifically included

\*Included as Future Local Areas, omitted from original program plan  
 Pinyon: Sky Trail to Lakeshore, near tennis courts  
 Prospect: Wagon Trail to Homestead

\*Other Areas (Gray) omitted from original program plan:  
 Sheridan, Bow Mar Drive east of Sheridan, and Prospect from BMD to Belleview



SCALE: 1" = 300'  
 SHEET NO. EX.

DRAWN BY: DESIGNED BY: DRAWING NAME: BOW MAR MASTER GIS MAP APPROVED BY:	TOWN OF BOW MAR MAP EXHIBIT BOW MAR, COLORADO --- Prepared for: TOWN OF BOW MAR
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 FAX: 303.733.1101  
 WWW.MINERANDCOMPANY.COM

## Main Arterial Paving

In addition to the remaining uncompleted and unrehabilitated side streets contemplated under the 2014 roadway plan and funded by a 10-mill assessment approved by the voters, are the major arterials of Sheridan from the Town entrance to Bow Mar Drive, Bow Mar Drive from Sheridan to the Berry curve, and Prospect from Bow Mar Drive to the Belleview entrance. Conditions on these roadways continue to deteriorate, including the regular presence of potholes and alligatored pavement. Lineal footage calculations, and estimated cost for the pavement and rehabilitation of the major arterials is as follows:

Proposed Scope Label Measurement Unit Estimate

1- Reconstruct Sheridan Blvd 3,192 ft - \$510,720

2- Overlay Bow Mar Dr 5,503 ft - \$412,725

3- Overlay Prospect Dr 1,401 ft - \$105,150

Total Main Arterial Paving Projections - \$1,028,595





# Traffic Calming

Throughout the years, as Bow Mar's roadways have been maintained and paved, a variety of traffic calming measures have been periodically used to reduce cut through traffic. As the roadways have changed, some traffic calming measures in place are no longer even useful. For example, Bow Mar Drive currently has several speed bumps located at stop signs. Additional speed bumps have been placed periodically on the main arterials, but without an overall comprehensive plan. The entrance circle at Belleview lends itself to cut through traffic on Prospect leading to Wagon Trail. Sunset is also used as a cut through road to avoid existing traffic calming measures and speed enforcement activity on Sheridan. To create a uniform and more effective traffic calming approach to cut through traffic, the Town engaged David Evans and Associates to provide an analysis along with recommendations for more effective traffic calming within the community, including the main arterials. The Town also engaged Miner & Company to provide budget estimates for implementing the proposed traffic calming measures provided by David Evans and Associates. Miner & Company provided a budget of \$459,810 to implement the traffic calming measures recommended by David Evans & Associates. This number is contingent upon performing the traffic calming measures at the same time as the rehabilitation and repavement of the major arterials (i.e. Sheridan, Bow Mar Drive and Prospect). The complete report by David Evans and Associates provided to the Town is attached hereto.



DAVID EVANS  
AND ASSOCIATES INC.

## MEMORANDUM

DATE: February 19, 2024  
TO: Mayor Bryan Sperry; David Peterson, Public Works  
FROM: Stacy Tschuor, PE, PTOE; Hannah Polow, AICP  
SUBJECT: Recommendations for Improvements  
PROJECT: Bow Mar Traffic Calming and Multimodal Improvements  
CC: Jason Minor, PE, CPC

### Introduction

David Evans and Associates, Inc. (DEA) has worked with the Town of Bow Mar to provide traffic engineering and transportation design services since 2019. DEA completed the *Bow Mar Traffic Study Final Project Report* in November 2019, which summarized the evaluation of cut-through traffic and potential mitigation measures, with concepts for several traffic mitigation measures. In 2022, DEA provided final design plans for the West Berry Avenue Improvements project.

The Town of Bow Mar staff contacted DEA in January 2024 to provide review of existing traffic calming treatments and an evaluation of potential new treatments that could be installed to address speeding issues and reduce cut-through traffic volumes, as well as identification of potential multimodal improvements for the main arterial roadways. This memorandum describes the recommendations for traffic calming and multimodal improvements along key roadways in Bow Mar. Bow Mar and DEA staff collaborated to identify and evaluate potential improvements.

