

Technical Memorandum

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Subject: Tellico Village Pavement Program Evaluation and Recommendation

INTRODUCTION

The pavement on the streets of Tellico Village is the most visible and most used asset the Property Owners Association own. It is more visible and used than the golf courses, recreation centers and other amenities combined. It is used every day by every resident whether they leave the house or not. Trash pick-up, mail and package delivery, maintenance and construction all rely on quality pavement. It is arguably, one of the biggest assets that influence the property values of the homes in the Village. The condition of the Village's roads reflects the fiscal and managerial health of the Village. It is also the asset with the greatest expense to manage and maintain.

Jacobs was hired by the Tellico Village Property Owners Association (TVPOA), Public Works Department, to evaluate its pavement program including an assessment of the streets and the products currently being used to maintain the quality of its pavement and to extend its life between overlaying new pavements.

OVERVIEW OF CURRENT PAVEMENT PROGRAM

When the Village was first planned over thirty years ago, the Street Master Plan called for a pavement program whereby streets would be repaved approximately every 15 years. Tellico Village began its first street overlay in 2003 in the Toqua Neighborhood. This was followed in an annual procession for the streets within Mialaquo, Chatuga and Chota Neighborhoods. These initial overlays are very important to the longevity of the streets because they not only provide a better riding surface but they build up the structure of the pavement. Localized failures in the pavement were identified and repairs were made as part of these pavement overlays. In 2008, with the downturn of the economy and the increase in crude oil prices, the overlay program was halted and no streets have been repaved since due to budgetary constraints.

The price of crude oil continued to climb after 2008 and it has only been in recent years that we have seen a dramatic decrease in its price. Going forward, the price of crude oil will likely be unpredictable thereby complicating the management of long term capital improvement budgets. Other costs associated with the installation of an overlay have also risen and will continue to rise. These costs include the diesel to operate the equipment, gas to heat the asphalt, labor and the cost of equipment itself.

Public works departments around the country have come to realize that simply repaving streets is not a viable and sustainable plan going forward. They have developed Pavement Management Programs that include inventory and inspections of streets, making critical, timely repairs and looking at pavement maintenance products and the managing of these products to extend the longevity of their pavement to get the most for their budgets. Eventually though, the pavement will need to be overlaid or replaced.

Over the years, the Property Owner Association, Public Works Department, has developed a Pavement Maintenance Program. They maintain an inventory of the streets, inspect and identify pavement issues and make the necessary repairs. Around 1996, the Public Works Department began incorporating into its preventative maintenance program the use of pavement rejuvenation products to further help extend the life of its pavement.

Next to design, construction and traffic loading, weather and climate are the two biggest factors that affect the longevity of the pavement. The hot, dry summer days, evaporate and dry out the emulsified oils that pavement needs to give it flexibility thereby will led to surface cracking. This is known as oxidation. The winter freeze thaw cycles allow water that enters the pavement structure to stress the structure of the pavement thus shorting its life cycle. Road salts and plowing also takes it tolls on pavement.

Pavement Maintenance Products

Researching the internet, there is not any one solution, product or products for the asphalt maintenance. There are many factors including, traffic counts, traffic loads, climate and weather, and gradation of asphalt that can affect the performance of the maintenance products. Many highway departments have conducted studies and test on the various products and the outcomes vary.

Currently, there are many different products on the market for maintenance of asphalt pavement. The key is to select the correct material for the appropriate application at the right time. From the research conduct for this report, these maintenance products used for asphalt can be broken down into two basic types of products, sealants and rejuvenators. Sealant products include crack sealants, fog sealants, slurry sealants etc. Sealant products, in simplest terms, help seal the asphalt surface from water penetration and slow the oxidation process. They do not add any benefit to replenishing the loss of emulsifiers within the asphalt only at the surface. Currently, the TVPOA use crack sealant as part of the annual pavement program. It seals the various cracks and helps protect the pavement structural by not allowing water from penetrating further into the asphalt pavement and gravel base. Water that penetrates deep into asphalt will freeze in the winter and stress the asphalt due to the expansion of the ice and begin the break down its structure. Water penetrating to the gravel base can weaken its structural capability to handle the traffic loads by increasing the moisture content above optimum. The TVPOA has not used any of the other types of sealants that are applied to the paving surface.

Rejuvenator products go one step further than the sealant products, they provide emulsified oil that penetrate the asphalt and help restore/maintain the plasticity of the pavement as well as provide some level of sealant to the asphalt pavement from moisture.

The first rejuvenator product used by the TVPOA was Reclamite. Reclamite is made of oils and resins that, as noted above, help restore the plasticity of the pavement. Reclamite when applied has a pinkish brown color. It cures over several hours thereby allowing traffic to resume the same day as the application. According to the product literature, it is applied with a fine aggregate to restore and improve the skid resistance. In my opinion, the long range benefits to skid resistance is minimal due to the fact that the fine aggregate becomes loose in a short time and becomes is a nuisance. Tellico Village's overall experience showed that Reclamite to be a cost effective solution to extend the life of the pavement.

