ASPHALT ROAD
MAINTENANCE PLAN

For
LAUREL VALLEY SUBDIVISION
TOWNSEND, TENNESSEE

Prepared for:
Laurel Valley Homeowners Association
Post Office Box 398
Townsend, Tennessee 37882
(865) 448-9857

Prepared by:
VISION
ENGINEERING AND DEVELOPMENT SERVICES, INC.
308 CATES STREET • MARYVILLE, TENNESSEE 37801
PHONE: (865)977-9997    FAX: (865)977-9919

April 26, 2013
File No. 121103-01
TABLE OF CONTENTS

I. General Information
   A. Introduction
   B. Objective/Background

II. Existing Conditions
   A. Street Survey/General Overview
   B. Road Classification
   C. Road Conditions

III. Improvement Alternatives
   A. Asphalt Repair Alternatives
   B. Cost Analysis/Cost Estimating Strategy

IV. Summary Recommendations

APPENDICES

Appendix 1  Base Road Map
Appendix 2  Road Classification Map
Appendix 3  Road Condition Map
Appendix 4  Photographs
Appendix 5  Reference Manuals
Appendix 6  Road History Summary, Budget Spreadsheet(s)
SECTION I – GENERAL INFORMATION

A. Introduction
VISION Engineering was tasked with reviewing the internal access roads for the Laurel Valley Subdivision. Laurel Valley is a private residential development in Townsend, Tennessee located on the “The Peaceful Side of the Smokies” in Blount County, Tennessee. The development contains a public 18-hole golf course with snack bar and restaurant, a small Bed and Breakfast Facility (Richmont Inn) and approximately 500 residential lots. Out of these 500 subdivided lots approximately 235 lots are developed with residential structures. The residences are used for approximately 135 full time residences and 100 vacation homes or rental cabins.

The development was originally subdivided in late 1970s, with interior subdivision plats filed later into the 1980s. Lots located in the higher elevations contain excellent views of the Smokey Mountains and surrounding landscape. The remaining structures in the lower sections of the development enjoy the serenity and tranquility of low density development and/or golf course views. Electricity is provided by Alcoa Electric and water is provided by Tuckaleechee Utility District for the majority of the development. A new water system expansion is being completed in several of the more densely populated areas. No sanitary sewer is available requiring septic tank and subsurface disposal for individual lots.

Traffic counts for the various roads are difficult to estimate with the wide variety of uses but specific roads within the network will be assigned a road classification and estimated traffic counts will be assigned in an effort to recommend where the repair/maintenance budget should be concentrated. Current traffic consists mainly of private vehicles with intermittent traffic consisting of delivery trucks for the golf course and restaurant, construction delivery trucks (concrete and building materials) and trash collection vehicles. The Average Daily Traffic (ADT) estimate would be in the range of 500-700 trips per day on the Major Collectors with the variable being peak season versus off-season for the golf course and rental cabins.

B. Objective/Background
The purpose of reviewing the private road network was to determine the existing/current condition of the access roads, investigate the existing maintenance strategy and assign priorities to normal repairs and more importantly maintenance items to prolong the life expectancy of the current asphalt surfaces. The life expectancy of asphalt varies with several factors (speed limits, grades, curve radii, frequency of use, etc.) but generally speaking the life expectancy of asphalt should be 10-12 years. Other factors (bad sub-grade, low quality materials, improperly placed stone/asphalt, etc.) often cause premature failure or decrease the useful life.

The road network has been relatively well maintained with select resurfacing and emergency repairs made on a yearly basis based on funds budgeted from homeowners dues. It is our understanding the current yearly budget is $50,000 for road maintenance and/or repairs. The normal procedure in the past has been to make emergency repairs and resurface a set amount of asphalt with minimal thought as to the location, travel frequency, current condition, etc. This plan will establish priorities and identify a schedule for making repairs, completing maintenance measures and surface overlays.
SECTION II – EXISTING CONDITIONS

A. Street Survey/General Overview
Four separate site visits were made to review the existing condition of the asphalt roads. The majority of the roads were traveled in a vehicle with intermittent stops to review locations more closely and to take photographs. Based on our base map taken from the Blount County Geographic Information Systems (GIS) there are approximately 12.6 total miles of private roads located in the development and maintained by the Laurel Valley Homeowners Association (LVHOA).

