



PROVIDENCE PARTNERS

REPAIR PLAN REPORT

Prepared For:
Quail Run Homeowners' Association

Russell Pate, HOA President
1050 21st Avenue NW
Hickory, NC 28601

April 17, 2026

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April 17, 2026

Russell Pate

Quail Run Homeowner's Association, Inc.

1050 21st Avenue Northwest
Hickory, NC 28601

Dear Mr. Pate,

Per the request of the Quail Run Homeowners Association, we have reviewed available information provided by Jim Lee, PE, of Lee Solutions and Services, PLLC, and developed a coordinated structural repair plan for Buildings 1 through 7. This effort includes evaluation of existing conditions, identification of likely causes of distress, development of construction details, establishment of repair phasing, and preparation of a unit-based cost framework to support implementation.

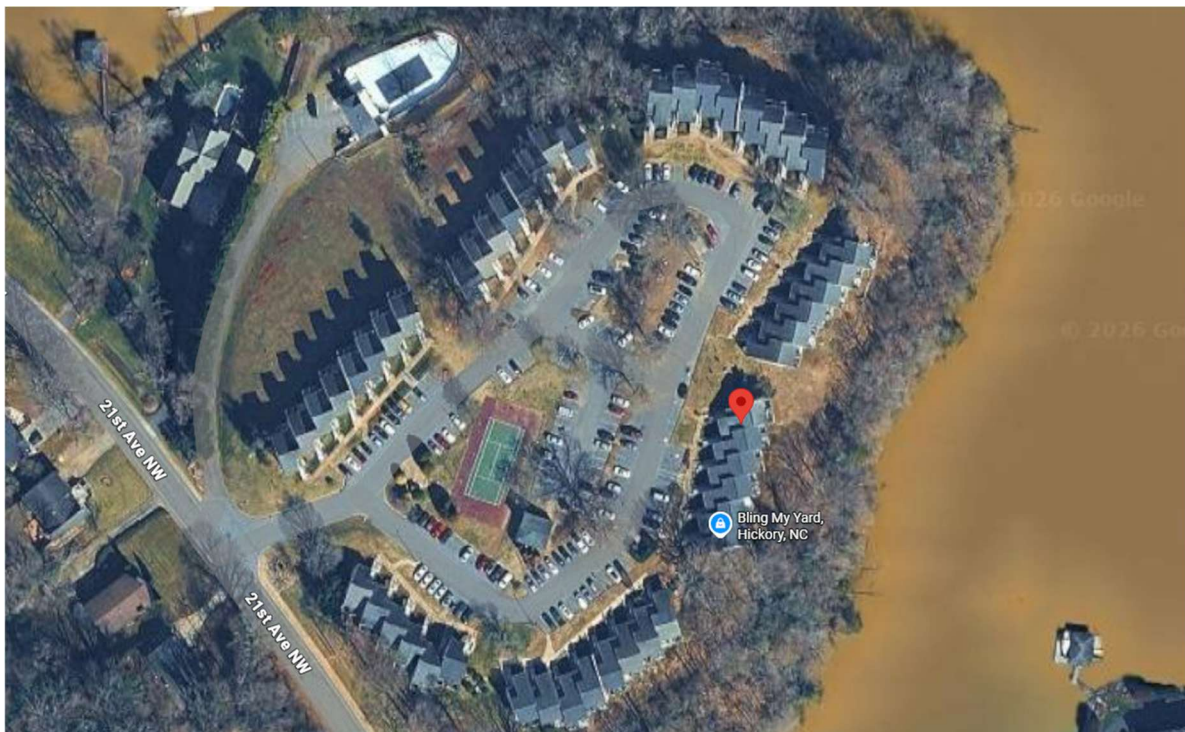


FIGURE 1: PROJECT OVERVIEW MAP



1. EXECUTIVE SUMMARY

A structural evaluation was performed for Buildings 1 through 7 to assess crawlspace conditions, foundation performance, and contributing drainage and moisture issues. The intent of this effort was to identify the extent of structural distress, determine likely causes, and provide a clear path forward for repair and long-term stabilization.

Across the site, the primary issues observed include inadequate or displaced crawlspace supports, sagging floor framing, localized foundation settlement, and recurring moisture intrusion. Exterior grading and drainage deficiencies are contributing to water accumulation at and beneath several buildings, which is accelerating deterioration of structural elements and reducing soil bearing capacity at support locations.

The severity of conditions varies by building:

- **Building 5** exhibits the most significant distress. Observations indicate footing instability, erosion at support locations, and structural degradation requiring partial reconstruction of support elements. This building represents the highest risk of continued movement and should be addressed first.
- **Building 6** shows widespread sagging at girder supports and deterioration at bearing interfaces. Conditions are consistent with long-term moisture exposure and support displacement. Repairs are required to restore alignment and load transfer.
- **Building 7** includes localized support instability, cracking, and areas requiring post-stabilization and foundation reinforcement. Conditions are more isolated than in Building 6 but still require coordinated structural repair.
- **Building 2** shows multiple areas of settlement and water-related impacts, including pooling and soft bearing conditions. Underpinning and localized footing stabilization are recommended.
- **Buildings 1, 3, and 4** generally exhibit lower levels of distress, consisting primarily of supplemental support needs and drainage improvements. These buildings are suitable for later-phase repairs.



The observed conditions are attributed to a combination of insufficient or degraded support systems, prolonged moisture exposure, and inadequate site drainage. In several locations, these factors have acted together, leading to progressive settlement and loss of effective load paths.

A standardized repair approach has been developed to address these conditions. Recommended work includes installation of new crawlspace supports, girder reinforcement and realignment, footing extension and underpinning, crawlspace drainage improvements, and full replacement of failed support elements where required. These repairs are organized into a detail package for consistency in design, pricing, and construction.

A risk-based phasing plan is recommended to prioritize the work based on severity and likelihood of continued deterioration:

- **Phase 1:** Building 5
- **Phase 2:** Buildings 6 and 7
- **Phase 3:** Building 2
- **Phase 4:** Buildings 1, 3, and 4

This sequencing prioritizes structural stability and minimizes the potential for increasing repair scope due to delay. Cost estimates have been developed using unit-based repair components and aggregated by building and phase. A phased implementation allows the Association to plan assessments over time while addressing the most critical conditions first.

This report, along with the associated detail package and appendices, is intended to provide a practical framework for executing repairs. Field verification during construction is required, and adjustments should be made as needed to address actual site conditions encountered.

The recommended approach restores structural support, improves drainage performance, and provides a consistent basis for long-term maintenance of the buildings.



2. PROJECT OVERVIEW

A structural evaluation was performed for Buildings 1 through 7 within the subject residential community. The purpose of this evaluation was to assess the condition of crawlspace structural systems, identify signs of foundation distress, evaluate drainage and moisture-related impacts, and develop practical repair recommendations.

The evaluation consisted of visual observations of accessible areas within crawlspaces and at building exteriors. No destructive investigation or subsurface exploration was performed as part of this scope unless otherwise noted.

This report documents observed conditions, identifies likely causes of distress, and provides a structured repair approach supported by a standardized detail package.

3. CURRENT CONDITIONS

The scope of services included the following:

- Visual observation of crawlspace framing systems, including girders, joists, posts, and bearing conditions
- Observation of foundation elements, including footings, piers, and foundation walls, where accessible
- Evaluation of crawlspace moisture conditions and ventilation characteristics
- Review of exterior grading and drainage conditions adjacent to each building
- Identification of structural deficiencies and distress patterns
- Development of recommended repair strategies
- Preparation of a detail package to support construction and pricing
- Development of a risk-based phasing plan for repair implementation

No geotechnical investigation, material testing, or structural analysis beyond engineering judgment based on observed conditions was included unless specifically stated.

4. ASSESSMENT

The following section will review the current condition of the buildings in the Quail Run community individually. This attempts to outline the overall condition of each of the buildings to better plan for construction phasing based on risks and potential cost objectives.

4.1 BUILDING 1 (UNITS 1–12)



Observed conditions include generally minor structural deficiencies consisting of localized areas requiring supplemental crawlspace support and minor drainage concerns. No widespread structural instability was observed. Conditions are considered stable with low risk of rapid progression.



FIGURE 2: CRAWLSPACE CONDITION

4.2 BUILDING 2 (UNITS 13–28)



Multiple areas of settlement were observed, including signs of soft bearing conditions and water accumulation within the crawlspace and along the perimeter of the building. Localized displacement of supports and uneven floor framing were noted. Conditions indicate the need for underpinning and footing stabilization in select areas.



FIGURE 3: MOISTURE CONDITION

4.3 BUILDING 3 (UNITS 29–40)



Conditions are generally moderate, with isolated areas of support deficiency and minor moisture intrusion. Supplemental supports and drainage improvements are recommended to prevent future deterioration.



FIGURE 4: ISOLATED SUPPORT DEFICIENCIES

4.4 BUILDING 4 (UNITS 41–52)



Similar to Building 3, conditions consist primarily of localized support needs and minor drainage deficiencies. No significant structural distress was observed at the time of evaluation.



FIGURE 5: DRAINAGE ISSUES AND FOUNDATION DETERIORATION

4.5 BUILDING 5 (UNITS 53–68)



Building 5 exhibits the most severe conditions observed across the site. Significant crawlspace distress is present, including footing instability, erosion at support locations, and degradation of structural support elements. Areas of slope-related impact and moisture concentration were also observed.



FIGURE 6: CRAWLSPACE MOISTURE DRIVE

The extent of deterioration indicates the need for partial reconstruction of support systems, including replacement of posts, beams, and footings in select areas.



FIGURE 7: STRUCTURAL SUPPORT AND CRAWLSPACE DEGRADATION

4.6 BUILDING 6 (UNITS 69–84)



Widespread sagging of girders and displacement at support locations were observed. Bearing interfaces show signs of deterioration consistent with long-term moisture exposure. Structural realignment and reinforcement of support systems are required.



FIGURE 8: SAGGING GIRDERS IN CRAWLSPACE DUE TO LACK OF POST SUPPORT

4.7 BUILDING 7 (UNITS 85–100)



Localized structural issues were observed, including post-instability, cracking, and areas requiring foundation reinforcement. While less severe than Building 5, these conditions require coordinated repair to restore structural performance.