The potential traffic calming and multimodal improvements are typical treatments from neighborhood traffic programs and the evaluation is supported by traffic engineering and transportation planning experience with various jurisdictions in the Denver metropolitan area. The identified recommendations are based on information about existing conditions, operations, and circulation provided by Town staff. Further information may be necessary as part of a design process, including traffic counts, topographic survey, and community engagement.

### Traffic Calming

Bow Mar experiences non-resident, cut-through traffic primarily on the route of Sheridan Boulevard, Bow Mar Drive, and Prospect Street. As they cut-through the neighborhood, these drivers tend to travel substantially over the speed limit, creating safety concerns. The Town recently instituted a 20-mile per hour (mph) speed limit on all roadways, to help deter speeding and improve safety for neighborhood residents.

Traffic calming treatments are designed to slow drivers with small diversions, obstacles, and/or narrowed areas in the roadway travel path. The introduction of these treatments along routes also discourages cut-through traffic, as drivers lose the perception of time savings. Although not

guaranteed to slow drivers or reduce cut-through traffic, the treatments considered here have been studied and utilized by local agencies for many years with varied success.

### Potential Treatments

The following traffic calming treatments were initially considered for installation on Sheridan Boulevard, Bow Mar Drive, and Prospect Street. Traffic calming treatments were also considered on Bow Mar Drive/Sunset Drive and Wagontrail Road, because they are possible alternate routes taken by drivers to avoid the treatments on the main cut-through route.

#### Chicane

A chicane is a series of raised curbed areas on the edge of travel lanes that shift and narrow travel lanes, requiring drivers to steer around a curved area at a slower speed, as opposed to going straight through on a roadway. The visual narrowing and curves also convey the roadway is a local, slow-speed road.



#### Traffic Circle



A traffic circle consists of a raised curb area installed in the middle of an intersection that requires drivers to travel around the obstruction as they enter the intersection. This is similar to the concept of a roundabout, but with a smaller footprint and slower speeds, as appropriate for neighborhood intersections.

#### Corner Bulb-out or Corner Extension

Bulb-outs extend corners of an intersection to narrow the roadway width at the intersection approach and reduce the radii of the intersection corners, reducing the speed of turning drivers. These corner extensions may also help delineate the preferred vehicular movements at the intersection.



## Speed Bump



Speed bumps are additional asphalt with a substantial vertical deflection (i.e., a bump) installed across the width of the roadway that forces drivers to slow down to travel over. Speed bumps are generally installed in series along a roadway. Studies have shown that speed bumps installed at spacings of 260 to 600 feet provide optimal speed reduction along the length of a roadway.

## Raised Pedestrian Crossing

A raised pedestrian crossing is a vertical deflection (i.e., a bump) at a striped pedestrian crossing location that forces drivers to slow down to travel over. The crosswalk is striped across the flattened top of the raised area. The raised crossing provides additional warning to drivers of the potential presence of pedestrians and bicyclists and also improves visibility of pedestrians and bicyclists crossing the roadway.



## Pinch Point



A pinch point is a series of two curbed areas on the edge of travel lanes that narrow the usable travel width to only allow for one-way traffic. This slows drivers to navigate the one-way section and also may convey the roadway is a local, slow-speed road.

## Traffic Diverter

A traffic diverter is a series of curbed islands in the middle of the roadway at an intersection that force or prohibit certain traffic movements, such as forcing all traffic to make a right turn or prohibition of left turns. The limitation of certain movements eliminates cut-through traffic, but also impacts access for neighborhood residents.



## Recommendations

The following tables provide recommendations for existing and/or new traffic calming treatments on the primary cut-through routes of Sheridan Boulevard, Bow Mar Drive, and Prospect Street, as well as the potential secondary cut-through routes of Bow mar Drive/Sunset Drive, and Wagontrail Road. The tables summarize the recommendations by roadway section and intersections.