The existing roads vary in width but generally range from 15 feet to 24 feet in width. The posted speed limit is 25 miles per hour. The roads are mainly asphalt surface with three or four extremely steep locations surfaced with concrete. The roads are all cross sloped to the shoulders (crowned in the center or super elevated in curves) and the shoulders consist of either stone or grassy surfaces. The drainage consists of road side ditches with intermittent corrugated cross drains to facilitate removal of the water from the road network and prevent overtopping of the shallow ditches.

B. Road Classification
The existing roads will be classified primarily by the frequency of use, number of residences located on the street with a minor emphasis being placed on physical characteristics of the asphalt surface (i.e. widths, steepness, etc.). A base map of the road network is located in Appendix 1 and a color coded map is provided in Appendix 2 to assist with identifying the classification of the roads. Most cities and towns classify their roads with a variety of labels but Knoxville uses Expressway, Major Arterial, Minor Arterial, Major Collector, Minor Collector, Local Street and Alley. For the purposes of the report we will assign the roads in Laurel Valley classifications to include Major Collector, Minor Collector and Local Street categories. As you will note on the map the three categories are relatively close in overall distances.

Major Collectors (4.3 Miles) –
Laurel Road - 3.8 miles (To Tolliver Trail)
Country Club Drive - 0.5 miles

Minor Collectors (4.2 Miles) -
Laurel Road - 0.5 miles (Tolliver Trail to back gate)
Bear Den Road - 0.9 miles
Kelly Ridge Road - 0.8 miles
Hawk View - 1.2 miles
Cutter Gap - 0.4 miles
Tolliver Trail - 0.4 miles

Local Streets (4.2 Miles) -
Remaining Roads (Blueberry Lane 0.4, Rainbow Circle 0.2, Clearwater Circle 0.1, Fairway Circle 0.1, Sequoyah 0.3, Lakeside Trace 0.2, Pioneer Trace 0.2, Pioneer Circle 0.1, Christi 0.4, Big John Cove 0.1, Allison, 0.1, Mountain Loft, 0.2, Penni 0.1, Quail 0.1, Red Wolfe 0.2, Fox Chase 0.1, Laurel Trace 0.1, High Springs 0.1, Slate Quarry 0.1, Settler's View 0.2, Hunter's Run 0.4, Kurt's Corner 0.2, Nathan's Nook 0.2, Cold Springs Trace 0.1, Brenda Circle 0.1, Iris <0.1, Tree Frog <0.1, Fern Hollow < 0.1.
C. Road Conditions

A general description of the roads with needed repairs will be provided in this section. The attached Road Condition Map in Appendix 3 shows the general areas where specific problems have occurred in the past or were observed. There are basically four conditions/situations that will be addressed in this report:

- Miscellaneous Issues - Immediate Response Required
- Potential/Existing Slope Failures
- Sub-Grade Failure (alligator cracking)
- Deteriorating Asphalt
  - i. Longitudinal cracks generally from slope or shoulder movement.
  - ii. Asphalt sliding generally from lack of bond between asphalt surfaces.
  - iii. Porous asphalt surface.

There are a few locations where existing problems require immediate attention to resolve issues to prevent safety hazards or to prevent additional failures:

- The existing slope failure on Laurel Road near Cooper Ridge Road requires immediate attention (currently being addressed).
- Christy Lane edge cracking on the east side of the road approximately \( \frac{3}{4} \) of the way to the top of the hill should be repaired as soon as possible.
- Steep slope on Laurel Road at the future building site adjacent or just north of intersection of Bear Den Road (currently being addressed).

Other areas requiring monitoring on a regular basis:

- Inadequate shoulder on Laurel Road at the sharp curve just before or west of the Maintenance Facility and dumpster enclosure.
- Large drain culvert under Laurel Road near the intersection of Sequoyah Village.
- Waterline (Utility) Installation backfill and ditch repair.
- Hawk View Road - Monitor steep shoulder slopes.
- Previous Slide Repairs - Monitor for effectiveness of repairs.

