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## 2021 PAVEMENT REPORT UPDATE

High Forest Ranch Subdivision

El Paso County, Colorado

PREPARED FOR:

High Forest Ranch Homeowners Association  
3578 Hartsel Dr, Unit E338  
Colorado Springs, CO 80920

JOB NO. 182965

July 19, 2021

Respectfully Submitted,

RMG – Rocky Mountain Group

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Sr. Principal Engineer



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# 2021 - GENERAL PROJECT OBJECTIVES

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## Overview

Pursuant to our proposal, dated May 10, 2021, RMG-Rocky Mountain Group is pleased to assist High Forest Ranch Homeowners Association (HFR HOA) with the ongoing evaluation of pavement conditions throughout your roadway network. Our current services are intended to provide an update on the roadway conditions as described in our 2019 Pavement Condition Report (PCR), and provide additional thoughts and proposed actions regarding the long-term maintenance of the asphalt roads.

For this 2021 update, RMG has been requested to comment on:

- Small area repair techniques, including estimated depth/thickness of repair and need for slurry seal over repaired areas.
- Crack sealing/filling techniques
- Update 2019 Pavement Management Program spreadsheet incorporating observed current conditions and recent work completed.
- Develop recommendations regarding relative road replacement types such as chip/Cape seal, mill and overlay, and full depth repair.

## Background

In 2019, RMG completed a subdivision-wide evaluation of the HFR roadway network. The findings of this evaluation were presented in the 2019 PCR. A matrix of roadway segments, anticipated pavement life, estimated remaining pavement life, and recommended repair/rehabilitation measures was created, and included, as part of that PCR.

Nathan Dowden, PE, performed a site visit on June 3, 2021. An onsite meeting with representatives of HFR HOA was conducted to discuss overall pavement conditions. Observations of pavement conditions of the roadways were performed on June 3<sup>rd</sup>.

## Considerations

The purpose of a roadway pavement is to create a durable, all weather, and smooth roadway surface for vehicular traffic. A quality pavement surface is expected to withstand weather and climatic conditions, facilitate drainage away from the travel surface, reduce the maintenance effort to maintain an effective roadway system, and provide a smooth and safe surface for operation of motor vehicles and other modes of transportation.

A mutual challenge presented in these criteria is achieving this while remaining within the budgetary realities of the owning agency. In this case, the owning agency is HFR HOA.

# PAVEMENT CONDITIONS, 2021

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## Overall Conditions

In general, the overall condition of the HFR roadway pavements are as described in RMG's 2019 PCR. Ongoing maintenance, primarily consisting of crack sealing and localized patches has been completed on some roads. In general, the roadway pavement conditions can be subjectively described as "fair to good".

As traffic loading is light, consistent with rural residential local road usage, and no significant truck traffic is ongoing throughout HFR, the primary factors impacting roadway pavements are environmental/climatic and intrinsic material properties of the asphalt pavements.

## Specific Area Conditions

- Mountain Dance/Open Sky Way  
Significant repairs have been completed on Open Sky Way since 2019. Additionally, "mill and overlay" operations were completed for portions of Mountain Dance. We understand that both "full depth repairs" as well as "mill and overlay" operations were completed. New asphalt pavement thicknesses are reported as being 4" to 6" in depth.

Structurally, no failing nor deteriorated areas were noted throughout these roadway segments during our recent observations. The finished roadway surface is not smooth, having a discernible unevenness in roadway surface, and does not provide a comfortable ride in an automobile at standard driving speed.

- Lodge Parking Lot  
The Lodge Parking Lot has had repairs completed although it shows areas of deteriorated pavement surfaces consistent with basecourse/subgrade failures in repaired areas.
- Hwy 83/High Forest Road Entrance  
Significant repairs have been completed to the High Forest Road entrance off of CO Hwy 83. Drainage improvements and reconstruction of the concrete gate area were included in this work. The conditions appear to be "good to excellent".

