Tanyard Springs HOA <tanyardsprings@abarisrealty.com>

Tanyard Springs HOA - CSG - Concrete Spalling RFP

Nicholas "Miki" Vikor <nvikor@abarisrealty.com> Mon, Feb 15, 2021 at 6:16 PM
To: Wayne Hosking <Whosking@csgengineer.com>
Cc: Tanyard Springs HOA <tanyardsprings@abarisrealty.com>

Hi Wayne,

The Tanyard Board approved your proposal to take samples of the spalled concrete for lab testing to determine the cause of the spalling. The Board noted that Section D and The Pointe were both excluded from the developer warranty settlement which means the HOA still has recourse against the developer if the testing proves that the spalling is caused by defective installation. The Board wants you to inspect both sections thoroughly for concrete spalling and select areas for samples to be taken in both sections where the spalling conditions are the worst.

Mark-
Would you please provide Wayne with a map showing Section D and The Point?

Thank you,
Nicholas "Miki" Vikor
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CSG
CONSTRUCTION SYSTEMS GROUP, INC

May 12, 2021

Ms. Shireen Ambush
Abaris Realty, Inc.
7811 Montrose Road, Suite 110
Potomac, MD 20854

RE: Tanyard Springs HOA, Glen Burnie, Maryland
Sidewalk Limited Condition Evaluation
CSG Project # 20-133

Dear Ms. Ambush,

Pursuant to your email authorization dated March 3, 2021, this office has undertaken a limited condition evaluation of the concrete sidewalk surfaces at the above referenced property. The scope of work included the following:

- A visual survey of the concrete sidewalk surfaces to observe the present condition and identify repair issues. The survey addressed concrete sidewalks in the property cluster west of the Solley Elementary School.
- Extraction and repair of three (3) concrete core samples for Petrographic Analysis.
- Extraction and repair of three (3) concrete core samples to evaluate for Air Void and Acid-Soluble Chloride Analyses
- Evaluation of the survey results and laboratory testing, and preparation of this letter report summarizing present conditions and recommendations for repair/maintenance.

I. BACKGROUND

In February 2021, CSG was made aware of the Board of Director's desire to analyze premature degradation of sidewalk surfaces at the property cluster west of the Solley Elementary School. The sidewalks at this cluster display surface deterioration in the form of spalling that appears disproportionate to their age. Accordingly, this office recommended that concrete core samples be collected and analyzed by an engineering laboratory to assist in determining the underlying cause(s) of the deterioration. After competitive analytical services proposals were received, Froehling & Robertson, Inc. (F&R) was selected. The conclusions provided in this report pertain to our limited evaluation of the sidewalks at the property cluster west of the Solley Elementary School.

II. OBSERVATIONS

On March 11, 2021, a representative of Construction Systems Group, Inc. (CSG) performed a visual survey of the concrete sidewalks at and around the townhouses west of the Solley

Elementary School (Photo 1). The concrete surfaces in this area display deterioration in the form of concrete scaling and exposed aggregate.

Light deterioration of the sidewalks was characterized by the loss of surface substrate without the exposure of the coarse aggregate (Photo 2). Medium deterioration of the sidewalks was characterized by the loss of surface substrate and exposure of the coarse aggregate (Photo 3). Severe deterioration was characterized by the loss of the surface substrate with some loss of the substrate surrounding the aggregate particles (Photo 4).