FIGURE 9: POST INSTABILITY

5. ENGINEERING ASSESSMENT

In multiple locations, these factors are acting simultaneously, resulting in progressive structural movement and loss of effective load paths. The observed conditions are consistent with long-term performance degradation rather than isolated failure. The following outlines these factors:

5.1 STRUCTURAL FACTORS

- Inadequate spacing or capacity of the crawlspace supports
- Loss of bearing at post and footing interfaces
- Deterioration of wood members due to prolonged exposure

Structural deficiencies cause load path interruptions, change building load points, and do not provide adequate support for code-prescribed loading scenarios.

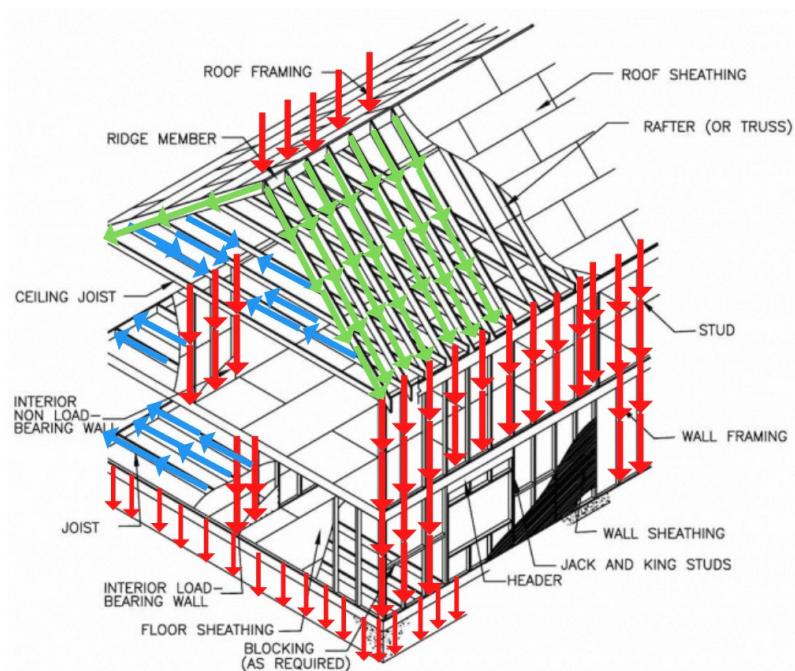


FIGURE 10: TYPICAL RESIDENTIAL LOAD PATH DIAGRAM

5.2 MOISTURE AND DRAINAGE

- Poor site grading resulting in water accumulation near foundations
- Lack of effective drainage systems
- Elevated crawlspace humidity contributing to material degradation

Lack of proper drainage causes these accumulations and does damage to structures when left for long periods of time.

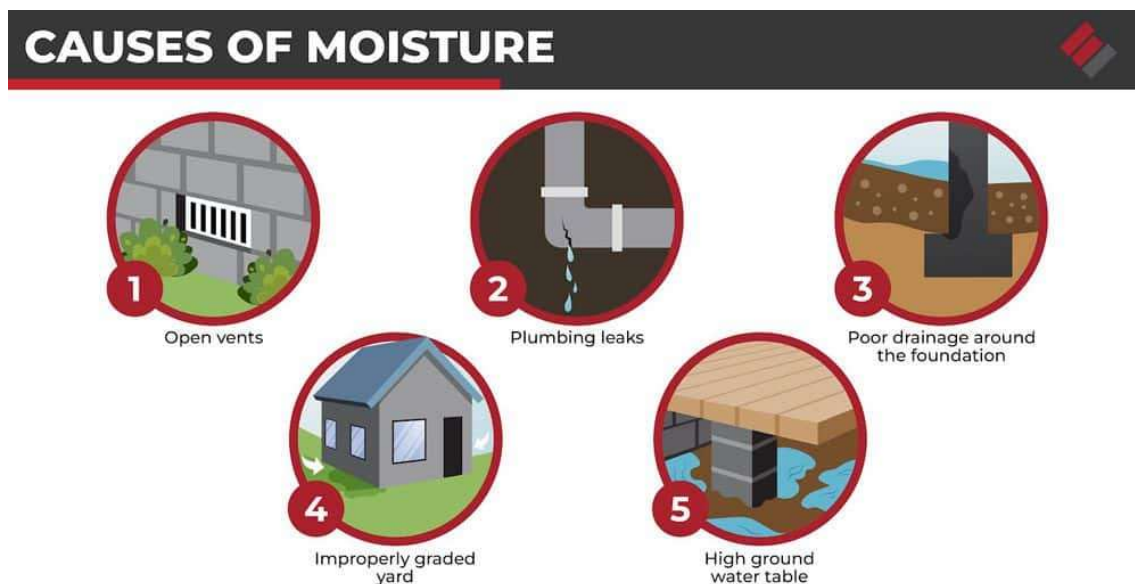


FIGURE 11: TYPICAL CAUSES OF MOISTURE INTRUSION

5.3 SOIL AND FOUNDATION CONDITIONS

- Localized settlement due to soft or saturated soils
- Erosion at footing locations
- Reduced soil bearing capacity from prolonged moisture exposure

Soil and foundation issues attribute to a lack of load path, causing unanticipated structural loading of support members.



5.4 COMBINED EFFECTS

In many areas, the above factors are acting simultaneously, resulting in progressive structural movement and loss of effective load paths. This occurs over long periods of time but can be mitigated with proper planning during original construction; additionally, periodic maintenance of the buildings can prolong the useful life of the building's components.

Without corrective action, continued settlement, material deterioration, and increased repair scope should be expected over time. Proper repair requires both structural stabilization and mitigation of contributing moisture and drainage conditions.

6. RECOMMENDED REPAIRS

Repairs are organized into a standardized detail package for consistency and constructability. While we have outlined various locations in the construction details, all detail locations may not be shown within the detail package. Should details that are hidden or undocumented be found, amendments to the construction details may be required.

Typical repair measures include:

- Installation of supplemental crawlspace supports (Detail 1)
- Girder reinforcement and joist sistering (Detail 2)
- Vapor barrier installation and moisture control (Detail 3)
- Exterior drainage improvements (Detail 4)
- Underpinning and footing stabilization (Detail 5)
- Footing extension where required (Detail 6)
- Girder realignment and controlled jacking (Detail 7)
- Full replacement of failed structural elements (Detail 8)
- Slope stabilization and erosion control (Detail 9)
- Crawlspace drainage trench systems (Detail 10)
- Crack repair and wall stabilization (Detail 11)
- Exterior post and deck support stabilization (Detail 12)



- Cleaning and treating of steel girders (See Material and Technical Specs)
- Damaged insulation repair (See Material and Technical Specs)
- Replacement of damaged siding (See Material and Technical Specs)

The specific combination of details varies by building based on observed conditions.

7. DETAIL PACKAGE INDEX

A complete detail package is provided in Appendix A. These details are intended to standardize construction methods, support cost development, and provide clear guidance for contractors.

The table below outlines the anticipated construction details required to perform repairs within the Quail Run community:

Detail ID	Detail Name	Category	Unit Type	Pricing Basis	When to Use	Risk Tier	Notes
1	Crawlspace Support Pier	Structural Support	EA	Per support location	Minor footing issues, added support needed	Moderate	Baseline support detail
2	Girder / Beam Sistering	Structural Repair	LF	Length of reinforcement	Sagging or undersized girders	Moderate	Often paired with Detail 1
3	Vapor Barrier	Moisture Control	SF	Area covered	High humidity, crawlspace moisture	Low–Moderate	Applies across most buildings
4	Perimeter Drainage / Swale	Drainage	LF	Length of drainage path	Water pooling, poor grading	Moderate–High	Exterior scope driver
5	Segmental Underpinning	Foundation	LF	Length of underpinning	Settlement, footing instability	High	Requires sequencing notes
6	Footing Extension	Foundation	EA / LF	Per footing or length	Undersized or eroded footing	Moderate–High	Often localized



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7	Girder Realignment / Jacking	Structural Adjustment	EA	Per lift point	Sagging or rotated framing	Moderate–High	Must include lift limits
8	Full Post / Beam / Footing Replacement	Structural Reconstruction	EA	Per replacement location	Severe damage, structural failure	Critical	Highest cost driver
9	Slope Stabilization	Geotechnical / Site	LF	Length of slope treatment	Erosion, slope cracking	High–Critical	Often tied to drainage
10	Crawlspace Reconfiguration / Drainage Trench	Drainage / Interior	LF	Length of trench	Chronic moisture, poor grading	High	Interior drainage system
11	Crack Repair / Wall Stabilization	Structural Repair	LF	Length of crack or wall	Foundation cracking or movement	Moderate–High	Distinguish structural vs non-structural
12	Deck / Exterior Post Stabilization	Structural Support	EA	Per post	Exterior support settlement	Moderate–High	Often at rear elevations

Each detail is associated with a unit-based pricing structure and may be applied at multiple locations depending on field conditions. Repairs shall be performed in accordance with the detail package provided in Appendix A. The contractor shall coordinate with the engineer to confirm repair locations and quantities based on field conditions. Any deviations from the intent of the details shall be submitted for review prior to construction.



8. COST AND PHASING OUTLINE

Cost estimate tabulations have been developed using unit-based repair components and aggregated by building and project phase. This approach allows for scalable pricing and flexibility in implementation.

A phased repair plan is recommended as follows:

- **Phase 1:** Building 5
- **Phase 2:** Buildings 6 and 7
- **Phase 3:** Building 2
- **Phase 4:** Buildings 1, 3, and 4

The phased repair approach is intended to prioritize structural stability and reduce the potential for escalation of damage. Delayed implementation, particularly for Buildings 5 and 6, is expected to result in increased repair scope and associated cost due to continued movement and environmental exposure over the next 10-15 years.

9. CONSTRUCTION SEQUENCING

While contractor means and methods are outside the engineering scope, the following sequencing requirements are critical to maintaining structural stability during construction:

- Temporary shoring shall be installed prior to the removal of structural elements
- Jacking operations shall be performed in controlled increments
- Underpinning shall be completed in staged segments
- Drainage improvements shall be installed to prevent reoccurrence of conditions

10. ENGINEERING CONSTRAINTS

The following limitations apply to this engineering project scope:

- Observations were limited to accessible areas
- Concealed conditions may exist
- No geotechnical investigation was performed
- Recommendations are based on conditions observed at the time of evaluation



The engineer shall be notified of any conditions that differ from those described in this report.