Listed below is a more detailed/road specific description of conditions observed during our site visits. The approximate locations of these items are identified on the Road Condition Map in Appendix 3.

Major Collector Roads

Laurel Road – Drainage Erosion (Monitor Only), Alligator Cracking, Asphalt Slippage and Failed Patch (4,500 SF), Erosion @ Large Culvert (Monitor Only), Longitudinal Cracks (25,000 LF), Slide Area (In Process), Pitted Asphalt or Porous Asphalt (7,500 SF), Steep Bank @ House Seat (General Repair), Narrow Shoulder Erosion (Monitor Only).

Country Club Drive – Steep Grade (Monitor Only), Longitudinal Cracks (2,500 LF), Porous Asphalt (4,000 SF).
Minor Collector Roads
Kelly Ridge Road – Total 0.75 Miles - 63,000 Sq Ft – Steep Grades (monitor only), Pitted Asphalt, Longitudinal Cracking, Porous Asphalt, Alligator Cracking. (The worst overall condition of any road in the development). Overlay or Slurry Seal Coat when funds are available.

Hawk View – Prior Repair (monitor only), Patches (monitor), Lack of Shoulders (monitor only), Steep Slopes (monitor only), Longitudinal Cracking (9,000 LF), Steep Grades (monitor only).

Bear Den Road – Generally Good Condition, Porous Asphalt (near the end of road) (16,000 SF).

Cutter Gap – Steep Grade (Monitor Only), Previous Repair (Monitor Only), Alligator Cracking (750 SF).

Tolliver Trail – Prior Patches (Monitor Only), Alligator Cracking (500 SF), Longitudinal Cracking (800 LF).

Local Streets (Less time/attention was directed at these roads due to less travel frequency, relatively flatter road sections and generally better condition)
Pioneer Trail/Pioneer Trace, Lakeside Trace, Sequoyah Village, Fairway Circle, Clearwater Circle/Laurel Trace, Rainbow Circle, Club View Road, Fox Chase Road, Settler’s Rise/Settlers View Road, Nathan’s Nook/Kurts Corner, Ace Gap, Alison Way, Big John Cove, Craig Cove/Brighton Terrace, Mountain Loft/Quail Lane/Red Wolf Lane/Penni Lane

SECTION III – IMPROVEMENT ALTERNATIVES, COSTS & RECOMMENDATIONS

A. Asphalt Repair Alternatives
There are basically five alternatives for repairing or maintaining the integrity of any asphalt road surface. Specific details and/or specifications are provided in Appendix 5. They include:
  o Asphalt overlay of the entire existing surface.
  o Seal existing asphalt surface with Slurry Coat.
  o Excavation and replacement of asphalt, base stone and sub-grade (if required).
  o Asphalt overlay areas where cracking and settlement warrant.
  o Seal existing cracks to prevent additional water intrusion.

B. Cost Analysis/Cost Estimating Strategy
Estimating repair alternatives can be difficult if not impossible to predict. Unknown sub-grade conditions, inflation of materials and labor costs and availability of competent contractors to complete the required repairs. We have attempted to estimate repair costs with the assistance of two medium to small local paving contractors.
Approximate Costs for Repair Methods

- Asphalt Overlay (Large Areas - 2,500 sq. ft.) - $1.21 per Square Foot
- Asphalt Overlay (Small Areas - 250 sq. ft.) - $2.75 per Square Foot.
- Seal Coat Existing Asphalt Surface (5,000 sq. ft. min) - $0.10 per Square Foot.
- Excavation/Replacement of Asphalt System (2,500 sq. ft. min.) - $2.56 per Sq. Ft.
- Seal Cracks - $1.00 per Linear Foot (250 lf min.).

In reviewing documents available from other state department of transportations a general time frame for the life expectancy of asphalt pavements is seven to ten years. The slurry seal system will prolong the life expectancy of an existing asphalt road for an additional four to six years.