# REPAIR/REHABILITATION TECHNIQUES

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## Concepts

Pavement maintenance activities can be separated into two primary categories consisting of "preventative maintenance" and "corrective maintenance". Preventative maintenance may be described as those activities such as minor crack sealing, undertaken for pavements that are in good condition in order to forestall pavement distress. Corrective maintenance are those activities,

such as “full depth pothole repairs”, that are undertaken to repair distress to a localized area of pavement surface.

Rehabilitation differs from “repairs” in that it is more extensive and comprehensive, typically major work to an entire roadway segment that has reached the end of useful service. Rehabilitation can also include comprehensive repairs where the cost/benefit of numerous localized “corrective maintenance” operations exceed the cost of performing rehabilitation activities for the entire roadway segment.

Development and implementation of a Pavement Maintenance program should be based on an identified and established prioritization basis. Factors influencing priority may include:

- Usage of the roadway segment
- Age of pavement
- Funding availability
- Existing condition of the pavement
- Users aesthetic desires

In pavement maintenance, one model that is often implemented is to prioritize preventative maintenance for roads that are in good condition, as it is less costly to maintain pavements that are in good condition in order to prevent deterioration necessitating more costly corrective maintenance.

### **Small Area Repairs**

As documented in the 2019 PCR, several areas throughout HFR are experiencing block cracking, alligator cracking, and numerous utility street cut patches are exhibiting settlement. As traffic loading (e.g. heavy trucks) is relatively light throughout HFR, most of the block and alligator-cracked areas are remaining without loss of pavement “chunks”. Where cracking results in loss of pavement blocks, such that potholes form, these areas should be prioritized for full-depth repairs.

In general, the pavement mat (the asphalt pavement materials comprising the roadway surface) throughout HFR consists of 3” to 5” of asphaltic pavement. Where full-depth repairs are required, it is recommended that the repair area extend a minimum of 1 foot beyond the limits of the cracked area to provide for joining the replacement asphaltic materials to sound pavements. Replacement asphalt pavement thicknesses should be a minimum of 5 inches.

In general, following removal of damaged asphalt pavement during the repair procedure, additional subgrade material may require stabilization. If the subgrade is soft or unstable, removal of the subgrade will be required to a minimum depth of 6 inches below the bottom of the replacement asphalt. Compacted basecourse materials should be placed and compacted in lieu of the unsuitable subgrade.

### **Crack Sealing/Crack Filling**

Crack sealing can typically be completed for longitudinal or transverse cracks up to approximately 1 inch in width. Where cracks exceed 1 inch in width, crack filling is typically required. Crack

filling may utilize a fine-graded hot mix asphalt material, backer rods, specialized mastics or other products in order to obtain a finish product that does not settle, deform or otherwise fail to adequately address the intent of the crack filling procedure.

Specialized mastic products such as Crafcoc Inc's "Mastic One"<sup>®</sup> are being evaluated throughout Colorado to determine if they will provide better long-term performance compared to the typical industry methods being utilized. Products such as Crafcoc's, when used in conformance with the Manufacturer's guidelines, are demonstrating better filling of large cracks with less settlement or deformation of the filler material and better resilience to environmental/climate conditions encountered throughout the Colorado Front Range area. Reportedly, these enhanced mastics are also being used as an expedient repair for larger areas, such as alligator cracking, to reduce the need for full depth repairs. RMG does not have any direct experience with the performance of Mastic One.

### **Industry Specifications**

To provide clear direction for Pavement Contractors performing work within HFR, it is necessary to provide guidance documents or specifications for materials, procedures and required work products. In the future, the HFR Road Committee may elect to create a set of criteria, procedures and specifications controlling the paving work within HFR, however the following are some local and Industry Standard Specifications and guidelines that should be considered for reference and inclusion at this time. Referenced documents are intended to be the "most current edition".