11. CONCLUSION

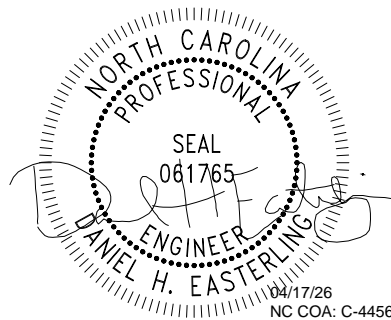
The buildings evaluated exhibit varying levels of structural distress primarily driven by inadequate support conditions and moisture-related impacts. The recommended repair program provides a practical and scalable approach to restoring structural performance and mitigating future deterioration.

Implementation of the phased repair plan will improve structural reliability, reduce long-term maintenance costs, and provide a defensible framework for ongoing capital planning. Failure to address the identified conditions will likely result in continued degradation and increased future repair costs. While the community is not at risk for imminent structural failures, further progression of the deterioration over the next 10-15 years could cause severe structural deficiencies.

The opinions stated in this report are based on visual observations only. This report was prepared for the exclusive use of the client. This report was based on the information available at this time. Should additional information become available, I reserve the right to determine the impact, if any, the new information may have on my opinions and conclusions and to revise my opinions and conclusions if necessary and warranted.

Regards,

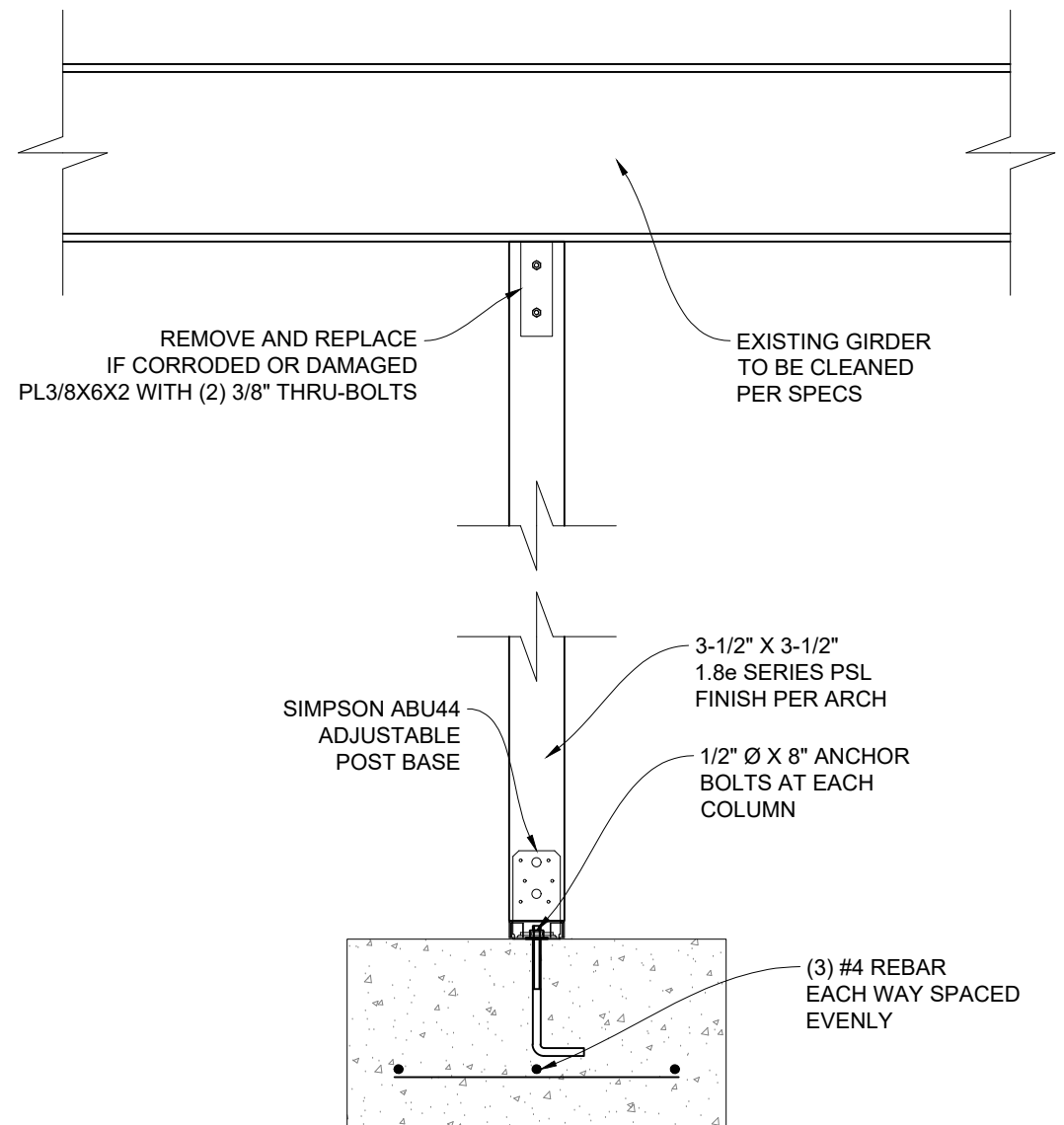
Daniel H. Easterling, PE





APPENDIX A

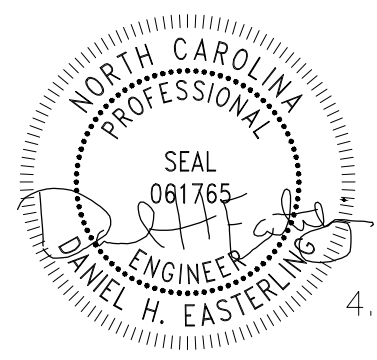
Detail Package



DETAIL NOTES:

1. REVIEW EACH POST AND FOOTING IN CRAWLSPACE.
2. IF CORROSION IS PRESENT ON POST BASE, OR GIRDER TAB REPLACE PER THE DETAIL.
3. IF THE WOOD POST IS DAMAGED, REPLACE PER THE DETAIL.

1 TYPICAL POST AND FOOTING
Scale: 1" = 1'-0"



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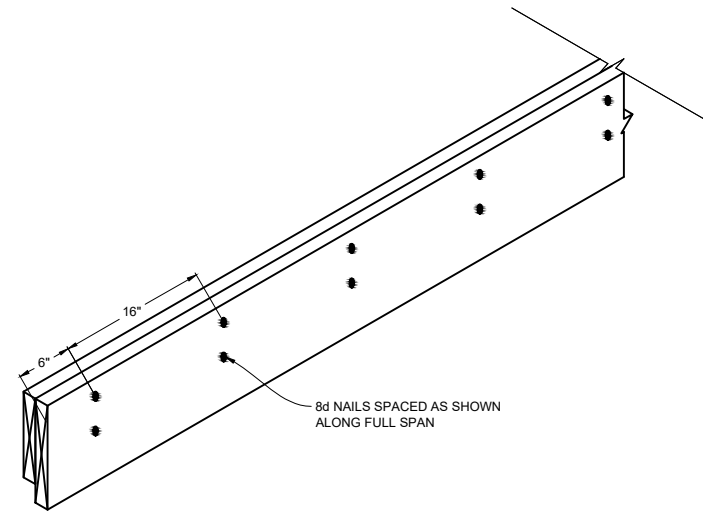
QUAIL RUN HOMEOWNERS' ASSOCIATION

STRUCTURAL REPAIR AND CRAWLSPACE STABILIZATION PROJECT

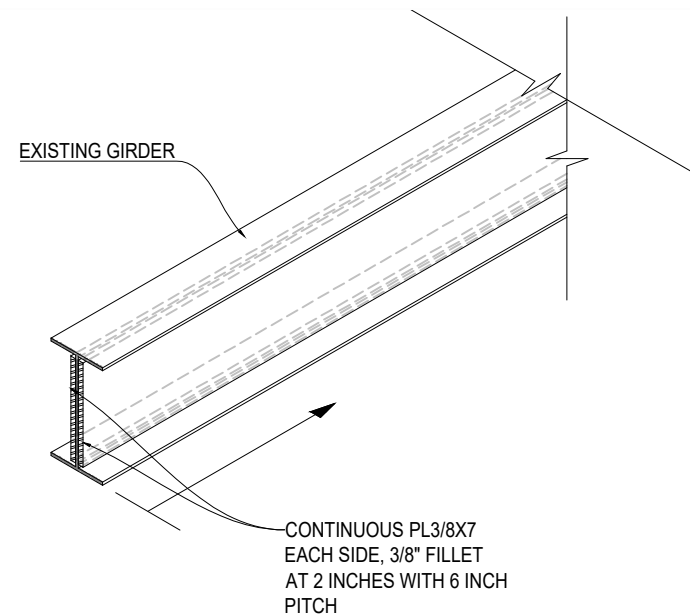
SHEET SCOPE: TYPICAL POST REPAIR SCOPE

Project No. QUAIL RUN HOA
Date 4.17.2026
Sheet

DTL. 1



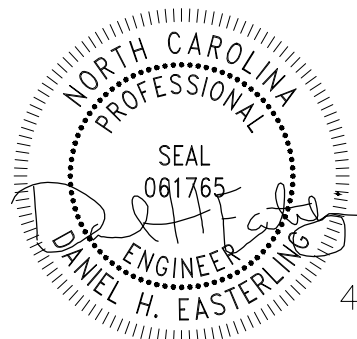
1 TYPICAL JOIST SISTERING Not to Scale



2 TYPICAL GIRDER REPAIR Not to Scale

DETAIL NOTES:

1. REVIEW EACH JOIST AND GIRDER FOR ROT AND/OR CORROSION.
2. PROVIDE SISTERED JOIST AT EVERY OTHER JOIST TO PROVIDE ADDITIONAL FLOOR SUPPORT.
3. INSTALL PLATE ON EACH SIDE OF GIRDER AFTER CLEANING PER THE PROJECT SPECIFICATIONS.



