06.18.2021

Findings & Opinions based on reviewing the Reserve Study and Engineering Report, followed by an in-person drive through.

High Forest Ranch Reserve Study Notes

1. Photos do not show evidence of a regular surface sealing program. Cracks appear to have been filled/sealed. The lost economic life from lack of surface sealing cannot be recovered. However, the best time to start maintenance is now! Physical inspection needed to confirm right time, right place, right material, right method.
2. Picture of Lodge Mill & O.L. shows catastrophic failure, probably due to sub surface water, poor base, poor subbase, and maybe insufficient asphalt thickness. Requires investigation to determine exact subsurface conditions before deciding on repair method.
3. Winding Trails – Mill & O.L. photo shows a wide crack that would be best to R & R full depth next time.
4. I am concerned by the photo at the bridge at High Forest Road & Community Lodge.
5. Stamped Concrete at Clubhouse entry should be regularly sealed, maybe with tinted sealer, if it is in good shape now, otherwise R & R.
6. Based on photos and verbal descriptions, I have no major dispute with the report. Cost numbers appear to be in line with 2019 costs, although they are out of date now.

RMG Engineering Report Notes

1. The report appears to be well prepared and used industry standard methods.
2. Under the Pavement Maintenance Program.
    a. I agree with the four basic maintenance & rehabilitation options and process descriptions with the following exceptions.
        i. To more clearly define Seal Coat/Slurry Seal I would split them into two different processes.
            1. Seal Coat. Basically, the description used in the report, an asphalt emulsion with no aggregate larger than sand added, able to be applied by spray equipment.
            2. Slurry Seal. I would change to Type 2 Slurry, this is an industry standard product with 3/8” nominal size aggregate that meets a specific gradation, and stone hardness specifications. Must be applied with specialized computer control mixing and laydown equipment.
    b. Mill & Overlay. I would offer a minor change to the description. 1.5” minimum thickness since industry best practice is for a compacted thickness equal to three (3) times the ½” nominal aggregate size.

i. The addition of reinforcing fibers is a promising process. Most projects using this process in Colorado are relatively new, my recommendation is to wait and see. I would note that by the time High Forest Ranch is ready for significant mill & overlay work a much better body of real-world data should be available.
ii. I concur that the use of pavement interlayers is a very good idea. Although the overall thickness should be increased by 1" (total of 3") to allow for a "scratch" course under the interlayer, before placing the overlay. Interlayers can also be used in spot applications for troublesome areas while deleting it on the areas of the same road without a history of problems. This approach can be very successful when the pavement interlayer is placed over existing full depth patches under the new overlay.

c. Chip Seal. I disagree that this product should not be used on residential streets. Chip Seal has some advantages when used on the right street, at the right time in its service life.
   i. The City of Cherry Hills Village has used properly specified Chip Seals for many years with great success.
   ii. However, when specified as shown in the RMG report, the disadvantages listed are accurate.

In Person Drive Through Notes

1. On 06.09.2021 I conducted a drive through of all High Forest Ranch roads. I was accompanied on part of the drive through by Pam Hinchman and Mark Fitzgerald.
2. Visual inspection indicated some surface treatments had been applied sometime in the past, but not recently. The treatment used in the past appeared to be a Seal Coat, not a slurry or chip seal. All roads were in need of a surface treatment.
3. Reflection Entrance/Exit area observations.
   a. Some full depth patching. Crack sealing, and a surface treatment needed.
4. Mountain Dance Drive observations
   a. Full depth patching needed for wide cracks (over 1" wide), other full depth patching and surface treatment needed.
5. Winding Trail observations
   a. Full depth patching needed for wide cracks (over 1" wide), other full depth patching and surface treatment needed.
6. Pine Air Trail observations

a. Full depth patching and surface treatment needed. Seal Coat would work for the surface treatment.