- Appendix J and K of the El Paso County Engineering Criteria Manual (ECM)
- Pikes Peak Region Asphalt Paving Specifications
- Colorado Department of Transportation (CDOT) *Hot Mix Asphalt Crack Sealing and Filling Best Practices Guidelines*, Report No. CDOT-2014-13, October 2014
- Asphalt Institute, *MS-16 Asphalt in Pavement Preservation and Maintenance*

## **UPDATED HFR PAVEMENT MANAGEMENT PLAN - 2021**

Development of a defined Pavement Maintenance Program, to include definitions and examples of various types of pavement distress, standard repair procedures, and quality control measures, for the HFR Roadway Network should be completed in the future. Such a program will require input and decision-making from the HFR HOA Board of Directors. Consideration of factors such as ride quality, aesthetics, budget prioritization and funding mechanisms will impact such a Program.

The intent of the Pavement Maintenance Program is to extend the life of the existing roadway pavements in a condition deemed suitable within the funding capacity and desire of the HOA. Continuing the maintenance of the pavements that has occurred to date and implementing focused preventative and corrective maintenance may allow the existing asphalt pavements to perform well beyond the original estimated "20-year design life". The goal is to utilize maintenance techniques so that the asphalt pavements do not require full "removal and replacement" at the end of their initial 20-year life.

## Updated Spreadsheet, Pavement Management Program-2021

The 2019 spreadsheet presenting HFR Roadway Segments and estimated remaining useful life has been updated and is included as an Appendix to this report. In revising the spreadsheet, it is assumed that needed preventative and corrective maintenance will be implemented on an ongoing and recurring basis.

### Surface Treatments

Surface treatments implemented as a component of a pavement maintenance program are intended to rejuvenate asphalt pavements and provide a uniform, suitable driving surface. Existing distress to pavements, such as cracks, alligator/block cracking, potholes, subgrade failure, etc. must be completed prior to advancing the surface treatment. Surface treatments performed prior to completing needed repairs will simply mask distress which will, in a relatively short time, propagate upward through the new surface treatment.

As the asphalt pavement wears, crack sealing/filling, utility patches, and localized repairs may not be sufficient to maintain the roadway surface to the criteria established. To bring the roadway surface to the established and desired performance standard, rehabilitation of the asphalt pavement is required. Such treatments can include:

- Slurry Seal
  - Mixture of fine-graded aggregate, emulsified asphalt, water and additives to a mortar-like consistency. Spread to uniform thickness to, primarily, seal cracks and fill voids. Preventative and corrective maintenance must be completed prior to slurry sealing. Slurry sealing not provide any structural improvement. Typically least expensive.
- Chip/Cape Seal
  - Both consist of an asphalt binder layer with an aggregate layer (typically 1/4" to 3/8" aggregate) spread then rolled into the binder layer. The chip seal may consist of 1 or 2 layers of binder and "chips" with a "fog seal" afterward. The "Cape Seal" process utilizes the chip seal then tops the chip seal layer(s) with a slurry seal rolled in with pneumatic tired rollers. Preventative and corrective maintenance must be completed prior to chip sealing. No structural improvement is gained from chip sealing, but it does aid in creating a smooth and uniform driving surface. As the Cape Seal "sandwiches" the chip seal beneath a slurry seal, it does offer greater ability to repair/fill irregularities in the underlying roadway surface
- Thin Overlay
  - Typically, a 1" thick layer of select hot mix asphalt with a maximum aggregate size of 1/2" placed atop a binder coat on existing pavement surface. Preventative and corrective maintenance must be completed prior to performing any overlay. Overlays provide the ability to fill irregularities in roadway surface, re-establish drainage grades, roadway profile and driving surface. This treatment does provide limited structural capacity. Typically, overlays are more expensive that Slurry Seal or Chip/Cape Seal.

- Mill and Overlay
  - Mill (remove) existing pavement to a specified depth (typically 2” to 3”) and overlay with a new hot mix asphalt pavement. Reduces need to seal/fill cracks. Repair of localized failures must be completed prior to overlay process. This treatment adds structural capacity to roadway and provides for “like-new” roadway surface. Typically, it is more costly than other options with the exception of full-depth reconstruction.
- Full depth reconstruction
  - Complete removal and replacement of existing asphalt pavement. This allows for full reconstruction of roadway. Fundamentally, full depth reconstruction builds a new road with full new pavement life. Typically, this is the most costly of the options.