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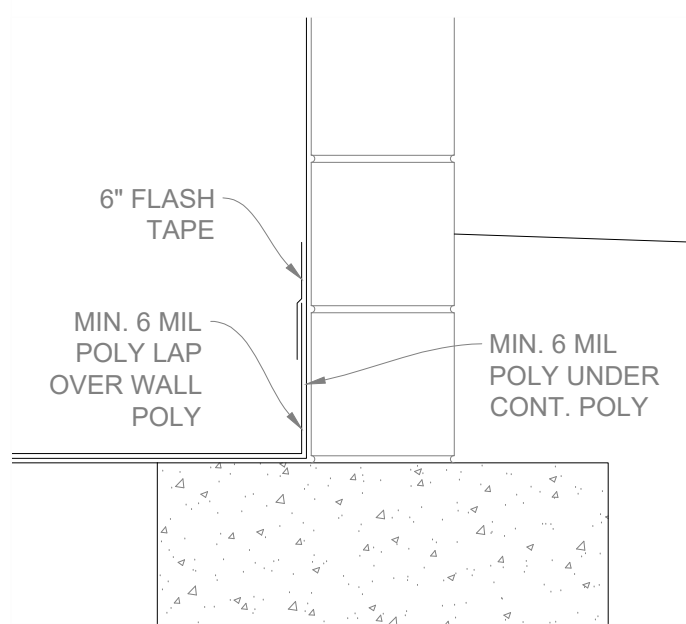
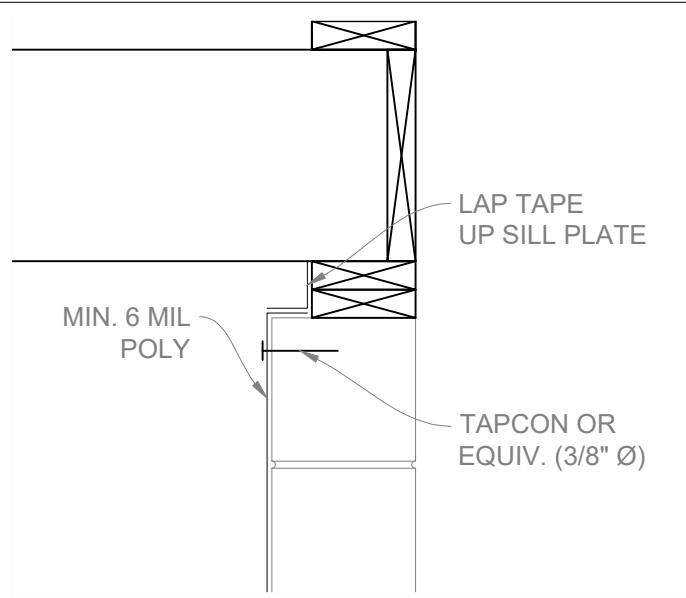
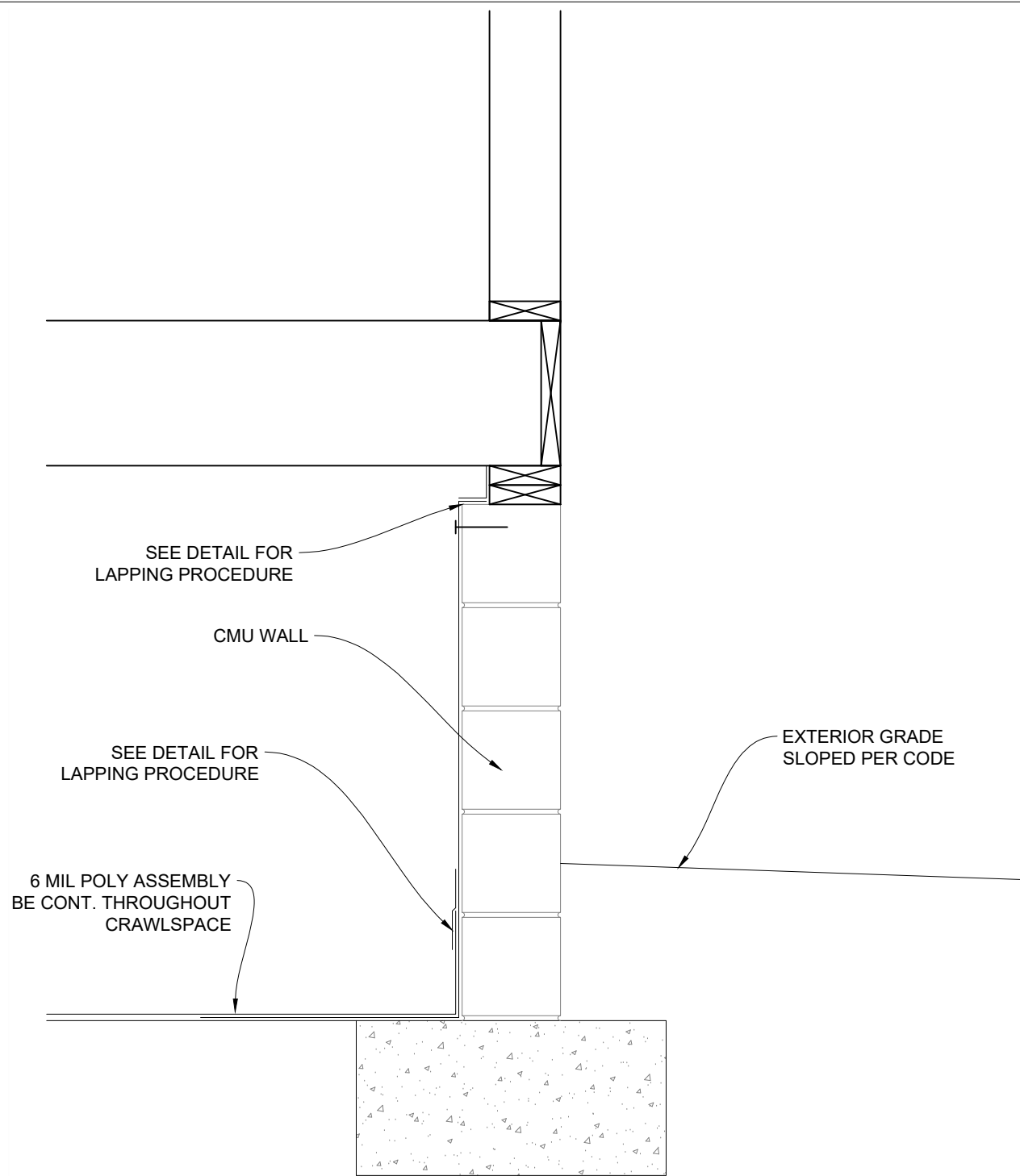
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STRUCTURAL REPAIR AND CRAWLSPACE STABILIZATION PROJECT

SHEET SCOPE: GIRDER/BEAM REPAIR AND SISTERING

Project No. QUAIL RUN HOA
Date 4.17.2026
Sheet

DTL. 2

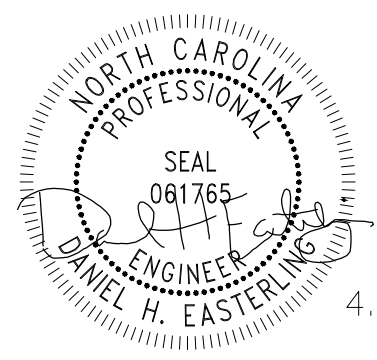


DETAIL NOTES:

1. INSTALLATION OF VAPOR BARRIER TO APPLY TO ALL CRAWLSPACES.
2. VAPOR BARRIER SHALL BE LAPPED WITH COMPONENTS AS SHOWN.
3. THIS IS TO BE INSTALLED IN CONJUNCTION WITH DETAIL 10.
4. VAPOR BARRIER TO BE A MINIMUM OF 6 MIL.
5. SUPPLEMENTAL DETAILS ARE NOT TO SCALE.

1 TYPICAL CRAWLSPACE VAPOR BARRIER INSTALLATION

Scale: 1" = 1'-0"



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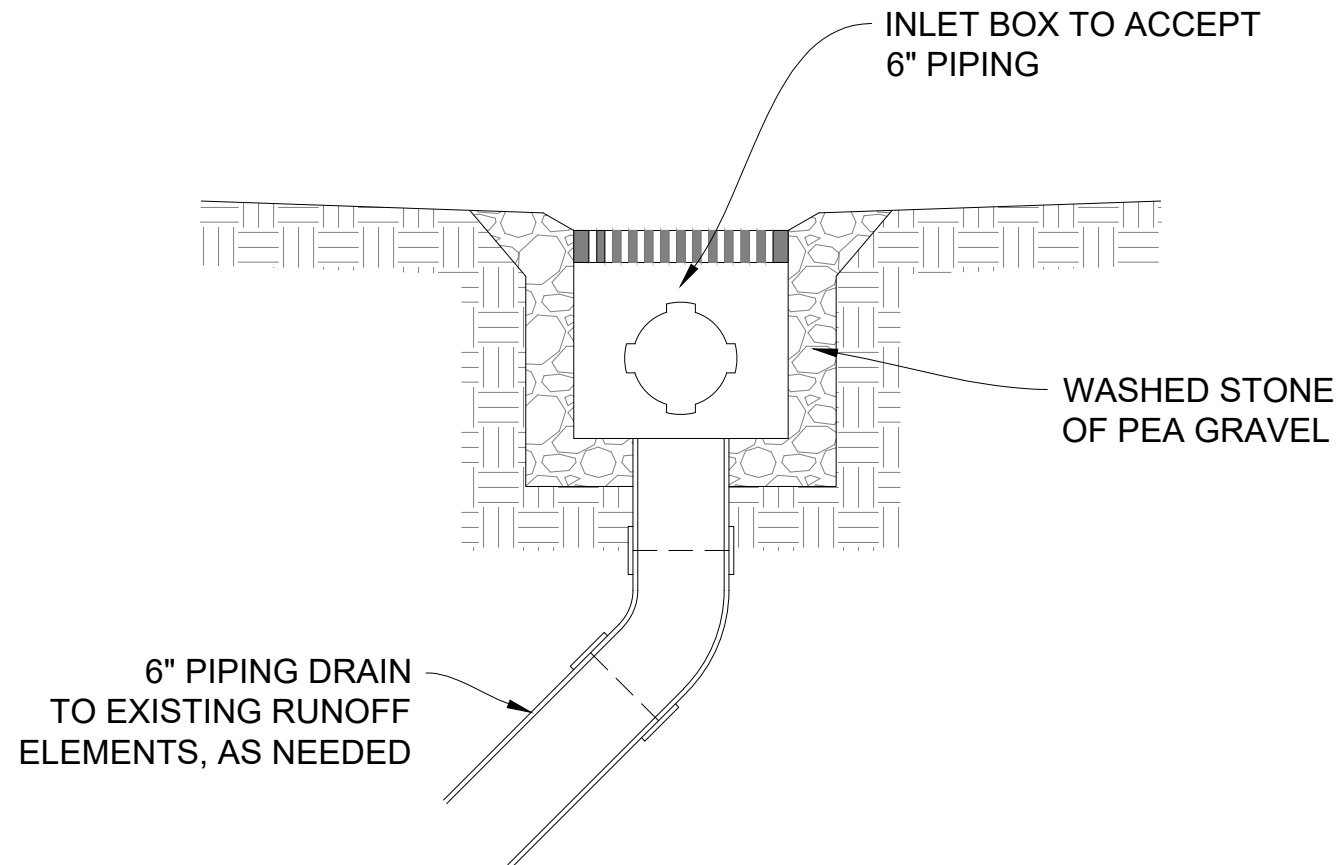
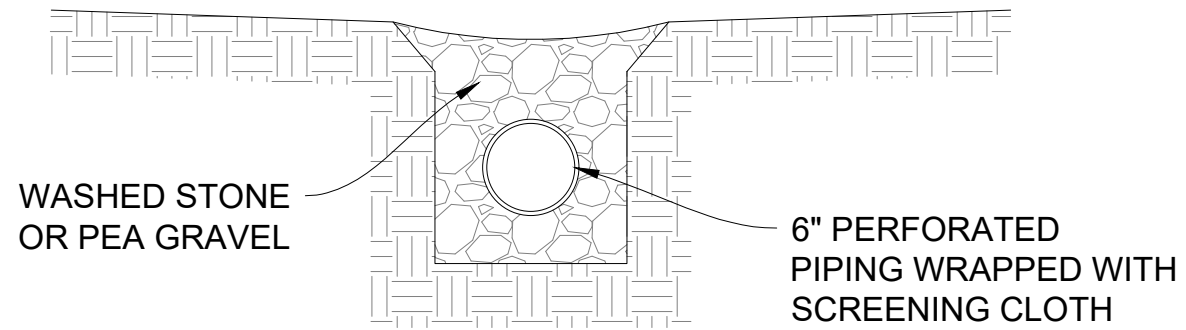
QUAIL RUN HOMEOWNERS' ASSOCIATION