### Recommended Traffic Calming Treatments -Sheridan Boulevard

Location along Sheridan Blvd	Recommendation	Notes
North of traffic circle with Sunset Dr (entering town)	Speed limit sign - southbound Sheridan Blvd	Identifies 20-mph speed limit through town
South of traffic circle with Sunset Dr	Replace existing speed bump	Existing speed bump effective in slowing traffic
Between Sunset Dr and Longhorn	Add speed bump	Slows traffic with speed bumps at approximately 500-foot spacing
Between Yellowstone and Ridge Trail	Replace existing speed bump	Existing speed bump effective in slowing traffic
Between Wagontrail Rd and Bow Mar Dr	Replace existing speed bump	Existing speed bump effective in slowing traffic
Sheridan Boulevard and Bow Mar Drive Intersection	Corner extension on northeast corner to realign intersection and tighten radii	Realigning the intersection will slow speeds for westbound right turn southbound left turn and encourage full stops at stop signs
	Raised crosswalk across west leg	Raised crosswalk will slow traffic and connect pedestrians to path along south side of Bow Mar Drive
	Chicane	Locate between Sheridan Blvd and first driveway as a visual cut-through deterrent for westbound traffic

### Recommended Traffic Calming Treatments -Bow Mar Drive East of Sheridan Boulevard

Location along Bow Mar Dr	Recommendation	Notes
Bow Mar Drive and Lakeshore/Homestead Intersection	Raised crosswalk across west leg	Raised crosswalk will slow traffic and increase visibility and warning of pedestrians at school bus stops with connection to path
Between Lakeshore/Homestead and Larkspur	Replace existing speed bump	Existing speed bump effective in slowing traffic
Bow Mar Drive and Prospect Street	Remove speed bumps on north and south legs of intersection	Intersection is already stop controlled and speed bump may interfere with stop compliance
Bow Mar Dr and Beach Rd	Remove speed bumps on south leg of intersection	Intersection is already stop controlled and speed bump may interfere with stop compliance

**Recommended Traffic Calming Treatments - Prospect Street East of Bow Mar Drive**

Location along Prospect St	Recommendation	Notes
East of intersection with Bow Mar Drive	Replace existing speed bump	Existing speed bump effective in slowing traffic
West of traffic circle	Replace existing speed bump	Existing speed bump effective in slowing traffic
East of traffic circle	Add speed bump	Slows traffic entering town
Prospect Street and Belleview Drive Intersection (existing traffic circle)	Corner extension on northeast corner to realign intersection and tighten radii (with removal of median on east leg)	Realigning the intersection will slow speeds and discourage right turn to Wagontrail Rd for unfamiliar drivers
	Chicane	Locate on Prospect St north of existing traffic circle as a visual cut-through deterrent

**Recommended Traffic Calming Treatments - Bow Mar Drive and Sunset Drive West of Sheridan Boulevard**

Location along Bow Mar Dr/Sunset Dr	Recommendation	Notes
Bow Mar Dr between Sheridan Blvd and Yellowstone	Add speed bump	Slows traffic with speed bumps at approximately 500-foot spacing
Bow Mar Dr between Yellowstone and Sunset Dr	Add speed bump	Slows traffic with speed bumps at approximately 500-foot spacing
Sunset Dr between Bow Mar Dr and Longhorn	Add speed bump	Slows traffic with speed bumps at approximately 500-foot spacing
Sunset Dr west of Sheridan Blvd	Chicane	Locate between Sheridan Blvd and first driveway as a visual cut-through deterrent

**Recommended Traffic Calming Treatments - Wagontrail Road East of Sheridan Boulevard**

Location on Wagontrail Rd	Recommendation	Notes
East of Sheridan Blvd	Chicane	Locate east of Sheridan Blvd as a visual cut-through deterrent

## **Treatments Considered and Not Recommended**

The following traffic calming treatments were considered at intersections, but are not recommended at this time:

- Corner Extensions at Sheridan Boulevard and Tufts Avenue Intersection - The intersection already has relatively tight turning radii and the design and construction of corner extensions would be difficult due to the layout of the sidewalk connections to the east.
- Traffic Circle at Bow Mar Drive and Lakeshore/Homestead Intersection - A traffic circle has the potential to negatively impact school bus and neighborhood delivery truck movements. The raised crosswalk recommended across the west leg of the intersection will slow traffic without the impacts to those movements.
- Traffic Circle at Sunset Drive and Sombrero Street and Sombrero Circle Intersection - The side streets are offset intersecting with Sunset Drive and a traffic circle would require realigning roadways with potentially substantial private property impacts. The chicane recommended on Sunset Drive west of Sheridan Boulevard will slow traffic and discourage cut-through traffic without those property impacts.

