Strand Associates, Inc.®
910 West Wingra Drive
Madison, WI 53715
(P) 608.251.4843
www.strand.com

November 25, 2025

Mr. Corey Stelljes
City of Madison Parks Division
330 East Lakeside Street
Madison, WI 53715

Re: Lincoln School Driveway Retaining Wall Replacement
City of Madison, Wisconsin (City)

Dear Corey,

This letter provides a summary of Strand Associates, Inc.®'s (Strand) structural assessment and review of alternatives to replace the existing retaining wall along the Lincoln School Driveway adjacent to James Madison Park.

Background

The City requested a structural assessment of the existing retaining wall supporting the driveway north of the Lincoln School Apartment Building. The Lincoln School was constructed in 1915 and was later converted into apartments in the 1980s. The building is privately owned, but the City Parks Department is responsible for maintaining the retaining wall and adjacent embankment. The existing retaining wall is noted in red on Figure 1.

Source: Strand

Figure 1 Lincoln School Apartments

Existing Condition

The existing retaining wall is located directly below a concrete curb along the edge of the driveway. The retaining wall is approximately 200 feet long with a maximum exposed height of approximately 2 feet. The wall is located along the top of a steep embankment, sloping approximately 1.7:1 away from the retaining wall. The concrete curb was constructed separate from the retaining wall and appears to have been added after the original retaining wall construction based on the condition of the curb relative to the retaining wall concrete. The existing concrete wall is in poor condition with significant spalling throughout and some locations where the wall has completely crumbled, leaving no support for the concrete curb above. The photograph in Figure 2 shows significant concrete spalling and exposed steel reinforcement.

Source: Strand

Figure 2 Existing Wall Condition

The loss of structural support for the concrete curb has resulted in settlement of the curb and caused the curb to separate from the adjacent asphalt pavement. Stormwater runoff flows into the gap between the asphalt pavement and curb, causing erosion, further deterioration of the concrete retaining wall, and loss of pavement support.

Tree Preservation

The current health and potential impacts to the trees along the existing driveway and embankment were reviewed by City Forestry staff. The eastern group of trees was determined to be in poor condition and recommended for removal as part of the project. The 24-inch-diameter oak tree near the west end of the embankment was determined to be in good condition. The tree (as shown in Figure 3) is approximately 8 feet north of the existing retaining wall, so excavation around the retaining wall is likely to harm the tree's root system. Preservation and impacts to the mature oak tree were evaluated for each retaining wall replacement alternative.

Source: Strand

Figure 3 Mature Oak Tree

Alternatives Analysis

Several alternatives were considered and evaluated to address the failing retaining wall. The alternatives analysis included considerations related to slope stability, geotechnical evaluation of subsurface soils, maintenance of the embankment slope, construction impacts, park space impacts, preservation of existing trees, construction cost, and current design standards for retaining walls and vehicular barriers along roadways.

A summary of alternatives is provided in the following with the primary advantages and disadvantages of each in relation to the considerations listed previously.