STRUCTURAL REPAIR AND CRAWLSPACE STABILIZATION PROJECT

SHEET SCOPE: MOISTURE MITIGATION/VAPOR BARRIER

Project No. QUAIL RUN HOA
 Date 4.17.2026
 Sheet

DTL. 3

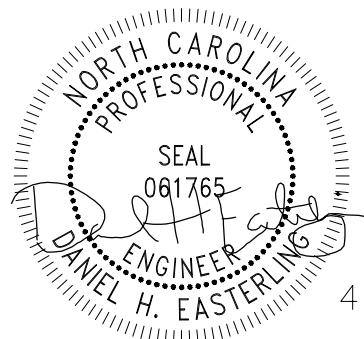


1 TYPICAL PERIMETER DRAINAGE SYSTEM

Scale: 1" = 1'-0"

DETAIL NOTES:

1. INSTALL DRAINAGE SYSTEM AROUND PERIMETER OF EACH BUILDING.
2. OUTLET SHALL DISCHARGE TO DAYLIGHT AT THE CLOSEST LOW POINT/STORMWATER DRAINAGE ELEMENTS
3. WASHED STONE TO BE MAXIMUM OF 1-1/4" AND SHALL BE "WELL-GRADED".
4. DEPTH TO BE MIN. 16" AND WIDTH TO BE MIN. 12".



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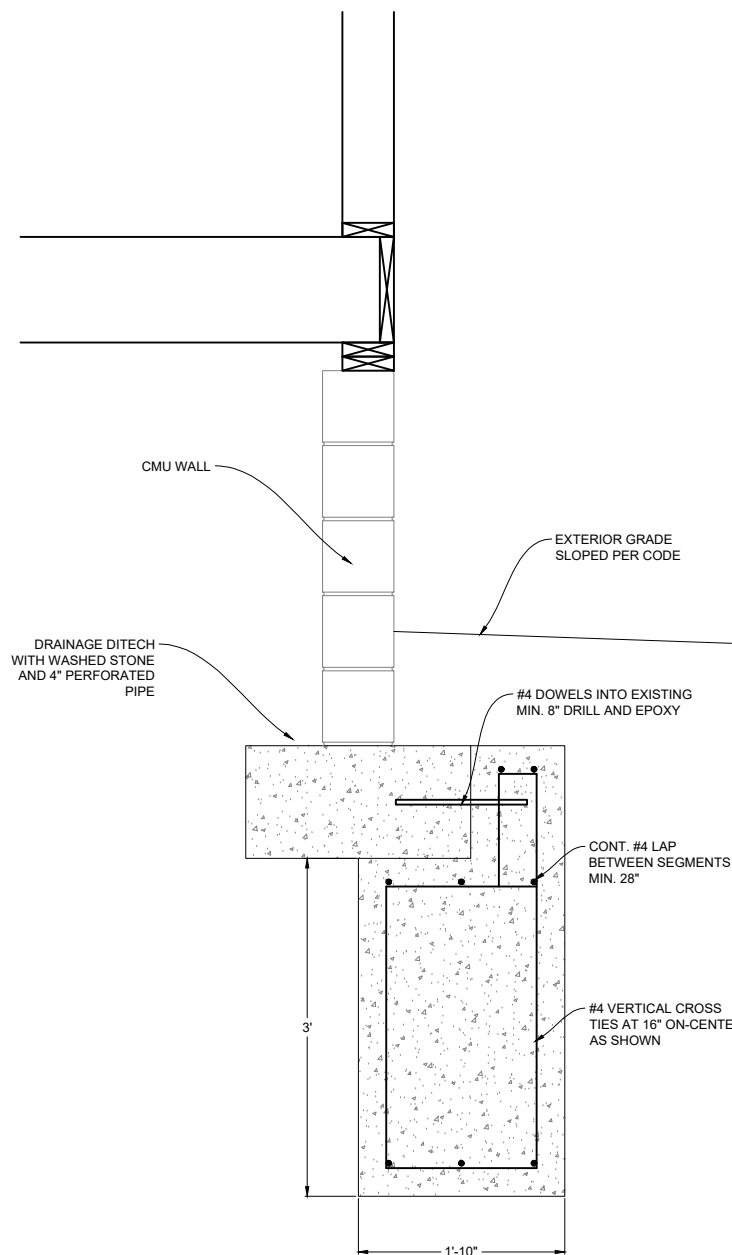
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STRUCTURAL REPAIR AND CRAWLSPACE STABILIZATION PROJECT

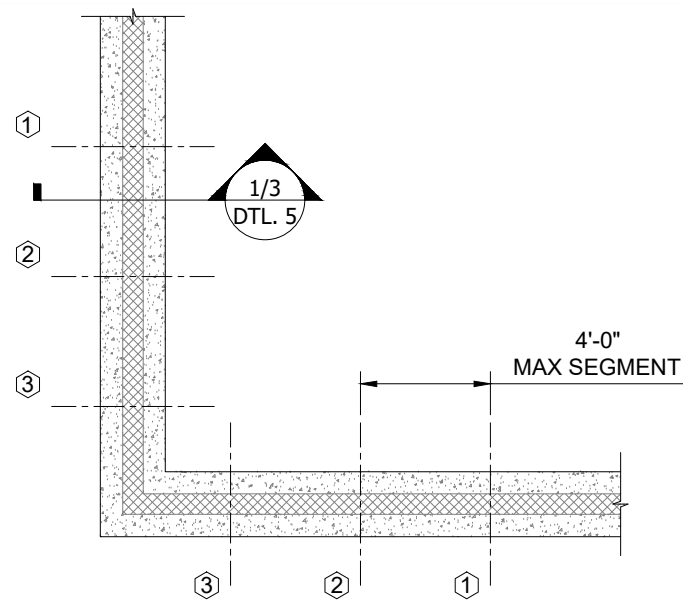
SHEET SCOPE: PERIMETER DRAINAGE/SWALE

Project No. QUAIL RUN HOA
Date 4.17.2026
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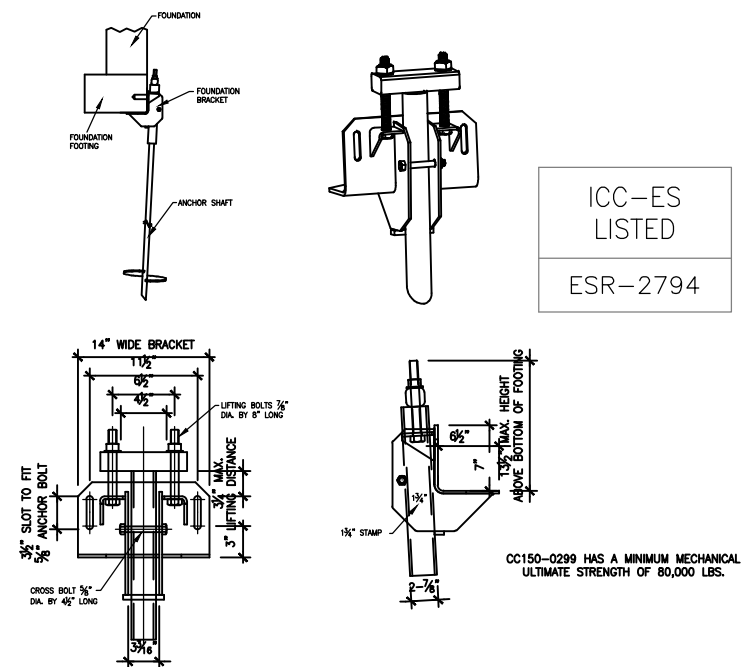
DTL. 4



1 TYPICAL SEGMENTED UNDERPIN
Scale: 1" = 1'-0"



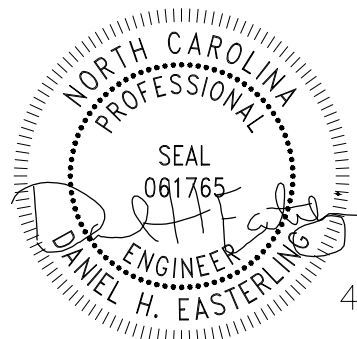
2 CORNER LAYOUT
Not to Scale



3 TYPICAL HELICAL UNDERPIN
Not to Scale

DETAIL NOTES:

1. UNDERPINNING TO OCCUR AT EXTERIOR CORNERS OF EACH BUILDING.
2. CORNER LAYOUT SHOWS SEGMENTS TO BE INSTALLED.
 - 2.1. SEGMENT 1-2 FIRST, SEGMENT 2-3 NEXT, AND SEGMENT 3-CORNER LAST TO NOT STRAIN FOUNDATION.
3. SEGMENTS ARE LIMITED TO 4'-0" MAXIMUM AS SHOWN.
4. IF HELICAL PIERS ARE CHOSEN AS THE UNDERPIN OPTION, INSTALLATION SHALL OCCUR AT LOCATION 3 ON EACH EXTERIOR CORNER OF THE BUILDINGS.
 - 4.1. HELICAL PIERS SHALL BE TORQUED TO A MIN. OF 20-KIPS.