## **Implementation**

The recommended traffic calming treatments can be effective in reducing cut-through traffic volumes and reducing travel speeds. However, the treatments would also impact resident travel. Therefore, phased installation of the treatments may be used to reduce cut-through traffic volumes and speeds on the main route while minimizing impacts to residents. The phased installation would require collecting traffic counts on all of the routes (primary and secondary cut-through routes) before and after construction.

It is recommended to first install the traffic calming treatments on the primary cut through routes (Sheridan Boulevard, Bow Mar Drive between Sheridan Boulevard and Prospect Street, and Prospect Street). Approximately three to six months after those treatments are completed, the Town may monitor traffic counts and speeds to see if traffic volumes have increased on the secondary cut-through routes (Bow Mar Drive/Sunset Drive west of Sheridan Boulevard and Wagontrail Road east of Sheridan Boulevard). If it is determined that traffic volumes on the secondary routes have increased due to drivers avoiding the traffic calming treatments on the primary routes, the Town may consider installing the recommended traffic calming treatments on those secondary routes as well.

## **Multimodal Improvements**

The Bow Mar roadway network does not include pedestrian and bicyclist facilities, such as sidewalks or bike lanes, except for a separated multi-use path along the south side of Bow Mar Drive west of Lakeshore. Therefore, residents walk and bike along the roadways, either within or next to the paved roadway area. The main arterial roadways of Sheridan Boulevard and Bow Mar Drive (east of Sheridan Boulevard) are generally 24 feet wide with no pavement markings. With the vehicular traffic volumes and speeds along these arterials, multimodal travel can be uncomfortable.

## **Potential Improvements**

The following potential multimodal improvements for the main arterial routes were discussed with Town staff:

- Roadway widening to provide striped bike lanes (at least five-feet wide) on each side of the roadway
- Roadway widening to provide five-foot shoulders on each side of the roadway that could be utilized by pedestrians and bicyclists
- Narrowing travel lanes with new edge lines to delineate the vehicular travel area without pavement widening

It was discussed that new pavement markings with a centerline and edge lines would look too urbanized and may actually increase driver speeds. Roadway widening would likely have property impacts and a wider pavement area for full shoulders and/or bike lanes could also lead to higher vehicular speeds, contrary to the Town's goals of traffic calming.

## **Recommendations**

To minimize property impacts and the potential for higher vehicular speeds, it is recommended to keep the roadway pavement area generally as wide as it exists but add new edge lines with narrowed travel lanes. Striping the roadway edge lines from the crown of the pavement with ten-foot travel lanes would provide approximately a two-foot shoulder area on each side of the roadway. However, the existing roadway pavement is not necessarily a consistent width, so the shoulder area created with the edge lines would not be a consistent width.

The narrowed travel lanes will encourage slower speeds and the edge lines will improve delineation of the vehicular travel area. Although no formalized pedestrian and/or bicyclist facility is provided, the edge line will improve the multimodal travel conditions from the existing situation. No center line striping is recommended, to maintain the non-urbanized character of the neighborhood. A minimum lane width of 9.5 feet must be maintained with recommended ten-foot lanes, where possible.

In the future, a separated sidewalk or multi-use path could be implemented along sections of the roadways with high multimodal use and connections to other facilities and/or routes. This would create a more comfortable and safe multimodal facility.

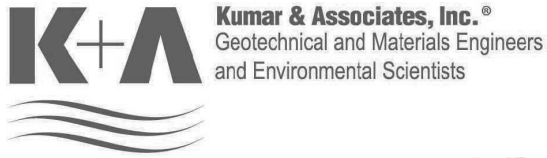


# Pavement Maintenance Guidelines

Over the past 10 years, the Town has made considerable investments in the rehabilitation and replacement of a number of our Town roads. It is important that these roads are now properly maintained. Up to this point, the Town has used the bulk of the road funding to pave and rehabilitate our streets. These assets need to be maintained to achieve 15 years or more of useful life. Within the past five years, including the last two, the Town has taken a more comprehensive approach to the rehabilitation and paving of roads. This has included the milling and replacement of much of the existing road base to provide a stable foundation now and in the future for our roads. Prior to 2014, road maintenance typically relied on a several inch overlay on top of a failing base. Adequate funding for the proper maintenance of the roads at the time was simply unavailable. Within a year or two, this type of repaving began to fail requiring additional work. With the current techniques being used by the Town today, a strong road foundation has been created that will allow for a successful mill and overlay when the current roads reach the end of their useful life sometime after 15 years from installation. For the purposes of the Town's analysis, a 16-year useful life for a section of road has been used. During the projected 16-year life of a road within our community, the Town, as part of the comprehensive roads asset management plan, has projected and budgeted for the following maintenance cycles.