Alternative 1–Construct New Concrete Retaining Wall

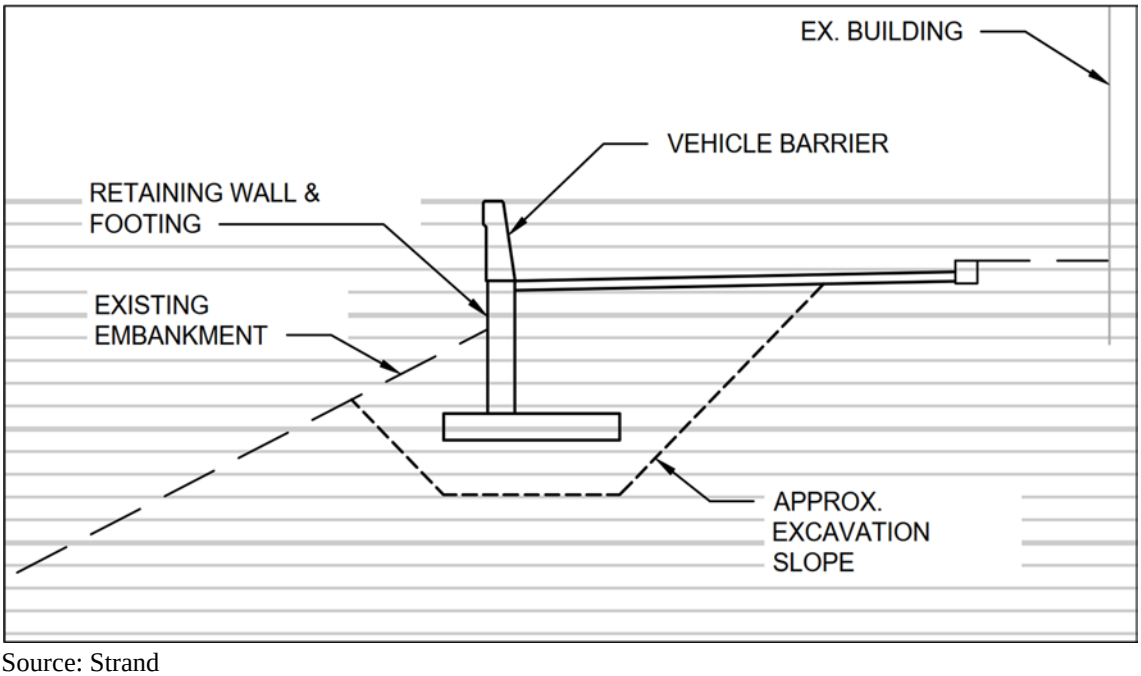
The first alternative considered was to replace the failing retaining wall with a new concrete retaining wall. The existing retaining wall is crumbling and structurally deficient, and it has no vehicular barrier along the drop off. These deficiencies would need to be addressed as part of the retaining wall replacement design.

Replacing the existing retaining wall with a new retaining wall initially seemed like a reasonable approach; however, it quickly became apparent that this alternative has the highest cost and most significant negative impacts.

Soil borings along the driveway and embankment were performed by CGC, Inc. on March 6, 2024. The soil borings indicated loose fill materials that are not suitable for support of a new retaining wall foundation. The geotechnical engineer recommended removal of at least 30 inches of soil below the retaining wall footing. The building code requires concrete footings to bear at least 4 feet below ground for frost protection. As a result, the excavation depth for a new retaining wall would be approximately 7 feet below the existing pavement. An excavation of this depth would require the driveway and parking structure to be closed during construction, or a temporary shoring wall would be needed to support the southern one-half of the driveway. This would result in additional cost and impacts to construct a temporary sheet pile or soldier pile retaining wall along the length of the driveway.

The existing driveway has a 6-inch raised concrete curb as the only separation between the driveway and a 2-foot drop off to the steep embankment. A concrete curb is not considered a vehicular barrier; however, the retaining wall replacement alternative would need to incorporate a concrete or steel vehicle barrier along the top of wall. The traffic barrier would provide protection for vehicles but would increase the cost, provide a visual barrier toward the park and lake, require additional long-term maintenance, and would make snow removal more difficult with a continuous wall along the driveway.

A typical cross section of the driveway and retaining wall for this alternative is shown in Figure 4. In addition to the negative impacts noted previously, the foundation depth and excavation required for this alternative would cause significant damage to the 24-inch oak tree at the west end of the site. In summary, this alternative has the highest construction cost, has the most significant impacts to the driveway access during construction, causes the most damage to the existing oak tree, and does not improve maintenance operations for the embankment slope.