III. DESTRUCTIVE TESTING

On March 11, 2021, CSG supervised F&R technicians collect a total of six (6) concrete core samples at three (3) locations, generally representative of the varying degrees of deterioration observed at property cluster (Photo 5). Sampling locations were patched following the extraction of the samples (Photo 6), which were labeled as follows:

Sample ID	Location	Characterization
1A, 1B	7519 Canton Way	Severe Deterioration
2A, 2B	7413 Tanyard Knolls Ln	Medium Deterioration
3A, 3B	503 Bluffton Dr	Light Deterioration

The sample average dimensions were 3.25-in long by 2.64-in diameter. Surface deterioration in the form of scaling and erosion was typical for the collected samples (Photos 6 and 7). Petrographic analysis was performed on samples 1A, 2A, and 3A according to ASTM C856-20 – Standard Practice for Petrographic Examination of Hardened Concrete. The following is a summary of the petrographic analysis results:

- Core Sample 1A: The body of the concrete was of good quality. The coarse aggregate was a hard nominal 1-in. crushed very fine grain and dense limestone. The aggregate was uniformly distributed throughout the concrete, and the paste-to-aggregate bond was tight. Based on the physical properties of the core, the water/cement ratio was estimated at low to medium (0.40 – 0.50). The paste content consisted of Portland cement and water. The core sample was non-air-entrained with small, entrapped voids in the core that were randomly distributed through the paste.

- Core Sample 2A: The body of the concrete was of good quality. The coarse aggregate was a hard nominal 1-in. crushed very fine grain and dense limestone. The aggregate was uniformly distributed throughout the concrete, and the paste-to-aggregate bond was tight. Based on the physical properties of the core, the water/cement ratio was estimated at low to medium (0.40 – 0.50). The paste content consisted of Portland cement and water. The core sample was low-air-entrained with small voids randomly distributed throughout the paste.
- Core Sample 3A: The body of the concrete was of good quality. The coarse aggregate was a hard nominal 1-in. crushed very fine grain and dense limestone. The aggregate was uniformly distributed throughout the concrete, and the paste-to-aggregate bond was tight. Based on the physical properties of the core, the water/cement ratio was estimated at low to medium (0.40

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– 0.50). The core was air-entrained with voids displaying a small spacing factor which helps protect the surface from cycling freeze/thaw damage.

Air-Void and Acid-Soluble Chloride analyses were performed on samples 1B, 2B, and 3B. The analyses were performed according to ASTM C457 – Modified Point-Count Method and ASTM C1152 – Standard Test Method for Acid-Soluble Chloride in Mortar and Concrete, respectively. The following is a summary of the results.

- Core Sample 1B: Total air content of 3.3% and determined chloride of 0.013.
- Core Sample 2B: Total air content of 2.7% and determined chloride of 0.077.
- Core Sample 3B: Total air content of 8.4% and determined chloride of 0.063.

IV. CONCLUSIONS:

Pursuant to our onsite visual survey and core sampling, the concrete sidewalks within the property cluster west of Solley Elementary School were generally constructed in accordance with industry standards at the time of the installation and are in serviceable condition, requiring maintenance repairs to extend their useful life. Required maintenance repairs include selective full-depth concrete sidewalk replacement.

Scaling is present throughout the concrete sidewalks of the cluster west of Solley Elementary School, necessitating replacement. Scaling can be caused by several different mechanisms but is most frequently observed when the concrete is exposed to freeze/thaw cycles.

Concrete that will be exposed to a combination of moisture and cycling freezing requires a water-cement ratio of 0.45. The petrographic analysis indicated that the core samples have an acceptable water-cement ratio. The use of low water-cement ratio prolongs the life of the concrete by reducing the penetration of moisture.

Hardened cement paste and aggregate behave differently when subjected to freeze/thaw cycles. Rocks have pores significantly larger than those in the cement paste, and they expel water during freezing. As the water freezes, it produces pressure in the pores of the cement paste, causing the cavity to dilate and rupture. The result is the separation of the substrate exterior layer from the aggregate.

To alleviate the damage of freeze/thaw cycles, an air entrainment agent is added to the concrete mix. Air entrainment is the intentional creation of air bubbles in the concrete to generate micro cavities that will accommodate expansion and contraction produced by freeze/thaw cycle in the hardened concrete.