- Yearly visual inspection of the Town's roadways, including yearly crack filling with an average crack rehabilitation of all roads being performed every four years.
- Perform a slurry seal, approximately eight years from the time of pavement install. A slurry seal is a mixture of asphalt, emulsion, aggregate, water, and additives applied to an existing asphalt pavement surface.
- Continued annual visual inspection and crack ceiling to complete an additional crack filling of the roads between 8 and 12 years from their installation.
- Following 16 years from the installation and rehabilitation of a road, a 2-inch mill and overlay would be performed on the road to provide another 16 years of useful life, and a repeat of the maintenance procedures and frequencies above.

A copy of the Kumar & Associates report outlining proper maintenance standards for our roads dated December 22, 2023, is attached along with annual maintenance projections prepared by Miner & Company of approximately \$256,508.



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December 22, 2023

Miner & Company, Ltd.  
Attn: Mr. Jason Miner, P.E.  
12600 West Colfax Avenue, Suite A-140  
Lakewood, Colorado 80215

Subject: Geotechnical Engineering Consultation Services, Town of Bow Mar Pavement Maintenance, Town of Bow Mar, Colorado

Project No. 23-1-754

Dear Mr. Miner:

The purpose of this letter is to provide general guideline recommendations for pavement maintenance of the Town of Bow Mar roadways.

Project History: Over the last 10 years, The Town of Bow Mar (Town) has been improving the conditions of its roadways under a "Roadway Maintenance Program." As of 2024, the Town is entering into the last year to the program and has requested guideline recommendations on pavement maintenance to best preserve and maintain the Town roadways. Kumar & Associates, Inc. (K+A), along with your guidance have been involved with the program since inception.

During the program, the majority of the Town roadways were either rehabilitated or reconstructed with the exception of Sheridan Boulevard, Prospect Street, and portions of Bow Mar Drive. The program included traditional reconstruction, reconstruction through full-depth reclamation (FDR), or rehabilitation via mill and overlay. A map of the completed pavement maintenance and proposed maintenance for 2024 was generated by Miner & Company, Ltd., and is attached herein.

Pavement Maintenance Recommendations: Routine pavement maintenance is critical to preserving and prolonging the serviceable life of the Town pavements. The following guideline recommendations are based on our experience and review of existing pavement maintenance plans generated by local Colorado municipalities such as the Metropolitan Government Pavement Engineers Council (MGPEC) and others. The recommendations provided herein are meant to be guideline recommendations that should be adjusted and/or modified based on the pavement condition at the time of the proposed rehabilitation. Judgment and visual observations of the pavements should be taken into account when selecting maintenance.

**Yearly Frequency** - We recommend the Town implement a yearly visual inspection of the Town roadways to evaluate the current condition of the pavements. Any failed pavements should be addressed as soon as feasible. Additionally, we recommend the Town perform a yearly crack sealing program. We recommend mastic for crack sealing. Mastic is a heat-applied asphalt binder containing aggregate with good load bearing and skid resistant properties. Preparation of the cracks should include removal of dirt, dust, loose, or broken pavement, and other debris within the cracks by compressed air. Existing vegetation should be eliminated by application of

an herbicide prior to application of mastic crack filler to improve adhesion and allow for a better seal between the mastic and existing pavement. The type of mastic will be based on environmental factors and should be determined by the contractor. We recommend a mastic suited to cover a wide range of temperatures.

Prior to sealing, all cracks should be cleaned as described above. A thin surface grinding treatment may be required to remove the buildup of tar from previous crack sealing operations.

**5 to 10 Year Frequency** – Every 5 to 10 years, depending on the conditions of the pavement, we recommend the Town perform a slurry seal on the residential roadways and a chip seal on the main Town roadways. We understand the Town has some concerns about the migration of aggregate chips from a chip seal migrating into adjacent landscaping. A slurry seal will also be suitable for use on the Town main roadways if the slurry seal is preferred over a chip seal.