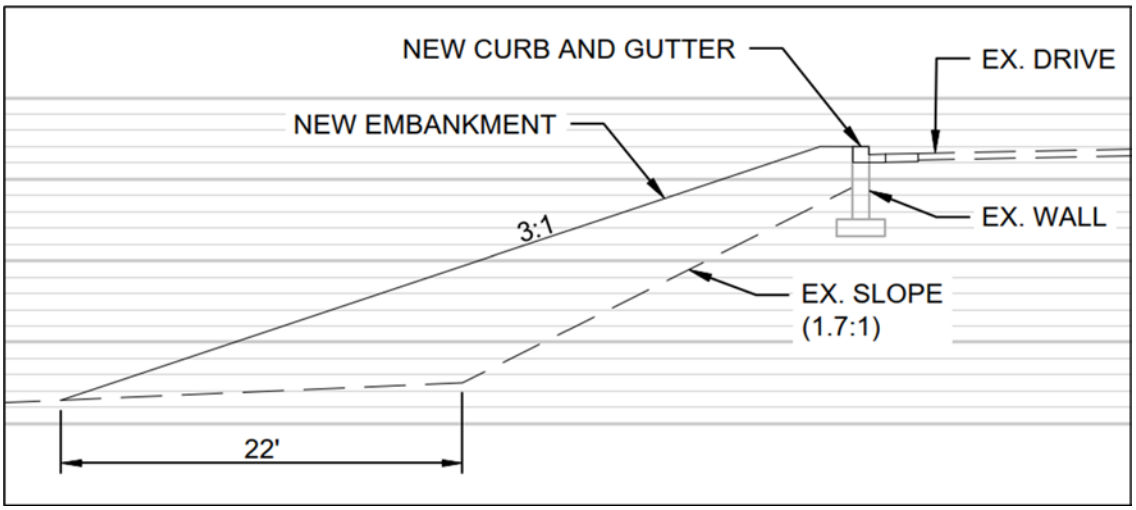
Source: Strand

Figure 4 Alternative 1 Typical Cross Section

Alternative 2–Eliminate Retaining Wall and Construct New Embankment

Rather than constructing a new wall to replace the existing retaining wall, another alternative would be to eliminate the need for a retaining wall. The historical constraints that led to construction of the existing retaining wall are not known, but the existing site has adequate open space to the north to eliminate the need for a retaining wall. This alternative includes adding soil (fill) over the existing embankment to bury the existing retaining wall and create a more gradual, "mowable" slope from the driveway to the north. A new 3:1 slope would be planted with turf that could be mowed and with new tree plantings. The existing slope is too steep to be mowed, so brush and undesirable trees have grown over time. Review of the existing trees by City Forestry found no healthy trees on the slope that are worth saving, except for the 24-inch oak tree as previously noted.

Adding fill and regrading the slope would require fill placement in the lawn area to the north of the existing embankment. The bottom of the new embankment would be approximately 22 feet north of the existing embankment, as shown in the cross section in Figure 5. The existing lawn area impacted by this alternative is approximately 3,300 square feet. While this alternative impacts the flat lawn area, the new embankment would be useable mowed turf rather than the steep overgrown embankment.



Source: Strand

Figure 5 Alternative 2 Typical Cross Section

The driveway modifications associated with this alternative include a new curb and gutter and an adjacent strip of asphalt patching, so the driveway could remain open to a single lane during construction.

Options to preserve the 24-inch oak tree were considered as part of this alternative. A modular block retaining wall around the tree was evaluated to avoid placing fill over the roots of the tree. City Forestry helped to develop the retaining wall layout for this alternative but remained concerned that the embankment near the tree would likely stress and shorten the tree's lifespan. After reviewing the cost-benefit considerations for the tree protection wall, the City determined the additional cost was not warranted, as the tree is likely to see tip dieback within 10 years and removal within 15 years even with a retaining wall to reduce impacts.

In summary, this alternative has the lowest cost, creates a mowed lawn area, and has the least impact to the existing driveway; however, it impacts the lawn area to the north and likely includes removal of the mature oak tree.

Alternative 3–Reconstruct Existing Wall Near Oak Tree and Regrade the Slope

Alternative 3 was developed with the goal of preserving the mature 24-inch oak tree near the east end of the site while still achieving the project objectives to repair the failing retaining wall. This alternative includes constructing a new embankment and eliminating the retaining wall as described in Alternative 2 for the eastern portion of the site tree, but the western portion of the site in the vicinity of the tree would remain unchanged. The existing retaining wall along the driveway is failing and must be replaced, but this alternative includes an approach to match the existing wall to minimize impacts to the tree. A conceptual site grading plan is shown in Figure 6.