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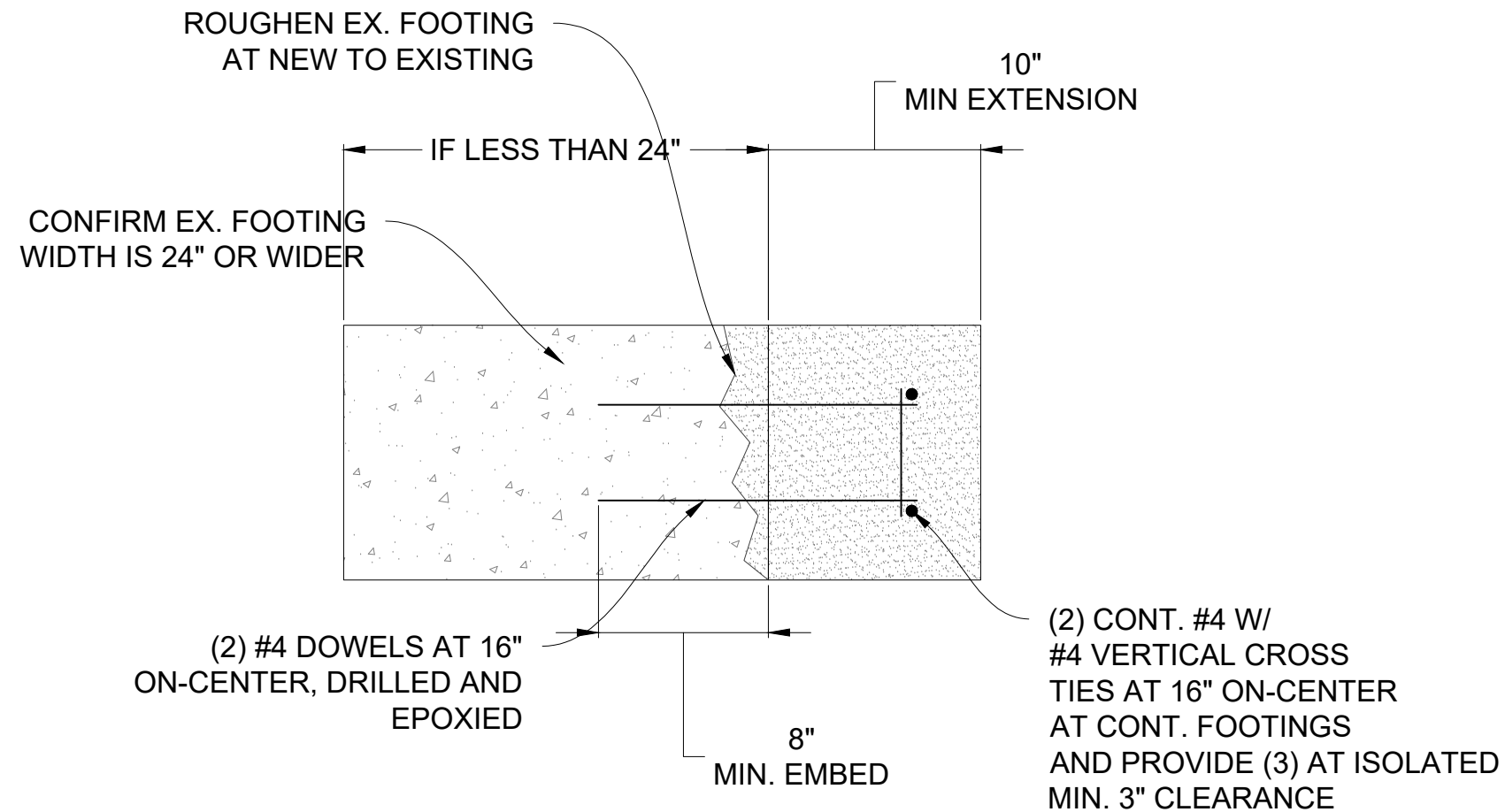
SHEET SCOPE: UNDERPINNING (SEGMENTAL OR HELICAL)

Project No. QUAIL RUN HOA
Date 4.17.2026
Sheet

DTL. 5

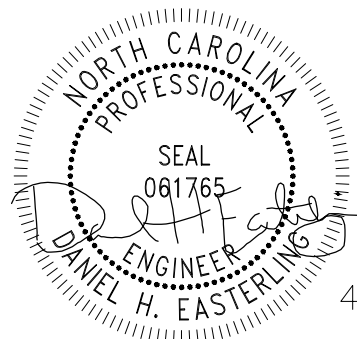
DETAIL NOTES:

1. FOOTING EXTENSIONS OCCUR AT LOCATIONS WHERE FOOTINGS ARE LESS THAN 24" DUE TO DAMAGE OR ORIGINAL CONSTRUCTION.
2. FOOTINGS SHALL BE EXPOSED OR PROBED TO DETERMINE EFFECTIVE WIDTH.
3. NEW CONCRETE SHALL BE A MINIMUM OF 3,500 PSI.
4. USE HILTI EPOXY OR EQUIVALENT.



1 TYPICAL POST AND FOOTING

Scale: 1" = 1'-0"



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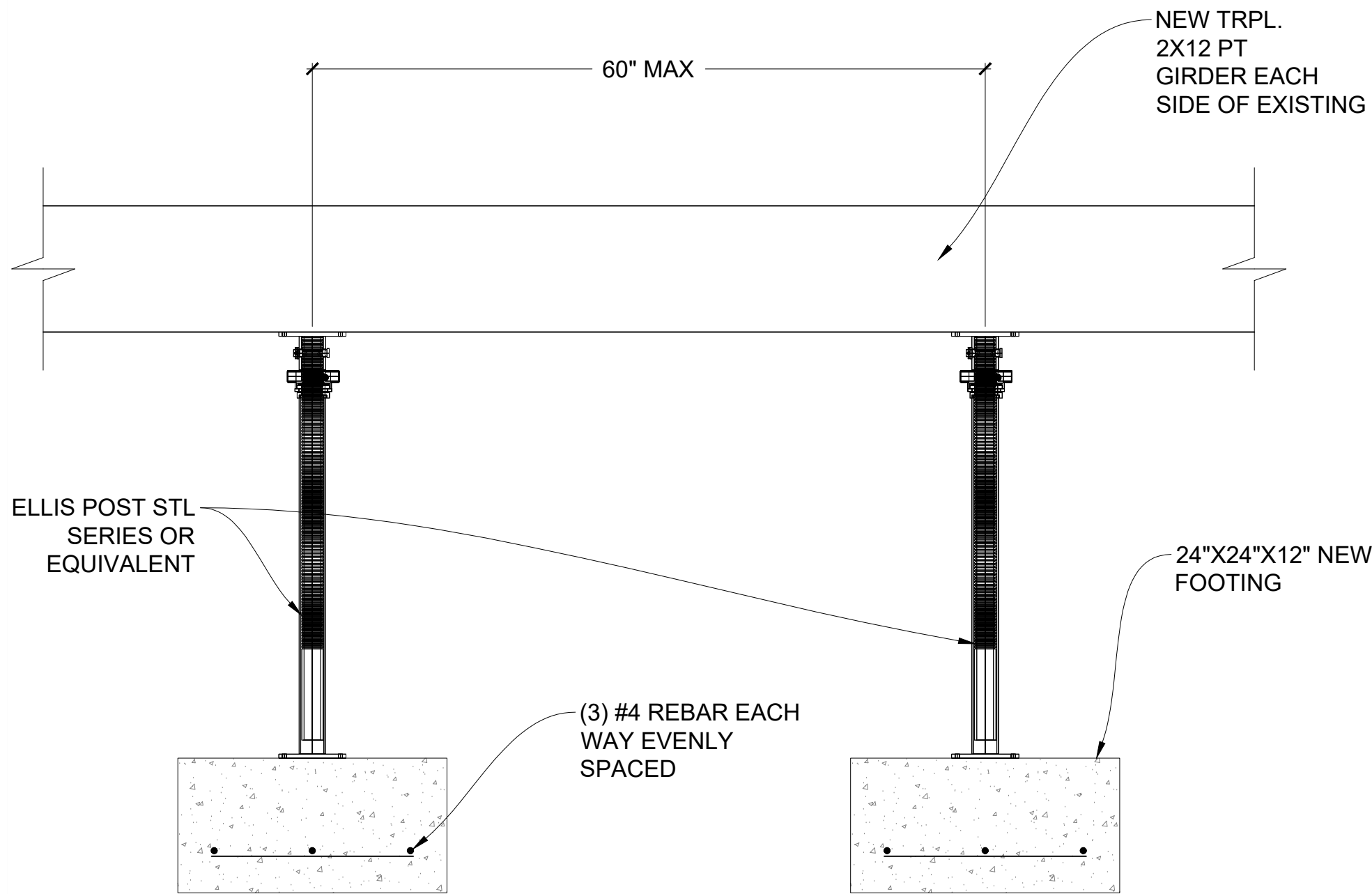
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STRUCTURAL REPAIR AND CRAWLSPACE STABILIZATION PROJECT

SHEET SCOPE: FOOTING EXTENSION

Project No. QUAIL RUN HOA
Date 4.17.2026
Sheet

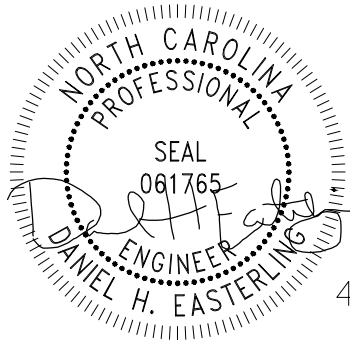
DTL. 6



1 TYPICAL JACK POST AND FOOTING
Not to Scale

DETAIL NOTES:

1. AT LOCATIONS WHERE THE FRAMING HAS DEFLECTED OVER $\frac{1}{4}$ ", JACKING WILL BE REQUIRED.
2. JACKS SHALL BE INSTALLED ON EACH SIDE OF EXISTING LOAD BEARING ELEMENTS.
 - 2.1. THESE SHALL BE WITHIN 6" OF THE EXISTING GIRDERS.
 - 2.2. AFTER JACKING IS COMPLETED, SHIM TO EXISTING GIRDERS.
3. JACKING MAY CAUSE INTERIOR DRYWALL OR TILE DAMAGES.
 - 3.1. DOCUMENT INTERIOR CONDITIONS PRIOR TO THE INSTALLATION AND SURVEY AFTERWARDS.
 - 3.2. PROVIDE ALLOWANCE FOR INTERIOR REPAIRS IN THE UNIT COST.