A slurry seal is a mixture of asphalt emulsion, aggregate (smaller crushed road), water, and additives applied to an existing asphalt pavement surface. The purpose of the slurry seal is to seal the pavement surface to attempt to preserve and protect the underlying pavement as well as to provide a new wearing/driving surface. The slurry seal helps to reduce water penetration into the pavement structures and can correct minor deformations in the pavement. The slurry seal will also provide an aesthetic black surface.

Similar to a slurry seal, a chip seal consists of a thin layer of heated asphalt liquid spread onto the pavement surface with small aggregate (chips) with a maximum aggregate size of 3/8-inch is then poured on the asphalt liquid. The chips are compacted by rubber-tired rollers to orient the chips and obtain maximum adherence to the asphalt liquid. The excess chips are usually swept/removed from the surface. Several sweepings may be required to remove the loose chips. The purpose of a chip seal is similar to the slurry seal with the added benefits of a highly-skid resistant surface provided by the chips as well as the chip seal provides anti-glare surface during wet weather and can provide an increased reflective surface for night driving.

**15+ Year Frequency** – Every 15+ years or so, depending on the pavement condition, we recommend performing a mill and overlay. The milling operation consists of the removal a portion of the upper section of the pavement structures and replacement with new asphalt pavement. Prior to placement of the new asphalt pavement on the milled surface, the milled surface should be swept clean and tack should be applied to the cleaned surface. For budgeting purposes, we recommend assuming some about of patching will need to be performed after the mill to replace any very poor condition or failed asphalt areas. Additionally, cracks present after milling should be sealed in accordance with industry standards. K+A can provide guidance on crack sealing of a milled surface prior to overlay if/when the Town requires. For budgeting and planning we recommend assuming a mill depth and overlay thickness of 2 inches. This depth/thickness should be suitable to remove the majority of the pavement surficial distresses. Edge milling may also be feasible depending on the roadway and shoulder conditions. Asphalt mixes of SX (75) PG 64-22 or SX (75) PG 58-28 should be considered for the overlay asphalt pavements.

**Reconstruction** – If a roadway is determined to need reconstruction, the reconstruction should consist of either traditional reconstruction or full depth FDR reconstruction as previously performed in the Roadway Maintenance Program. We recommend the Town budget for some subgrade remediation to address poor or soft subgrade conditions. The subgrade remediation could consist of overexcavation, moisture-conditioning (wetting or drying), and recompaction, or improvement via replacement with a higher quality material such as aggregate base course.

During reconstruction projects, we recommend drainage improvements be performed where feasible and necessary.

Existing Maintenance Program Roadways: It should be noted that some of the roadways rehabilitated via mill and overlay (not reconstruction) as part of the 10-year Roadway Maintenance Program will likely need to be reconstructed at some point, then placed on the recommended pavement maintenance schedule.

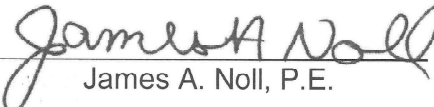
Limitations: This letter has been prepared for exclusive use by the client for planning purposes. The conclusions and recommendations submitted in this letter are based upon our understanding and interpretation of the pavement and subsurface conditions in the site vicinity, and the proposed type of construction K+A is not responsible for liability associated with interpretation by others of the assumed conditions described in this letter.

If you have any questions, or if we can be of further assistance, please contact us.

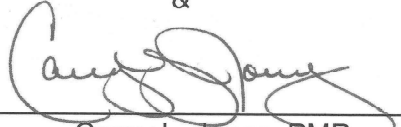
Sincerely,  
KUMAR & ASSOCIATES, INC.  
Justin Cupich, P.E.



Reviewed By

  
James A. Noll, P.E.