According to ACI 201.2R-16 Guide to Durable Concrete, the Severe Exposure category is defined as outdoor exposure in a cold climate where the concrete may be in water contact prior to freezing or where deicing salts are use. Concrete anticipated to be subjected to severe exposure requires an average air entrainment content of 6.0% (with a ±1½% tolerance) for aggregate of 1-in nominal size. Core Samples 1B and 2B yielded results of 3.3% and 2.7% respectively, indicating that insufficient entrained air in the concrete has had an impact on the serviceable life of the sidewalk. An entrained air insufficiency will leave the concrete unprotected against cyclic freezing, causing the substrate to scale and erode.

An acid-soluble chloride analysis was performed to determine the total chloride ion content present within the sidewalks. To provide corrosion protection of the reinforcement within the concrete, the chloride ion content is limited by specification. Limits for the chloride ion content are based on the exposure conditions of the concrete element to water and/or external chlorides such as deicing salts. According to the ACI 318-19 Building Code Requirements for Structural Concrete, the maximum allowable chloride content for concrete exposed to moisture and external chlorides (Exposure Class C2) is 0.15. The analysis of samples 1B, 2B, and 3B yielded results of 0.013, 0.077, and 0.063 respectively, indicating that deicing salts were not a contributing factor in the surface deterioration of the concrete sidewalks.

V. RECOMMENDATIONS/BUDGETS

Based on our findings, the concrete sidewalks within the property cluster west of Solley Elementary School require a maintenance project which should be performed in the near-term to prevent the emergence of a tripping hazard. Pursuant to our experience with similar projects, we have prepared preliminary construction cost estimates. Actual construction costs may vary significantly due to multiple factors including final design detailing, seasonality of pricing, accessibility to the site, the owner's permitted construction schedule and working hours, material cost fluctuation and availability, and other factors beyond our control.

The costs indicated should be used for preliminary budgeting purposes only. Cost estimates are based on the repairs being performed under a single contract in a single phase. This survey report is not a design document and should not be relied upon or used as such. The estimated cost of construction to perform the work identified above, including a 5% contingency, is $70,000.00. Construction Phase Engineering Services are not included in this estimate. This cost is typically estimated at 10-12% of the estimated cost of construction but it is dependent on the duration of the project.

If you have any questions or comments, please do not hesitate to contact the writer.

RESPECTFULLY SUBMITTED;
CONSTRUCTION SYSTEMS GROUP, INC.

Lorena Michel | *Wayne F. Hosking*

Lorena Michel, P.E.
Project Engineer

Wayne F. Hosking
Vice President

Cc: File 20-133

Attachments: Photographs
Appendix A: Petrographic Examination of Hardened Concrete
Appendix B: Air-Void System Analysis
Appendix C: Acid-Soluble Chloride Analysis