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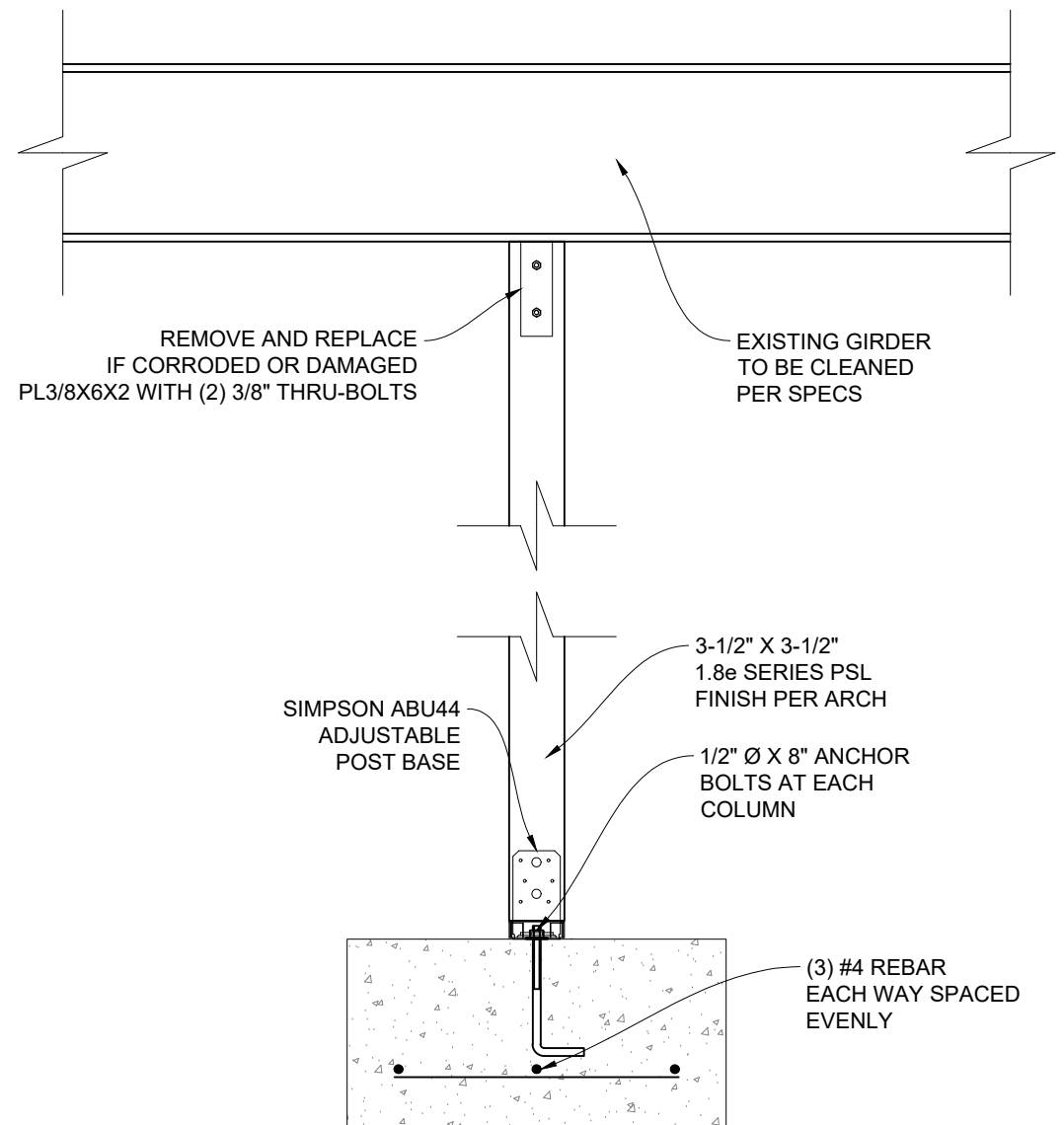
QUAIL RUN HOMEOWNERS' ASSOCIATION

STRUCTURAL REPAIR AND CRAWLSPACE STABILIZATION PROJECT

 SHEET SCOPE: GIRDER REALIGNMENT/JACKING

Project No. QUAIL RUN HOA
Date 4.17.2026
Sheet

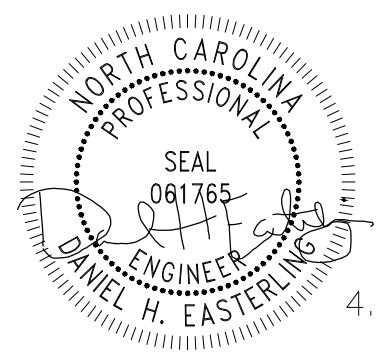
DTL. 7



DETAIL NOTES:

1. WHERE DAMAGES ARE TOO SEVERE FOR REPLACEMENT INSTALL NEW FOOTING AND POST.
2. THIS WILL APPLY WHERE POSTS HAVE COMPLETELY FAILED, EROSION HAS OCCURRED BELOW FOOTINGS, AND/OR BEARING POINTS ARE MISALIGNED.

1 TYPICAL POST AND FOOTING
Scale: 1" = 1'-0"



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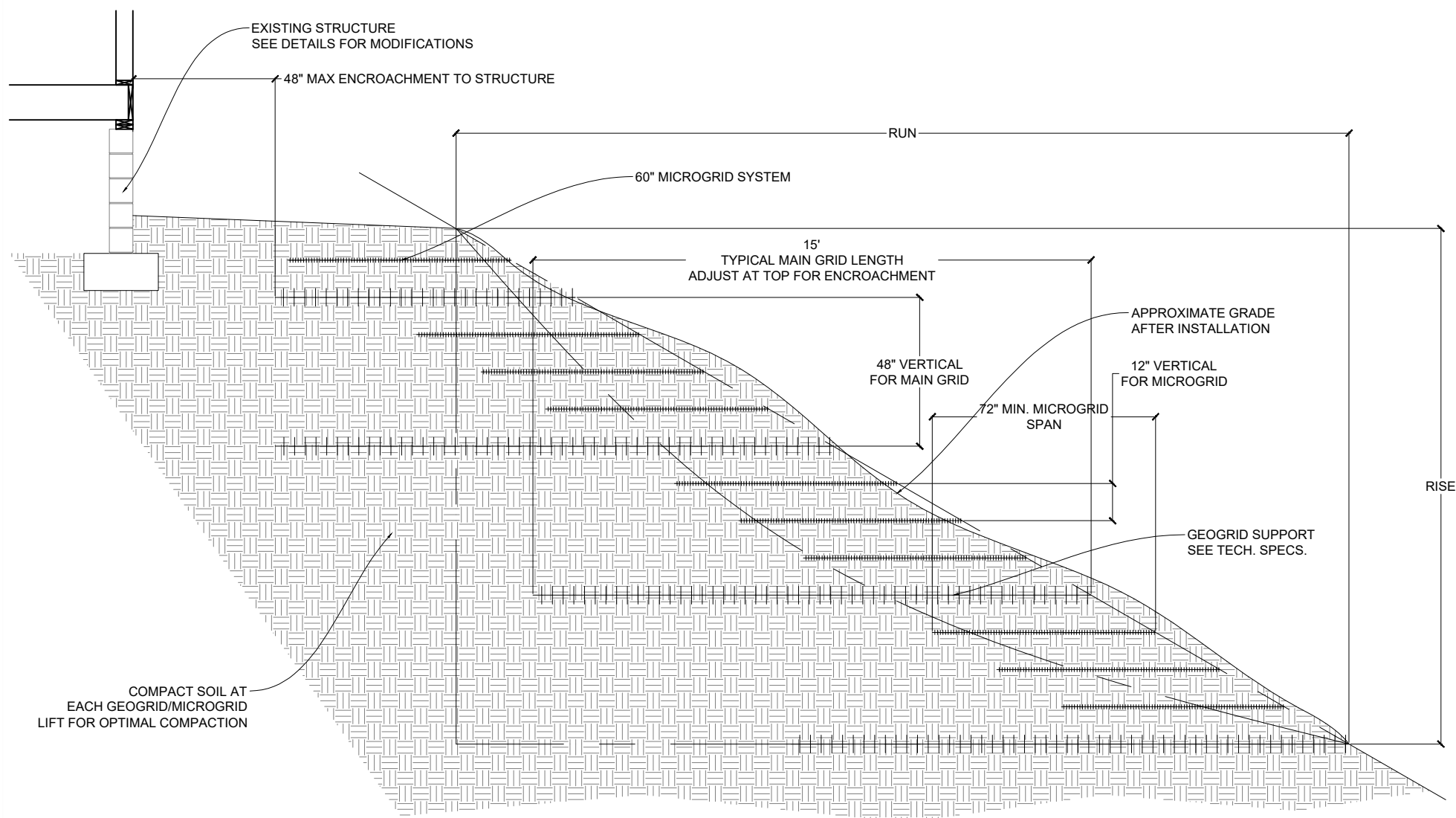
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STRUCTURAL REPAIR AND CRAWLSPACE STABILIZATION PROJECT

SHEET SCOPE: FULL POST/FOOTING REPLACEMENT

Project No. QUAIL RUN HOA
Date 4.17.2026
Sheet

DTL. 8

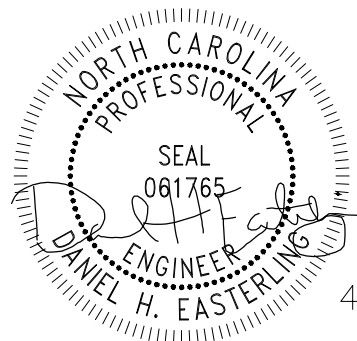


DETAIL NOTES:

1. INSTALLATION OF GEOGRID WILL BE REQUIRED AT SLOPE WHERE EROSION HAS OCCURRED.
2. LIFTS SHALL BE A MAXIMUM OF 18" AND BE COMPACTED TO 90% OCR.
3. USE OF VIBRATORY COMPACTION IS NOT PERMITTED DUE TO THE PROXIMITY OF THE HOMES.
4. MAX RISE/RUN IS EQUAL TO 1.