As the asphalt pavements throughout HFR do have an extensive amount of longitudinal and transverse cracks, the majority of which have been sealed/filled, and other pavement repairs, the Chip/Cape Seal or Thin Overlay options appear to be preferred treatments due to the ability to achieve the desired intent and cost-effectiveness. Slurry seal does virtually nothing to “smooth” the roadway surface and adds no structural capacity to the asphalt pavement.

“Mill and Overlay” and full-depth reconstruction are the 2 most costly treatments. As the traffic loading in HFR is relatively light (predominantly passenger vehicles), the need for significant improvement in structural capacity is not broadly necessary.

### **Lodge Parking Lot**

Based on our recent observations on June 3, 2021, it appears that ongoing pavement distress is continuing to occur. Preliminary observations are indicative of a failing subgrade issue. As such, it is anticipated that full-depth replacement will be required. Based on the appearance of the local drainage conditions, it appears that subsurface water (possibly from irrigation sources) may be the causative factor in the ongoing pavement failure. Additional engineering evaluation of the site conditions, both from a geotechnical and drainage consideration, should be undertaken to determine the cause of the damage. A site-specific repair plan can then be prepared based upon the findings of additional studies.

## **CLOSING**

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The long-term implementation of the HFR Pavement Management program will be an ongoing evolution of “lessons learned”, implementation of industry “Best Practices”, and collaborative development of criteria and standard procedures based on the Board’s input and directives. We look forward to continuing to provide our engineering assistance to High Forest Ranch in the development and implementation of this program.

This report has been prepared for **High Forest Ranch Homeowners Association** for application as an aid in the developing pavement management protocols in accordance with generally accepted geotechnical engineering practices. The analyses and recommendations in this report are based in



part upon data obtained from site observations and the information presented in referenced reports. The nature and extent of variations may not become evident without further evaluation. If variations then become evident, RMG should be retained to re-evaluate the recommendations of this report, if necessary.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers practicing in this or similar localities. RMG-Rocky Mountain Group does not warrant the work of regulatory agencies or other third parties supplying information which may have been used during the preparation of this report. No warranty, express or implied is made. Any contractor reviewing this report for bidding purposes must draw his own conclusions regarding site conditions and specific construction techniques to be used on this project.

If we can be of further assistance in discussing the contents of this report or analysis of pavement management considerations please feel free to contact us.