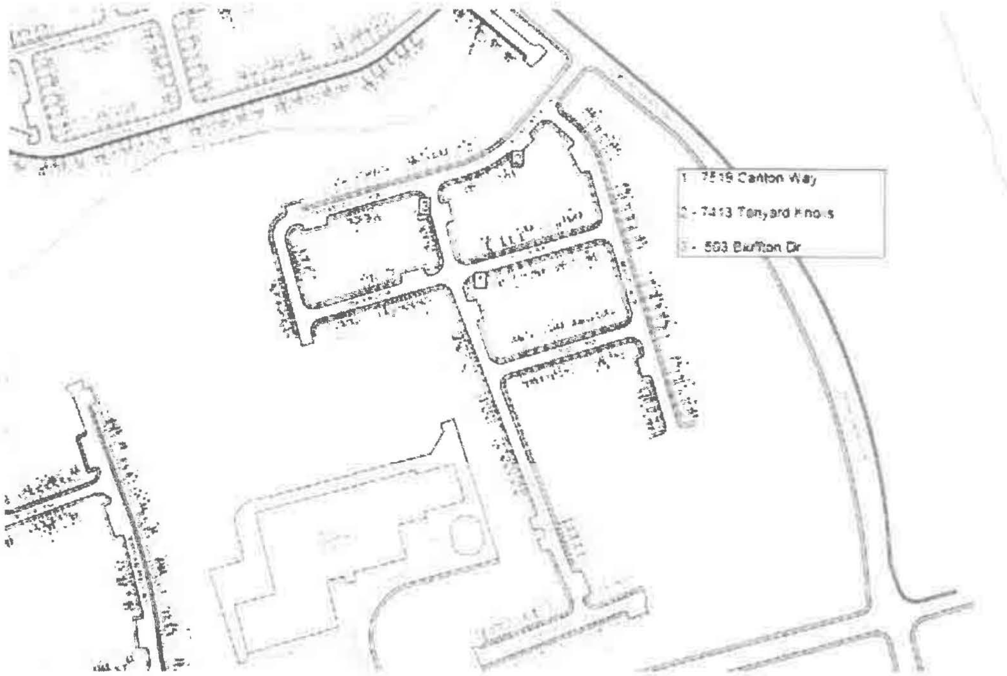

Photo 1 – Property cluster west of the Solley Elementary School.

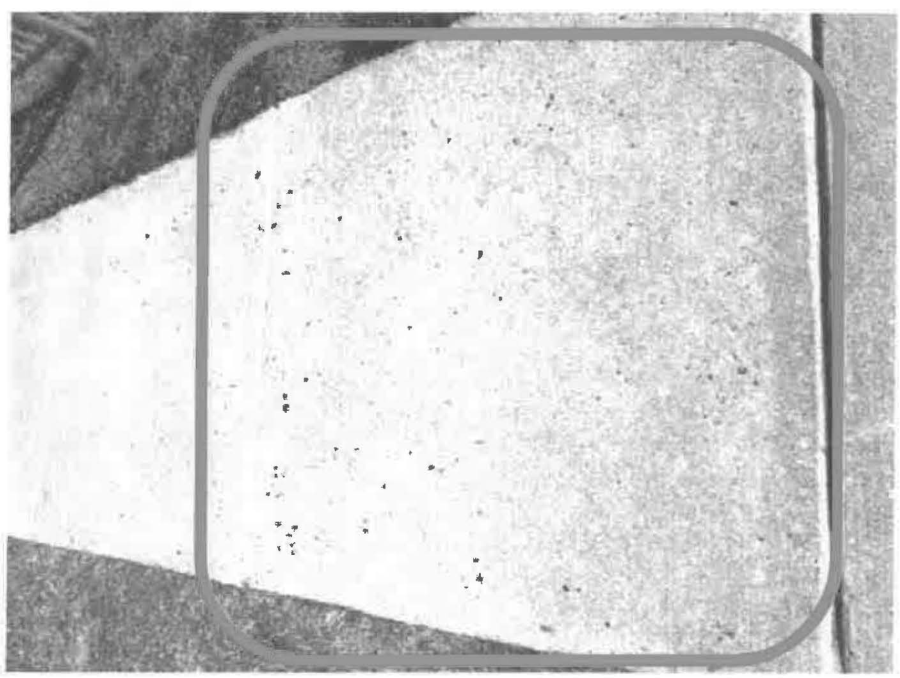

Photo 2 – Typical view of Light Deterioration.