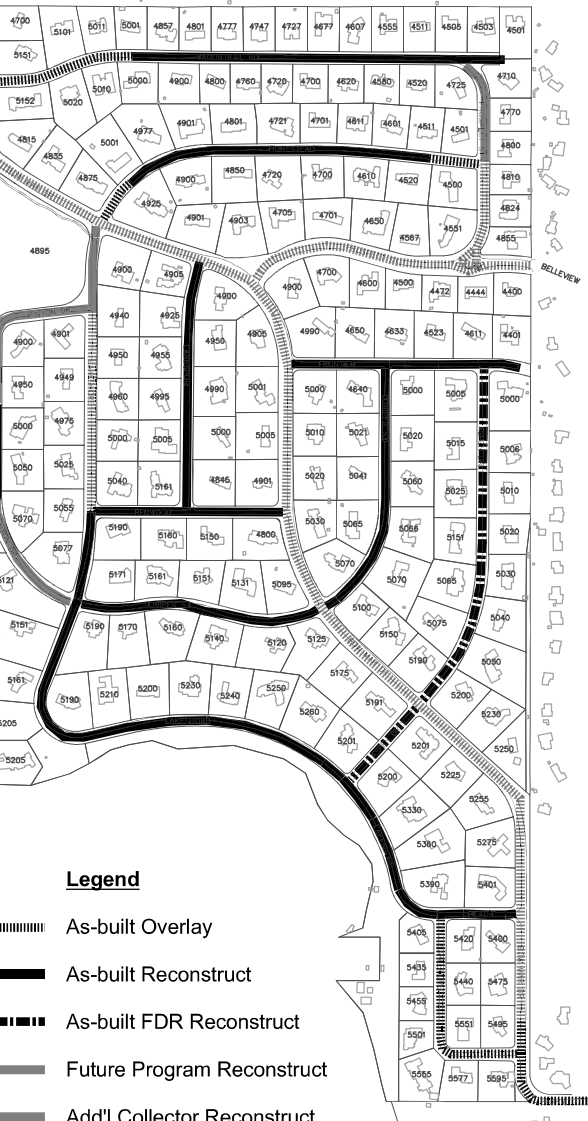
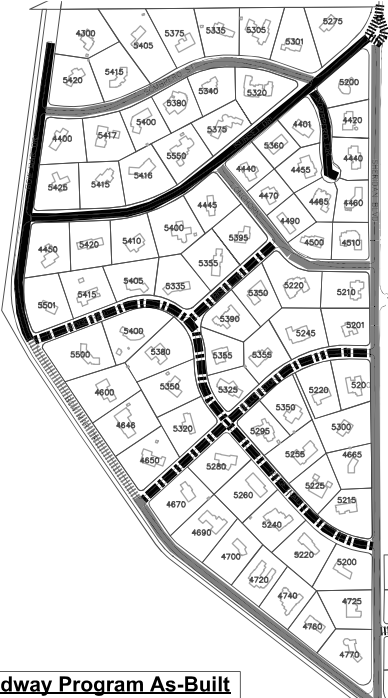
&

  
Carey L. Jones, PMP

JDC/mm  
Rev. by: JAN/CLJ  
cc: File

## Maintenance Program Activities

Maintenance Activity	Frequency (Years)	Estimate per Occurrence	Occurrences	Budget Estimate	Lifecycle (Years)	Annualized Budget
Reconstruct	0	\$ 369,360	1	\$ 369,360	16	\$ 23,085
Crack Fill	4	\$ 105,366	3	\$ 316,097	16	\$ 19,756
Slurry Seal	8	\$ 521,104	1	\$ 521,104	16	\$ 32,569
Mill & Overlay	16	\$ 2,897,560	1	\$ 2,897,560	16	\$ 181,097
<b>Total</b>				<b>\$ 4,104,121</b>		<b>\$ 256,508</b>
Maintenance Cycle (Years)					16	
Annualized Estimate				\$ 256,508		



