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CONSTRUCTION

CONSULTING

ASSOCIATES

**To: Raft Island Roads Committee**

**Project: Raft Island Road Study**

**Date: 3-18-2016**

**Purpose:** This study is intended to be an analysis of the existing roadways and drainage systems for the purposes of planning for full maintenance and rehabilitation of current roadways. The analysis has been based on visual field investigation of existing site conditions, coring of existing pavements for depth and reviewing prior and ongoing firsthand experience with island residents. Included will be a budget based on proposed construction methods and pavement section appropriate for the conditions with both value and long term success as priorities.

**Agency Contact:** Preliminary contact with PC Development Engineering confirmed maintenance with no permit required as maintaining the same roadway footprint without changes to subgrade-specifically asked about grinding, grading and paving. Also asked about drainage repairs-pipe sizes can be changed as long as drainage courses not changed.

**Site Visits:** Performed several site visits for different purposes. Initial visits to familiarize with current condition of pavements and possible perceptions of causes of roadway failure. Subsequent visits for more technical purposes-roadway measurement for budget and future bid documents, visits during storm events to view actual drainage conditions and potential areas of difficulty and then layout for coring for roadway depth and conditions underneath. Final times on site were for the correlation of core results and pavement condition along with further viewing and documentation of current driveway type and condition relative to roadway.

**Observation and History:** Existing roadways exhibit a myriad of conditions mostly at a point of failure with alligatoring and pavement checking on nearly all roadways. Obviously, the roads have had numerous patchings, full removal and replacements, overlays along with impacts caused by installation of underground power and water. First thought on many roadways was the probable cause of many failed sections due to improper drainage along roadway shoulder or areas of groundwater influencing sub-base materials causing pavement failure. Age of pavement is also a strong notable consideration-asphaltic concrete has a life span that once reached shows in fatigue cracking and major areas of failure. A factor of history regards the old bridge and weight restrictions which would have limited use of equipment more capable of obtaining suitable levels of compaction of both sub-bases and asphalt surfaces. Another historical point worthy of mention would be much of the original work and even some of the paving done in the last several years probably used materials that would be considered substandard relative to today’s standards and specifications.

**Technical Study-Coring Results(see Exhibit A & B for locations/results):** 30 locations were chosen somewhat randomly on only RIIA roadways. Results are shown on **Exhibit A** with core location map as **Exhibit B**. Cores were done for the primary purpose of establishing depth of asphalt and nature of material immediately underneath asphalt. The results were somewhat shocking relative the variety of thicknesses of asphalt and the absence of any base under the asphalt in most locations. Cores ranged between ¾” clear to 3½” with only eight having a base course underneath. Examining the cores themselves showed a variety of materials used in the asphalt and a general lack of compaction and good structure. Lack of compaction was obvious in the voids showing in the structure as well as the lack of strength of many cores. The poor structural component was obvious in the use of substandard crushed rock in the production of the asphalt and high quantity of sand and round aggregates. Further destructive testing would probably corroborate the lack of compaction and component-at this point it’s my opinion, that though this would be interesting, it would be a waste of money.

**Core Roadway Evaluation:** Site visit following the coring was somewhat surprising with many of the thicker cores with base course were in areas of massive alligatoring and checking. Some of the thicker cores reflect probable overlays due to some variation in material with depth. It is possible that the areas were in major failure and the overlay provided some respite but also

resulted in failure over time. Most of this section of roadway is on the east and north side of the island which appears very wet and has shown geo slide activity in the past-possible wet or plastic soils underneath the base course.

Many of the thinner cores with no base were in areas that, though beginning to show fatigue failure, were actually in fair to good condition. These cores were paved directly on the existing native material, which on most of the island primarily consists of a sandy glacial till. Glacial till in a dry condition can be very firm and unyielding providing for a suitable, though not preferred base for asphalt concrete, which may explain that even though thin in many areas the roadways have survived a long time. The visible observation of much of this roadway area almost appears to be an oil mat or chip seal type of pavement, another testament to the type of equipment possibly used in placing. Most probable is that these pavements, if not oil mat, were placed with a truck-pulled pavement spreader rather than a self-propelled paving machine-providing much less uniformity in depth and surface quality.