## APPENDIX A

# HIGH FOREST RANCH PAVEMENT MANAGEMENT PROGRAM - 2021 UPDATE

Roadway Segment No.	Street Name	Street Length (ft)	Pavement Width, nominal (ft)	Pavement Area (s.f.)	Original Construction Year	Expected Useful Life (design)	Years-in-Service	Remaining Useful Life (Original Design)	Pavement Condition Rating - Adjusted	Current Maintenance Priority	Current Est. Remaining Pmnt Life, years	Chip/Cape Seal		Extended Service Live (yrs)	Thin Overlay with Full-depth repairs		Extended Service Live (yrs)	Mill & Overlay		Extended Service Live (yrs)	Comments
												Perform at years from present			Perform at years from present			Perform at years from present			
												2 - 5 years	5 - 7 years		2 - 5 years	5 - 7 years		9 - 12 years	12 - 15 years		
1a	High Forest Road, Entrance (Hwy 83 to Gate)	830	24	17,982	2001	20	20	0	95	3	20	N	Y	4 - 8	N	Y	10 - 15	N	Y	15 - 20	Repairs completed 2020
1b	High Forest Road (Gate to Open Sky Way)	6,412	24	176,971	2001	20	20	0	82	2	5 - 8	Y	N	4 - 8	N	Y	10 - 15	Y	N	15 - 20	
2	Winding Trails Road	4,995	24	127,880	2001	20	20	0	86	2	5 - 8	Y	N	4 - 8	N	Y	10 - 15	N	Y	15 - 20	
3a	Timber Meadow Drive, Entrance (Hodgen Rd. to Gate)	540	24	15,270	2001	20	20	0	90	3	> 15	N	Y	4 - 8	N	Y	10 - 15	N	Y	15 - 20	Repairs completed 2020
3b	Timber Meadow Drive (Gate to Forest Light Drive)	2,850	24	78,660	2004	20	17	3	80	1	5 - 8	Y	N	4 - 8	N	Y	10 - 15	Y	N	15 - 20	Consider drainage improvements near the intersection of Forest Light Dr., and along landscape islands between lanes
4	Mountain Dance Drive	5,715	24	137,160	2001	20	20	0	88	3	20	N	Y	4 - 8	N	Y	10 - 15	N	Y	15 - 20	Portions re-paved in 2020
5	Hidden Rock Road	7,176	24	177,224	2004	20	17	3	90	3	8 - 12	N	Y	4 - 8	N	Y	10 - 15	N	Y	15 - 20	
6	Forest Light Drive	3,640	24	94,348	2004	20	17	3	88	3	8 - 12	N	Y	4 - 8	N	Y	10 - 15	N	Y	15 - 20	
7a	Open Sky Way - Detention Pond Area (~16007 to 15823)	780	24	17,500	2001	20	20	0	90	3	20	N	Y	4 - 8	N	Y	10 - 15	N	Y	15 - 20	Re-paved in 2020
7b	Open Sky Way - Remainder (less 7a)	6,340	24	164,160	2001	20	20	0	84	3	20	Y	N	4 - 8	N	Y	10 - 15	Y	N	15 - 20	
8	Serenity Place	667	24	24,980	2001	20	20	0	94	3	10 +	N	Y	4 - 8	N	Y	10 - 15	N	Y	15 - 20	
9	Pine Air Place	539	24	21,470	2001	20	20	0	94	3	10 +	N	Y	4 - 8	N	Y	10 - 15	N	Y	15 - 20	
10	Waving Branch Way	1,370	24	43,830	2001	20	20	0	94	3	10 +	N	Y	4 - 8	N	Y	10 - 15	N	Y	15 - 20	
11	Canopy Court	649	24	24,160	2001	20	20	0	94	3	10 +	N	Y	4 - 8	N	Y	10 - 15	N	Y	15 - 20	
12	Secluded Creek Court	745	24	28,604	2001	20	20	0	83	2	5 - 8	Y	N	4 - 8	N	Y	10 - 15	Y	N	15 - 20	
13	Wildroot Court	551	24	20,860	2004	20	17	3	94	3	10 +	N	Y	4 - 8	N	Y	10 - 15	N	Y	15 - 20	
14	Reflection Place	566	24	23,380	2004	20	17	3	92	3	10 +	N	Y	4 - 8	N	Y	10 - 15	N	Y	15 - 20	
15	Lodge Bldg Parking Lot (a)	400	24	16,180	2001	20	20	0	70	1	< 5	N/A	N/A	4 - 8	N/A	N/A	10 - 15	N/A	N/A	15 - 20	Repairs in 2020, still not performing adequately

(1) Applications of "Seal Coat/Slurry Seal" are anticipated to be applied to new pavements within approximately 4 - 7 years following paving

(2) We assume that the entire roadway system will receive a "Seal Coat/Slurry Seal" on an approximately 7 - 10 year recurring frequency. Additionally, we anticipate that the seal coat process may be completed in a "phased" approach considering potential pavement overlay processes on some streets

(3) Linear street distances and area calculations obtained by graphical measurement from aerial photographs from Google Earth©

(a) Lodge Bldg Parking Lot will require specific evaluation and design

GREEN = PCI ≥ 90

YELLOW = PCI between 80 < 90

RED = PCI ≤ 80