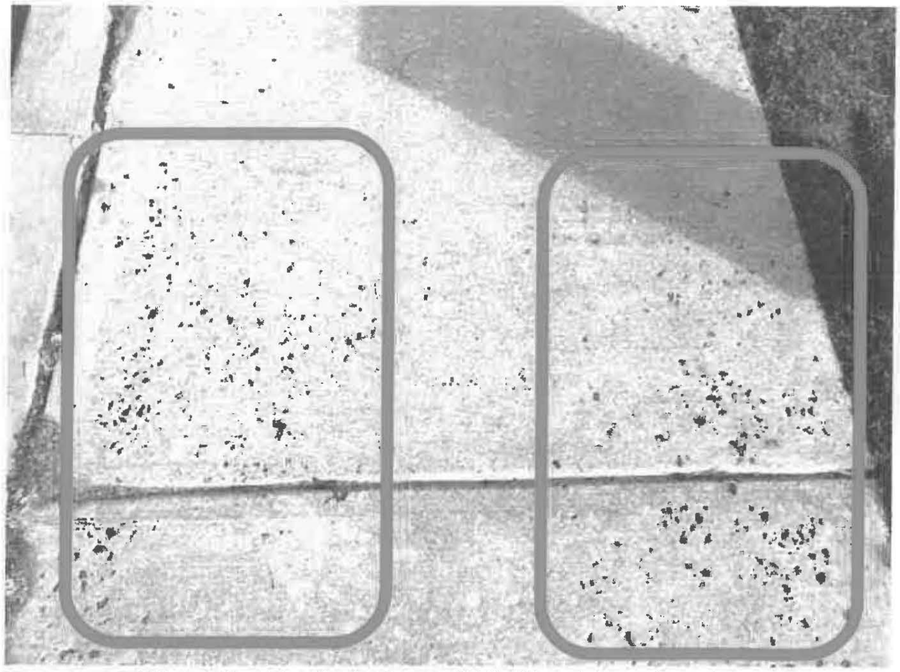

Photo 3 – Typical view of Medium Deterioration.

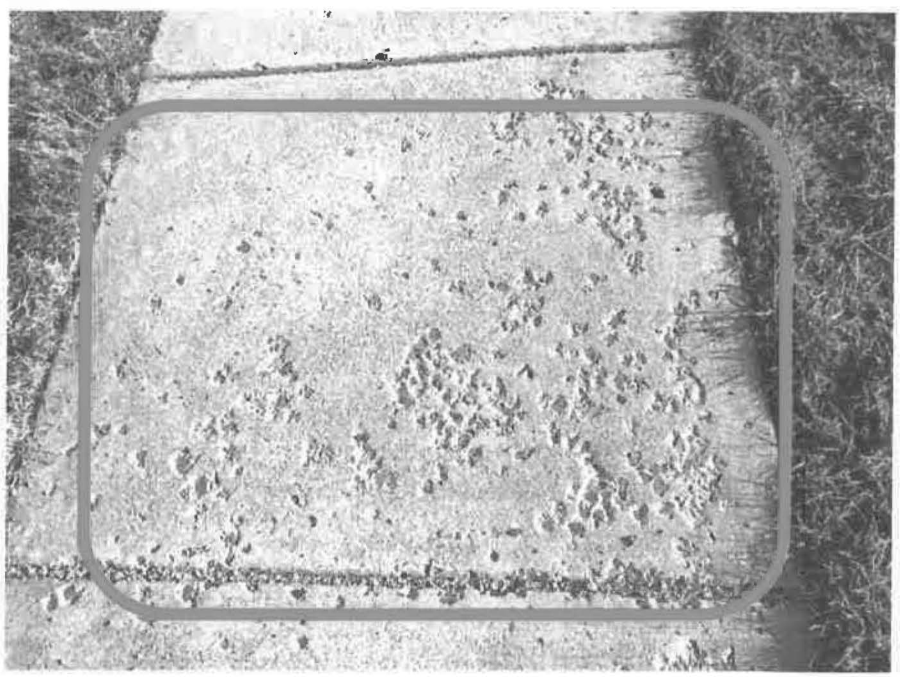

Photo 4 – Typical view of Severe Deterioration.

Photo 5 – Typical view of concrete core sample collection.