Our general recommendation is a maintenance philosophy for the road network should be established with the following criteria:

- The first priority should be to repair existing cracks and defects to prevent water intrusion. These tasks will be ongoing each year and will require funding to accomplish these tasks on a yearly basis.
- The second priority should be to complete slurry seal for the entire road network. This can be accomplished in years two thru five.
- The third priority should be to begin overlay of the existing roads with new asphalt in year six and continue until major and minor roads are resurfaced. The local roads should be reviewed at this point to determine the need for resurfacing.

The seven year budget spreadsheet included in Appendix 6 includes these year one costs and factors in five percent inflation for years two through seven. As you will note with the existing budget of $50,000 annually the road system cannot be adequately maintained. This is due to the eventual need to overlay the existing surfaces which will be cost prohibitive except for short sections of roads.

I have also enclosed a budget worksheet reviewing funding requirements if the following repairs are assumed:

- Seal coat Major Roads every seven years and resurface major roads every twenty years.
- Seal coat Minor Roads every ten years and resurface minor roads every thirty years.
- Seal coat Local Roads every fifteen years and resurface every forty years.

This repair schedule will require an annual budget of $91,500 per year and assume additional localized alligator cracking and crack repair each year. The placement of slurry seal surfaces will allow the existing surfaces to continue to function as designed and will prevent water infiltration. Thereby postponing the overlays to allow funds to build up in a reserve account until longer sections of roads can be resurfaced.
SECTION IV – SUMMARY RECOMMENDATIONS

As common sense approach would dictate the majority of emphasis in repair and maintenance funds should be directed to the most important roads. Therefore the budgeted funds will normally be appropriated to the most important or heavily traveled roads (Major Collector). With the Minor Collector roads are second in line and the Local Streets receiving the least attention. With that being said, the Local Streets do not need to be totally ignored. The same philosophy should be used in slurry seal coating and re-surfacing.

Based on engineering principles and common sense there are several items that contribute to premature failure of the road and asphalt. A general recommendation is the current homeowner’s association members and future members should pay particular attention to sections of the roads with these conditions in an effort to rectify problems before they intensify. The following factors contribute to asphalt deterioration:

- Steep Road Slopes.
- Lack of Shoulder Width.
- Poor Sub-Grade (either from inadequate fill materials and existing alluvial soils)
- Poor Road Drainage-Inadequate Ditch Flow
- Porous Asphalt (allows water to infiltrate the surface).

As noted in section IIC and on Appendix 3 there are current conditions that need to be handled as either an emergency repair for safety or require action as soon as possible to prevent future failures.

- Laurel Road near Copper Hollow Road (existing slide area previously repaired) – The LVHOA is in the process of receiving repair bids from turn-key contractors. We would recommend anytime there is a slope failure or a potential for a slope failure that a geotechnical engineer be consulted to determine a cause, recommend repairs and monitor repairs as they are progressing.
- Christy Lane in curve near the top of the hill just before the intersection with a common driveway – Existing longitudinal cracks continue to widen and settle. We would recommend an overlay of the entire area to seal the cracks and bring the sunken area level with the remaining asphalt.
- Clean Out/Reshape Ditches – Several of the roadside ditches have been backfilled level with stone thereby impeding the flow of stormwater. Other areas have accumulated leaves, trash or other foreign matter blocking the water flow. These ditches should be cleaned out and a flow line re-established for all roads.
- Steep slope on Laurel Road at the future building site adjacent or just north of intersection of Bear Den Road. – Currently there is no visual evidence of settlement or slope failure. But with the excessively steep slope being exposed to weather, unknown time until the structure is completed and loads from the adjacent road, it is our opinion the slope will eventually fail unless adequate measures are taken to protect the slope. There are two options for repair/remediation of the slope; one is to replace the dirt removed from the house seat. Placement of this dirt will require compaction and observance by a geotechnical engineer; or two construction of the front wall of the proposed residential structure. This front wall will require design by a licensed structural engineer as it will act as a retaining wall as well as support the structure.
o Inadequate shoulder on Laurel Road at the sharp curve just before or west of the Maintenance Facility and dumpster enclosure. The road in this area is cross sloped to the interior side of the sharp curve. Any water sheet flowing down the asphalt will drain to the lower side. There is very little shoulder in this area and the drainage will eventually erode the slope below. This area should be closely monitored in the coming months/years to make sure the slope is not undermined. If problems do occur an engineer should be consulted to size a drainage inlet, curb and slope drain to protect the area.