**Roadway Rehabilitation Recommendations:** Utilizing primarily experience in pavement restoration, it is recommended to try and utilize the resources that are tied up in the existing pavements. The best method to accomplish this is to pulverize the asphalt concrete surfacing with enough depth to slightly mix with the underlying base course or native materials. This provides a new crushed base course that can be regraded and repaved. Intentions on this project would be to regrade with a crown section to achieve drainage off both sides of the roadway taking careful consideration for matching existing driveways and retaining current successful drainage patterns. Once the grade is established it would be field determined whether additional crushed is required or the new base is sufficiently prepared for new asphalt. Compaction testing at this time along with proof rolling with a loaded truck will be utilized prior to paving. 3” of new asphalt concrete should be sufficient for the type of traffic and traffic counts. New asphalt paving will also be tested for compaction and spot check for gradation and asphalt content. Life span for this pavement section should exceed 20 years if good roadside maintenance is practiced.

Areas of on-going concern are difficulties in matching existing driveways and maintaining the current drainage patterns. Most of these concerns can be managed prior to and during construction with some after paving is complete and drainage patterns are more obvious. Rectifying problems afterwards can be fairly simply fixes with utilization of small wedge curbs of asphalt that can be easily added.

**Drainage Recommendations(see Exhibit C for locations/comments) :** Proper drainage along the roadway shoulder is important to assure long term success of a roadway. Ongoing maintenance of existing ditches, removal of vegetation and grasses along edges is also critical. One of the side benefits of this type of roadway restoration is usually a slight raising of the roadway elevation provides more positive drainage away from the road edge rather than ponding along the shoulders. Shouldering following paving would also be accomplished which helps with the vegetation maintenance that is an ongoing problem. Bid package will include both ditching and small asphalt raised edge as options to utilitzed during construction. (See Locations1, 2, 5, 7, 10, 11 and 19 as potential areas)

Drainage considerations that have been discussed are potential repairs or additions to culverts in specific areas as well as wholesale crossing replacement while the roadways are unpaved. See Locations 2, 3, 8 and 10, as examples of areas of probable repair or replacement. Some of the other improvements may be simply excavating around culvert ends and placing of a quarry spall or rip rap pad and/or placing a flared end section or small catch basin with beehive grate (Locations 1, 3, 17 and 19). It will be important to include in the bid documents the different possible repair options and include items in the bid schedule to allow for choosing the best applications-allowing for some flexibility during the construction process.

Other concerns are due to problems caused by private property encroachments on the roadway shoulders. Some of those concerns may fix themselves with the new roadway grade, the general regrading of the roadways and ditching, others may need remedy by adding additional culverts along the shoulders paralleling the roadway(Location 9 as example). Some of these situations are still being investigated by the Road Committee.

Last problem drainage area is impact totally on private property where drainage patterns have been disrupted by lot development. Key example to this is Location 13-area is extremely flat along roadway and the drainage corridor on the east side of the home has a very poor outlet point. The drainage relies on a small diameter pipe-maintenance and cleaning of this area is imperative to allow the water to leave the roadway area. The best fix would be to replace the pipe with a larger diameter line at a lower elevation-but this is a private property problem.

**Speed Bumps:** There has been intense discussion of speed bumps for speed control. Attached **Exhibits D and E** are standard details and pictures of a speed bump design that the City of Tacoma, City of Sumner and other municipalities are using. It is large enough to intimidate yet short enough to not cause damage to conventionally elevated vehicles. The pictures shown are from Mountain View Drive, located just below Jackson between 6th Avenue and South 19th Street.

**Budget Costs:** The attached budget, **Exhibit F**, reflects both hard construction and soft costs. The hard construction costs shown are a result of field measurements (**Exhibit G**), observation of existing conditions with an accurate calculation on most quantities and a best guess on some of the minor items. The costs utilized are a blend of actual construction costs from contractors who specialize in pulverizing, grading and paving. Utilizing surface measurement for pulverizing and grading is the most accurate method of bid preparation for these items when the intention is to match existing area. Using tonnage for the surfacing-both crushed and asphaltic concrete is probably the most accurate and easily accounted. Depth of asphalt will need to monitored to protect from unnecessary tonnage overruns but with increased depth is increased value and longevity. Other items are per each, per lf, per sf-easily counted or easily field measured for final accounting and final pay. Anticipated soft costs are shown and would include bid prep, project management and construction testing.

**Full construction costs RIIA Roads-Hard and Soft Costs w/10% Contingency & WSST $905,148.42.**

**Non-RIIA Roads-Hard Costs no Drainage/no Soft Costs w/10% Contingency & WSST $96,203.44.**

Questions or comment, please feel free to contact me.

Richard J. Day