### 2023.12 Roadway Program As-Built

Year	Label	Quantity	Unit
2015	Homestead	1,491	ft
2015	Homestead	461	ft
2015	Prospect Dr	682	ft
2015	Sheridan - N Entry	360	ft
2016	Bow Mar Dr	1,457	ft
2016	Bow Mar Dr	926	ft
2016	Lakeshore Dr	432	ft
2016	Lakeshore Dr	957	ft
2017	Lakeshore Dr	993	ft
2017	Wagontrail Rd	1,801	ft
2017	Wagontrail Rd	688	ft
2018	Larkspur Dr	1,203	ft
2018	Pinyon Dr	462	ft
2018	Redwood Dr	916	ft
2019	Beach Rd	381	ft
2019	Frontier St	1,108	ft
2019	Lakeshore Dr	237	ft
2019	Sombrero Cir	453	ft
2019	Sunset Dr	1,914	ft
2020	Lakeshore Dr	2,779	ft
2021	Bison Trail	545	ft
2021	Ridge Trail	2,259	ft
2021	Yellowstone St	1,357	ft
2022	Aspen Dr	2,144	ft
2022	Berry Ave	822	ft
2023	Juniper St	2,415	ft
Future	Bow Mar Dr	1,513	ft
Future	Lakeshore Dr	419	ft
Future	Longhorn Dr	940	ft
Future	Pinyon Dr	1,468	ft
Future	Prospect Dr	497	ft
Future	Sky Trail Dr	1,073	ft
Future	Sombrero St	1,353	ft
Other	Bow Mar Dr	5,503	ft
Other	Prospect Dr	1,401	ft
Other	Sheridan Blvd	3,192	ft

### Legend

- As-built Overlay
- As-built Reconstruct
- As-built FDR Reconstruct
- Future Program Reconstruct
- Add'l Collector Reconstruct
- Add'l Collector Resurface
- Maintenance Reconstruct



SCALE: 1" = 300' SHEET NO. EX.	<b>TOWN OF BOW MAR</b> <b>MAP EXHIBIT</b> <b>BOW MAR, COLORADO</b> Prepared for: <b>TOWN OF BOW MAR</b>		<b>REVISIONS</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>NO.</th> <th>DESCRIPTION</th> <th>DATE</th> <th>BY</th> </tr> </thead> <tbody> <tr><td>1</td><td></td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td><td></td></tr> </tbody> </table>	NO.	DESCRIPTION	DATE	BY	1				2				3				4				5				<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p style="margin: 0;">72 HOURS BEFORE YOU GO CALL THE UTILITY NOTIFICATION CENTER OF COLORADO (800.662.811)</p> </div> <p style="font-size: 8px; margin-top: 5px;">GAS, ELECTRICAL, TELEPHONE, CITY AND FIRE DEPARTMENT, WATER, SUTHERLAND PIPELINE LOCATIONS</p>
NO.	DESCRIPTION	DATE	BY																									
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## Proposed Funding for the Roads Asset Management Plan

Projected cost summaries for this comprehensive road asset management plan as provided by Miner & Company along with David Evans and Associates along with Kumar & Associates are summarized as follows:

Projected 2025 side streets pavement and rehabilitation	\$568,957
Projected traffic calming enhancements	\$459,810
Projected major arterial pavement and rehabilitation	\$1,028,595
<u>Contingency</u>	<u>\$142,638</u>
Total Projected Cost	\$2,200,000

One of the difficulties of a “pay as you go” type of pavement management plan is costs fluctuate year to year. Over the past several years, the Town has seen tremendous inflationary price increases for the installation of asphalt. To overcome this variable the Town, through ballot issue 2A, on the April 2, 2024 election ballot, will ask the voters to approve up to \$2,200,000 for the issuance of municipal bonds to pay for the pavement and rehabilitation of side streets not completed under the 2014 ballot initiative, traffic calming enhancements, and pavement of the major arterials. Using a “pay as you go” method would not provide the adequate funds all at once needed to complete the road as one project, lock in prices today, and allow for competitive pricing by increasing the size of the project, making it more attractive to additional bidders.

Ballot initiative 2B on the April 2, 2024 election ballot will ask the voters to extend/renew the existing 10 mills used under the 2014 ballot initiative for roadway pavement and rehabilitation. This extension will provide the funding not only for the repayment of the issued municipal bonds used to complete the pavement of our roads, but also pay for the interest, principal repayment, and ongoing projected maintenance cost of approximately \$256,508 annually, to maintain and rehabilitate (on 16-year cycles) to the pavement that has been installed over the past 10 years. Should costs be less than the projected amount as estimated above by the Town’s consulting engineers, then the trustees will have the ability to reduce or even eliminate the 10 mills used for the roads and in such a case, would result in a tax reduction for the citizens of Bow Mar. In addition, the proposed funding provisions of ballot issues 2A and 2B, provided by the renewal of the existing 10 mills, may only be used for the maintenance and paving of roads and for no other purpose.

This will ensure that the funds are used only for their intended purposes now and into the future.