o Large Drain Culvert under Laurel Road near the intersection of Sequoyah Village - There is evidence a considerable amount of drainage flows through this area during storms. Dirt/shale berms have been constructed along the edge of the road on both sides to prevent erosion of the road when the flows submerge the inlet pipe and velocities of the flowing water become excessive. This area should also be monitored and if the situation warrants, concrete headwalls should be constructed on each side of the road to prevent further erosion.

o Hawk View Road - Monitor Steep Shoulder Slopes - The upper/top section of Hawk View has sections with little or no shoulder. There is evidence of previous patches. There has also been clearing of vegetation of the lower slopes. All of the conditions warrant close monitoring.

o Previous Slide Repairs - All prior slide repair areas (except Laurel Road at the current slide) appear to be functioning adequately. These areas include upper section of Cutter Gap and southwestern leg of Hawk View. The Hawk View repair needs general, dressing up, shoulder and ditch replacement relatively soon. These areas should be monitored on a regular basis for any signs of future problems.

o Waterline Installation Backfill and Ditch repair – Evidence suggest and the normal sequence of operations for utility installations is utility contractors do not adequately compact the ditch backfill. This allows shoulder settlement as the ditch backfill settles. Also in several locations the rip rap placed in the re-formed ditches is piled up as opposed to lining the ditch. The stone essentially blocks the flow of water and causes the water to seek another route. The diverted water erodes the sides of the ditch. Continuous monitoring of any utility installations should be required to make sure the backfill is compacted and any rock lined ditches maintain the v-shape.

As noted throughout the report the most serious deterrent to the life span of a road system is water intrusion. This allows the sub-grade to become saturated and the freeze/thaw cycle in winter loosens the base stone and eventually the sub-grade. With that philosophy in mind our maintenance plan would be to make any repairs in 2013 that will prevent water infiltration. This mainly would include sealing cracks, repairing alligator cracking, sealing porous pavement and cleaning out drainage ditches. Once the surfaces are sealed and all emergency repairs are completed a plan for sealing the existing surfaces should be planned for the Major Roads first, the Minor Roads second and finally the Local Roads. This should allow all roads to be sealed prior to starting re-surfacing or asphalt overlays for the entire surface.

Based on the condition of the current roads the following items should be completed as soon as possible with year one allotted funds.

  o Repair Alligator Cracking on Laurel Road and Country Club Drive.
  o Repair Longitudinal Cracking on Laurel Road and Country Club Drive.
- Repair Alligator Cracking on Minor Collectors.
- Repair Longitudinal Cracking on Minor Collectors.
- Repair Any Cracking on Local Streets.
- Clean Out Drainage Ditches

The Seven Year Budget spreadsheet identifies the specific roads and amount of repairs that can be accomplished each year. Evaluation, maintenance and repairs to the road system will be an interactive/ongoing process. The spreadsheet is a simple form easily updated to adjust budgets each year and add future years. This spreadsheet is included to emphasize the fact that the current $50,000 annual budget is insufficient for road maintenance.

The Annual Maintenance Spreadsheet determines specific time frames for completing sealing (7 years for Major Roads, 10 years for Minor Roads and 15 years for Local Roads) and re-surfacing (20 years for Major Roads, 30 years for Minor Roads and 40 years for Local Roads) and assigns a cost structure for completing the maintenance and repairs. This analysis would suggest the annual budget be raised to $100,000 to maintain the road system without any emergency repairs. The optimum budget scenario would be to set the budget at $125,000 per year and place the unused funds in reserve to handle the emergencies and expedite some of the maintenance items of no emergencies exist.
APPENDIX 1
BASE ROAD MAP
APPENDIX 2
ROAD CLASSIFICATION MAP
APPENDIX 3
ROAD CONDITION MAP
APPENDIX 5
REFERENCE MANUALS