Source: Strand

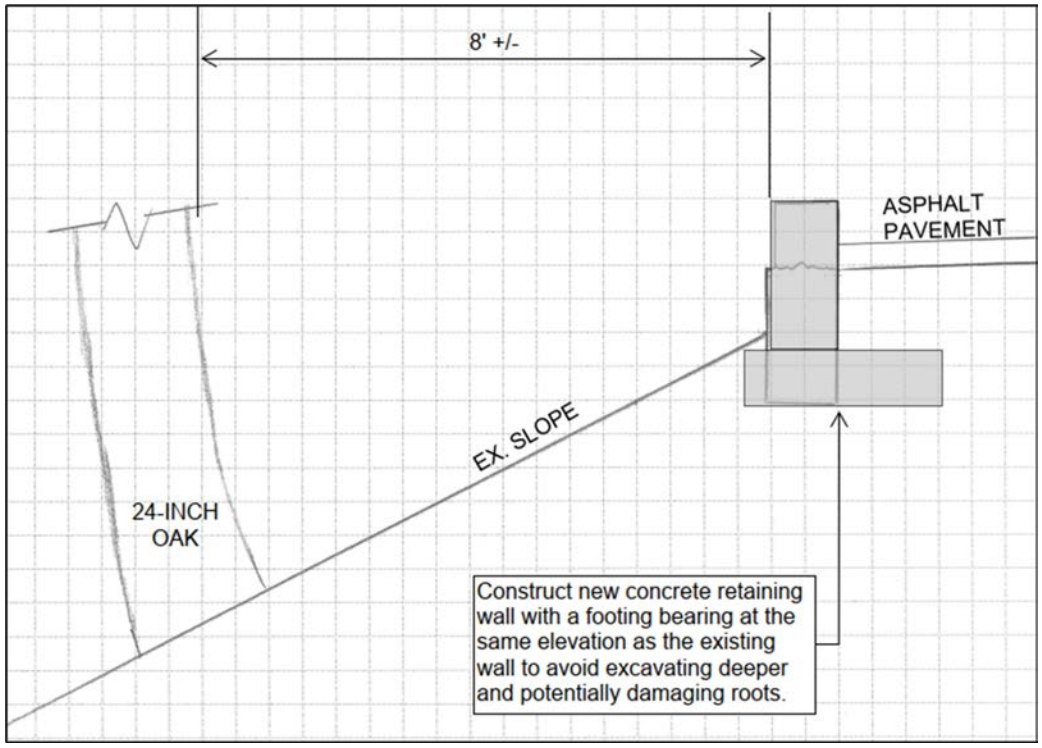
Figure 6 Alternative 3 Conceptual Grading Plan

The existing tree has grown around the retaining wall, so carefully removing and reconstructing the retaining wall with minimal excavation provides the best chance to preserve the tree according to City Forestry. From a structural standpoint, reconstructing the wall to match the existing wall does not meet current design standards, but it could be considered maintenance as opposed to constructing a new wall. The risk of disregarding the geotechnical recommendation to remove 30 inches of unsuitable soil below the new retaining wall footing is minimized, considering the long-term performance of the existing retaining wall. The existing wall deficiencies are primarily concrete degradation rather than settlement or instability. For this reason, acceptable structural stability is anticipated for a new retaining wall, matching the existing wall dimensions and footing depth.

This alternative could potentially incorporate a vehicle barrier along the top of the new wall, if desired, but maintaining the existing condition with no barrier may be an acceptable alternative if that is the City's preference.

Construction impacts to the driveway and site are similar to those described for Alternative 2. The driveway would need to be reduced to a single lane but could remain open during the retaining wall reconstruction and embankment construction. Impacts to the park space would also be similar to Alternative 2 for the eastern portion of the site, but there would be no impacts to the western end to avoid ground disturbance around the mature oak tree.

In summary, this alternative provides the highest likelihood of preserving the existing tree, while also improving maintenance on the eastern portion of the site by regrading the embankment to a mowable slope as seen in Figure 7.



Source: Strand

Figure 7 Alternative 3 Typical Cross Section

Other Alternatives

Other alternatives were considered as possibilities to preserve the tree including suspended pavement near the tree and a soldier pile wall with piles located using vacuum excavation to avoid tree roots. These alternatives were not considered practical because of the geotechnical conditions of the site.

Cost Comparison

A concept-level opinion of probable construction cost was developed for each alternative to assist the City with evaluating the three alternatives. The construction cost comparison is included in the following summary.

Alternative	Construction Cost
1–New Concrete Retaining Wall	$580,000
2–Eliminate Retaining Wall and Construct New Embankment	$180,000
3–Reconstruct Existing Wall Near Oak Tree and Regrade the Slope	$220,000

Summary

Alternative 3 is the alternative that best balances the City's objectives to repair the existing retaining wall, improve slope maintenance, and preserve the mature oak tree. Variations of this alternative could also be developed as appropriate. Alternative 1 has the highest cost and the most construction impacts affecting access to the parking facility and the existing trees. Alternative 2 has the lowest construction cost but does not preserve the mature oak tree.

Please call 608-817-4081 the City has any questions or would like further explanation regarding the alternatives considered.

Sincerely,

STRAND ASSOCIATES, INC.®

Brett M. Oftedahl, P.E.