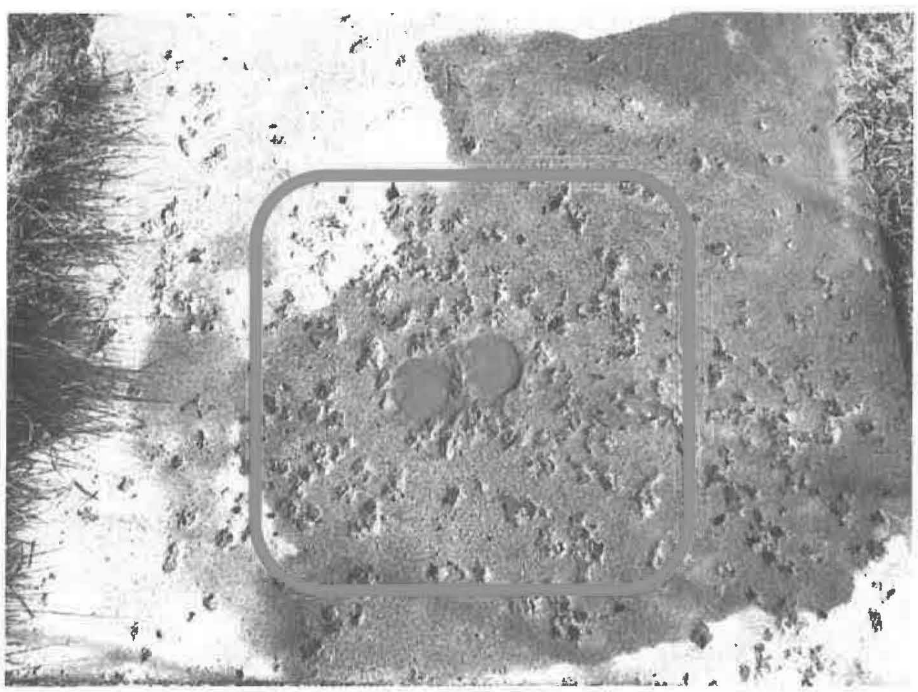

Photo 6 – Typical view of sampling area patched upon completion of collection.

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Photo 7 – Typical view of scaling in collected sample.

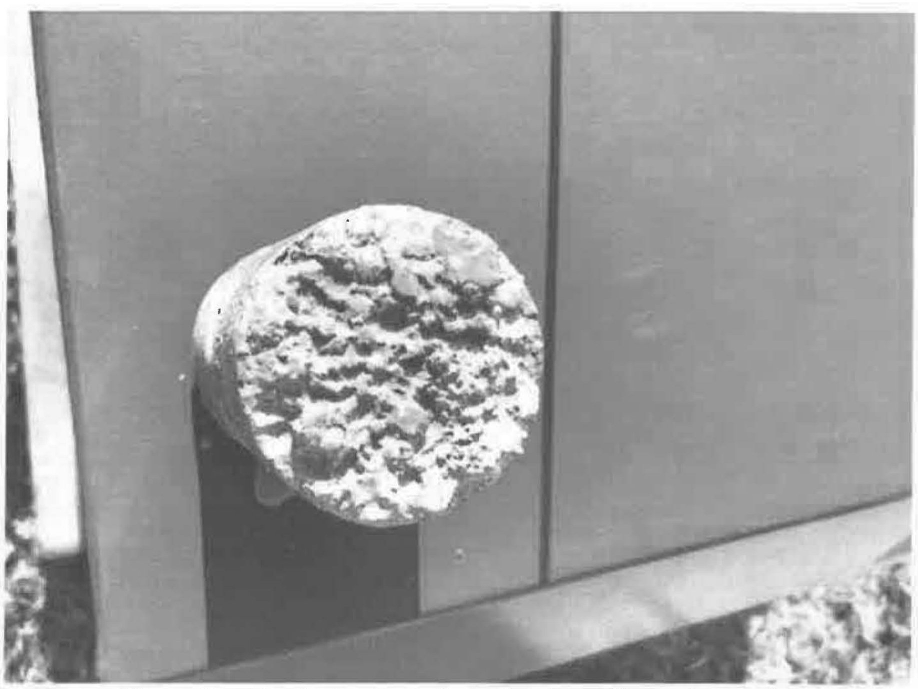

Photo 8 – Typical view of erosion in collected sample.

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