7. Serenity Place observations
    a. Full depth patching and surface treatment needed. Seal Coat would work for the surface treatment.
8. Canopy Court observations
    a. Full depth patching and surface treatment needed. Seal Coat would work for the surface treatment.
9. Hidden Rock observations
    a. Full depth patching and surface treatment needed.
10. Forest Light observations
    a. Full depth patching and surface treatment needed.
11. Open Sky Way observations
    a. New portion, surface treatment needed ASAP.
    b. Old portion, full depth patching and surface treatment needed.
12. Secluded Creek observations
    a. Upper approximately half, full depth R & R full width of roadway with surface treatment ASAP following R & R.
    b. Lower approximately half, full depth patching and surface treatment needed.
13. High Forest Road observations
    a. Full depth patching and surface treatment needed.
14. Waving Branch observations
    a. Full depth patching and surface treatment needed.
15. Timber Meadow observations
    a. Full depth patching and surface treatment needed.
16. Wild Root Court observations
    a. Full depth patching and surface treatment needed. Seal Coat would work for surface treatment.
17. The Club House Parking Lot observations
    a. This lot shows signs serious surface and subsurface drainage/water issues.
    b. To really "fix" it a complete reconstruction may be needed. Included in any reconstruction, careful consideration would be given to subsurface water and its source, as well as surface drainage to assure that all surface water is carried quickly off the surface to an appropriate area. Also, an engineered pavement design would be a good idea to address subsoil

conditions, new road base requirements, and new asphalt thickness.

Conclusions

Pam & Mark were very helpful explaining past maintenance practices and Community opinions on future maintenance. I was shown some specific sites and given background information on them, again very helpful in understanding the Community philosophy. I was informed that the Community is not united on some of the road issues such as remaining economic life and maintenance procedures. This is normal.

Basically, I concur with both the Reserve Study and the RMG Engineering Reports. They appear to have been prepared using tried and true industry best practices. Their estimates of remaining economic life, probably the biggest issue under discussion currently, are accurate. An industry professional must advise clients using the best data available, both reports do that well.

One item that an industry professional finds difficult to include in their recommendations is the dollar value a client assigns to aesthetics. Where property values are valued the highest, the smoothness, drivability, and appearance of an asphalt road receives a higher dollar value from the client when assessing maintenance programs. Since this value is determined by the client/owner you will almost never see it reflected in a professional engineer's report, they deal with industry best practices designed to get the maximum life at the lowest lifetime cost out of the roads, allowing for less-than-ideal surface conditions some of the time. Clients must communicate their higher standards to the planning professional to end up with a plan that meets the goal. Very roughly, the industry standards used in the Reserve Study and RMG's reports will come close to the higher standards, with some upgrades.

Another item that an industry professional cannot factor in when developing an asphalt maintenance plan, is the client's tolerance level, or threshold of pain. In other words, how bad can the asphalt surface get before the prevailing opinion is "we have to do something." This approach is almost impossible to provide accurate long-term costs for, and generally results in lower short-term costs and higher long-term or lifecycle costs.

A good rule of thumb is; a maintenance program that is started early in the life of a roadway, saves ten dollars in delayed maintenance and shorter life costs, for every dollar spent on proper maintenance.

Industry professionals agree that "right product, right place, right time" and "best first" is the best, most cost-efficient policy. And maybe most important, start early and be consistent.

OK, so now what?

1. The crack sealing, and perhaps the full depth patching appears to have been done on a regular basis, very good, and has extended the life of the pavement. However, the overall maintenance program appears to have lacked a regular surface treatment aspect.
    a. It is my opinion, that due to the existing subsoils conditions, the pavement designs common at the time of construction, and the asphalt materials available at the time of construction, the roads in High Forest Ranch have developed many wide cracks, described as more than 1" wide. There is no known permanent fix for this condition. Many approaches and materials have been tried all over the State of Colorado, all have had limited success. I personally have worked with one City Pavement Manager, one large multi-national contractor/material producer, one major local commercial developer, at least one pavement engineering firm, and the Colorado Asphalt Pavement Association. Although the research goes on, no permanent fix has been found. The most cost-effective procedure appears to be saw cutting and removing the crack at least 2 ft. wide or wider if needed to include sunken edges, recompacting the underlying soil, and placing a full depth patch. In the case of High Forest Ranch, a minimum of 6 inches thick new asphalt or match existing, whichever is greater. A crack will redevelop at both edges of the new patch, but it should be smaller and manageable with crack sealant for a few years. Although in extreme cases two wide cracks can develop, usually in areas where this has already been experienced. Personally, I wish there were a solution, there just isn't, the goal is to get by until the street has served a reasonable life and can be reconstructed or receive a major rehabilitation treatment, several options exist at that point.
    b. A proper surface treatment can extend the life of an asphalt surface considerably. Often the service life can be extended from the industry standard of 20 years to 30 years, maybe longer. Do not forget than even to reach the 20-year standard, a regularly scheduled surface treatment plan is expected. However, the surface treatment program is most effective when started early in the life of the pavement. This is because the asphalt binder is retained better in the road helping maintain flexibility and rock retention. The sun oxidizes the asphalt binder out of the pavement, causing the road to lose flexibility and rock retention faster,

increasing the rate of deterioration, resulting in early failure. Surface treatments reduce the impact of the sun. The earlier the first surface treatment is applied, the more asphalt binder is retained. Ever notice how an asphalt surface greys out? And after a while you can see and feel the individual rocks? This is the asphalt binder oxidizing out and loosing its binding strength, weakening the asphalt road.