Pavement rejuvenation products are constantly being improved. The Public Works Department looks for products that can further extend the life of the pavement while helping stretch the amount of miles they can maintain each year given the budget allotted. In 2012, after researching and conducting a test section, the Public Works Department began using a product called Pavement Dressing Conditioner or PDC. PDC is very cost competitive to Reclamite. It does not incorporate the use of the fine aggregate and it be shown to provide a better and longer lasting appearance to the pavement. It does have a longer curing time than Reclamite. Most important, it has also proven to extend the life of the pavement.

VISUAL OBSERVATIONS

During the month of April 2016, Jacobs drove most of the streets of the Village to get a general assessment of the conditions of the roadway pavement. Overall, the pavement is in very good condition. The efforts of the Public Works Department of maintaining the streets of Tellico Village have been successful while stretching its limited budget. The observed number of pavement failures was relatively few. This is especially surprising in the neighborhoods where the pavement has yet to receive its first overlay despite the asphalt being over 15 years of age. This speaks to a good design, construction and maintenance of the streets.

The areas that showed consistent need for attention are the center of the paved cul-de-sacs. A good percentage contained surface cracking. This is more than likely due to the lack of any traffic on these sections of pavement and exposure to extreme sun light increasing its oxidation. Other areas that need improvements are new utility and storm piping crossing or past pavement repairs. These demonstrated settlement and segregation of the asphalt from the surrounding asphalt that will only worsen and require more and more attention if not cut-out and replaced with proper compacted and binding of the new asphalt to the surrounding asphalt. Another area that needs attention is those places (found primarily in cul-de-sacs) where utility valves are located within the pavement and have settled. This has created a "bird baths" in the pavement and can damage the valves. If possible, it is recommended that the valves be relocated outside of the paved areas and in any case the pavement repaired properly. Again, only a relatively small number of structure failures to the pavement and its subbase structure were observed. These need to be identified and repaired as part of the annual preventative maintenance program.

RECOMMENDATIONS

Pavement Management Program: It is recommended that TVPOA Public Works Department take its Pavement Management Program to the next level. Developing an asset management type program and utilizing the Geographic Information System (GIS) as a tool. All types of information concerning the streets of Tellico Village are assimilated in a fashion that can be readily retrieved and used as part of an asset management program. The Public Works Department will find that it will provide useful information to develop maintenance programs, tract cost, and develop future budgets.

Preventative Maintenance: Jacobs recommends that the Public Works Department continue with its preventative maintenance. Preventive maintenance is generally planned and cyclical in nature. Its intent is to repair early pavement deterioration, prevent premature pavement failures, and reduce the need for corrective maintenance and service activities. Although this type of maintenance is not performed to improve the load-carrying capacity of the pavement, it extends the pavement service life. A regular street inspection program is vital to preventative maintenance. Maintaining positive roadway surface drainage and storm water piping, sealing of surface cracks, and the use of pavement rejuvenation products are all part of Tellico Village's preventative maintenance.

Pavement Maintenance Products: The TVPOA Public Works Department has adopted the use of products that have resulted in a solid maintenance program that has shown to be cost effective and demonstrated excellent results.

As noted in this Technical Memorandum, the Public Works Department is currently using PDC and getting excellent results for an economical price. Even though it requires approximately 24 hours of curing and means additional coordination by the Public Works Department and the property owners, the results as far longevity of appearance and increase pavement life outweighs the additional effort during installation. At this point in time, it is not recommended to move away from any of these products.

However, because product development is constantly occurring in this area, we recommend the Public Works Department keep an eye out for improved products and maintain a willingness to work with

manufacturers and test such products out in the future to further enhance the life of the pavement and improve cost efficiencies.

Pavement Overlays: There is no escaping the fact that TVPOA needs to resume an annual pavement program. Eventually, all of the pavement will need to be overlaid. Rejuvenation products have a limit on how long they can extend the life of the pavement. Unfortunately, the cost does not appear to do anything but rise over time. Jacobs obtained a budgetary cost for this Technical Memorandum from an East Tennessee Paving Company for a two-inch thick recycled asphalt mix of \$8.80 per square yard. At such cost, the Pavement Maintenance Program will need to develop an annual pavement plan.

In order to determine an annual pavement plan, pavement inspection results, roadway priorities and other factors will need to be assessed annually. From Jacob's recent visual pavement assessment, two of Tellico Village's major collector roads, Toqua Road and Sequoyah Road, appear to need overlays in the near future. The Public Works Department Pavement Maintenance Program will determine the timing for such resurfacing projects.

The neighborhood streets that have not received their first two- inch overlay need to be closely inspected each year. Presently, the pavement appears to be in good condition despite being 15 years old. The concern lies in the fact that the pavement is only a total of two inches thick for these roads. If the pavement is allowed to deteriorate to the point of failure, the TVPOA may have to pay the cost of repairing the roadway stone base as well as new pavement. In addition, it will lose a solid two inches layer of asphalt that will contribute to the future structural stability of the roadway pavement.

The neighborhood streets that have already been overlaid, have as much as four inches of asphalt thickness and are structurally better to extend well past a 15 year life, if properly maintained. Future overlays of these streets will include milling of the top layer of asphalt. An estimate on the costs to mill the old asphalt surface is another \$2.00 per square yard.

No doubt that the TVPOA will need to do a lot of fiscal planning to fund a consistent future pavement overlay program for the Village.