c. "Alligatored" areas, sunken areas and other types of damage should be repaired as soon as possible. The type of repair is determined by the type of failure.
d. It is my opinion that a plan for the replacement costs of a road should be in place for when the road reaches the end of its economic life or the tolerance of the community. There is more than one way to plan for these expenses, the recommendations in a Reserve Study are one good way to handle the issue. I suggest that it's a fact; there is no not paying, the road will fail to meet whatever expectations the community has at some point. The community is left to decide how to fund it, maintain it, replace it.

2. Specific recommendations
    a. All new surfaces, those overlayed or replaced recently should receive a surface treatment ASAP. Remember, start early and be consistent to gain maximum impact from your maintenance dollars. Always inspect each section scheduled to receive a surface treatment prior to applying the treatment for cracks and repairs, do those first. Remember "the right time."
        i. Use the right product in the right place. For low traffic cul-de-sacs and short streets with few houses seal coat is cost effective. (Note, the description in my review of the RMG report) A properly applied seal coat should last between 3 and 4 years on average.
        ii. For longer and higher traffic streets a chip seal or Type 2 slurry would be better. (Again, note description in the RMG report section) These surface treatments will last longer under higher traffic conditions, provide better wet traction, and shorter return to service times, normally open for traffic by the end of the workday, whereas seal coat needs 24 hours to properly cure before it is ready for traffic. Expect 7 – 12-year life for these products, usually longer for the chip seals, toward the shorter side for Type 2 slurry.
        iii. The above service life estimates are for new surfaces, older surfaces like, the bulk of High Forest Ranch, will have shorter surface treatment service life. The already oxidized surfaces do not provide the best surface for the treatments to adhere to, resulting in quicker wear. I would still recommend seal coat for the very low traffic roads but expect 2 – 3-years of service life. A chip seal may work better on the rest of the roads due to its greater flexibility that may help since there is extensive transverse cracking, its also thicker when larger size aggregate is used. Type 2 slurry is not as flexible

although it may be a better value, due to lower unit costs. Again, expect reduced service life from both due to the existing surface condition.

b. Since the High Forest Ranch roads have served most of their expected service life already, it may seem all is lost, forget the maintenance, lets just hang in there until we cannot stand it anymore. Take heart! The best time to start a maintenance program and start reaping the benefits is now! Sure, it would have been better to start earlier, but the roads can still look better, drive better, and last longer if a maintenance program is started now. The lifetime gained might be handy anyway to allow for saving up some money for the eventual replacement.
c. It is my opinion that High Forest Ranch Roads life span can generally be pushed out to 25 years, maybe longer with a good consistent maintenance program that starts now. A big challenge that I see is the fact that all the roads are almost the same age. Therefore, they will all need maintenance, replacement or major rehabilitation about the same time, nothing can be done about that, except to live with less-than-ideal conditions on the last roads completed as part of a phasing plan.

A qualified Asphalt Professional can develop a specific maintenance program and help manage it. It is my opinion that a plan is best developed with the client/owner and a consultant working together. The consultant can help with specifications, Request For Proposal preparation and evaluation, project construction observation, testing, inspections, contractor invoice evaluation, punch list preparation and implementation, final invoice approval, etc. I recommend that a consultant never be anyone who would end up bidding on the work, creating a conflict of interest. A danger of just calling for bids without an RFP with specific specifications and quantities is that bid comparison is impossible, the owner needs to control the specifications and quantities to assure they are getting “apples to apples” bids.

Before any of these recommendations, ideas, etc. can work, the Association must try and come to some type of agreement on the approach, let us see where our tolerance level is, let us follow industry best practices, or let us step up a bit from best practices. Then a consultant can be the most helpful for the least amount of money.

Respectfully Submitted,

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