1 TYPICAL SLOPE STABILIZATION

Not to Scale



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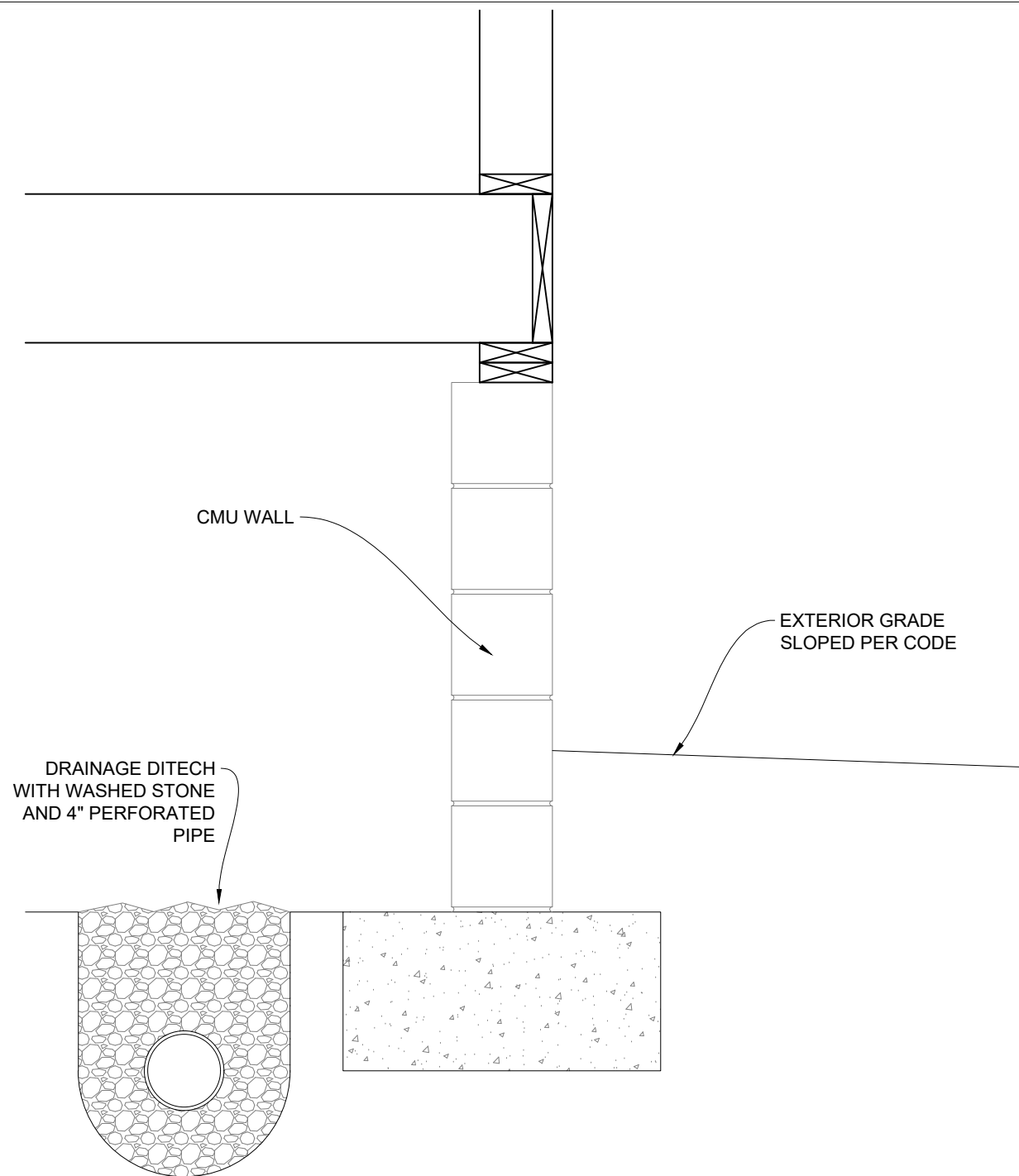
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STRUCTURAL REPAIR AND CRAWLSPACE STABILIZATION PROJECT

SHEET SCOPE: SLOPE STABILIZATION

Project No. QUAIL RUN HOA
 Date 4.17.2026
 Sheet

DTL. 9

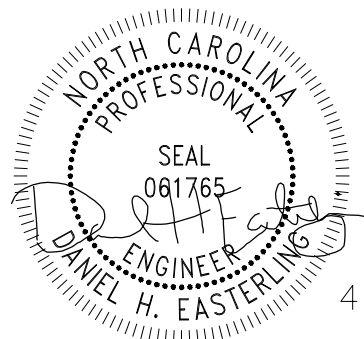


DETAIL NOTES:

1. INSTALL DRAINAGE SYSTEM AROUND PERIMETER OF EACH BUILDING.
2. OUTLET SHALL DISCHARGE TO DAYLIGHT AT THE CLOSEST LOW POINT/STORMWATER DRAINAGE ELEMENTS
3. WASHED STONE TO BE MAXIMUM OF 1-1/4" AND SHALL BE "WELL-GRADED".
4. DEPTH TO BE MIN. 16" AND WIDTH TO BE MIN. 12".
5. THIS IS TO BE USED IN CONJUNCTION WITH DETAIL 3 FOR ANY MOISTURE DRIVE THAT MAY OCCUR.

1 TYPICAL CRAWLSPACE DRAINAGE SYSTEM

Scale: 1" = 1'-0"



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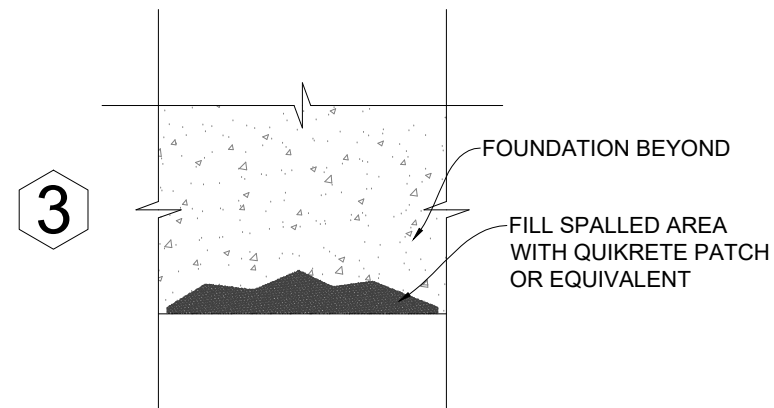
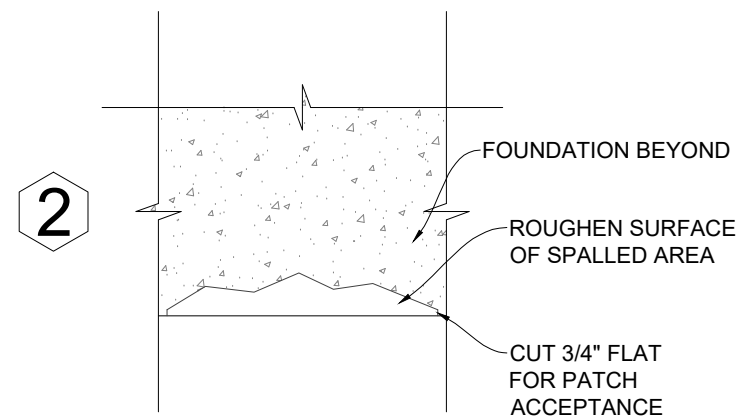
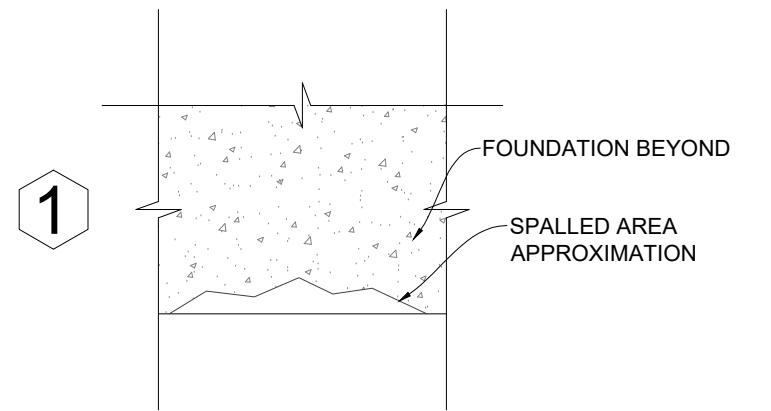
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STRUCTURAL REPAIR AND CRAWLSPACE STABILIZATION PROJECT

SHEET SCOPE: CRAWLSPACE DRAINAGE

Project No. QUAIL RUN HOA
 Date 4.17.2026
 Sheet

DTL. 10

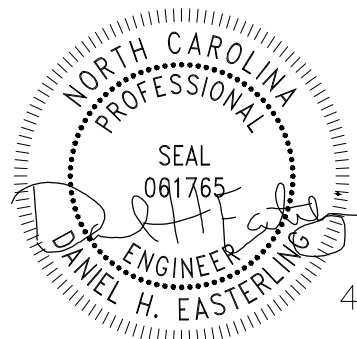


1 **TYPICAL FOUNDATION SPALLING REPAIR**

Not to Scale

DETAIL NOTES:

1. AREAS AROUND THE PERIMETERS OF THE BUILDINGS SHOW SIGNS OF CONCRETE SPALLING, ALL AREAS SHALL BE PATCHED.
2. IF REINFORCEMENT IS EXPOSED, IT SHALL BE CLEANED OF ALL CORROSION PRIOR TO PATCHING.



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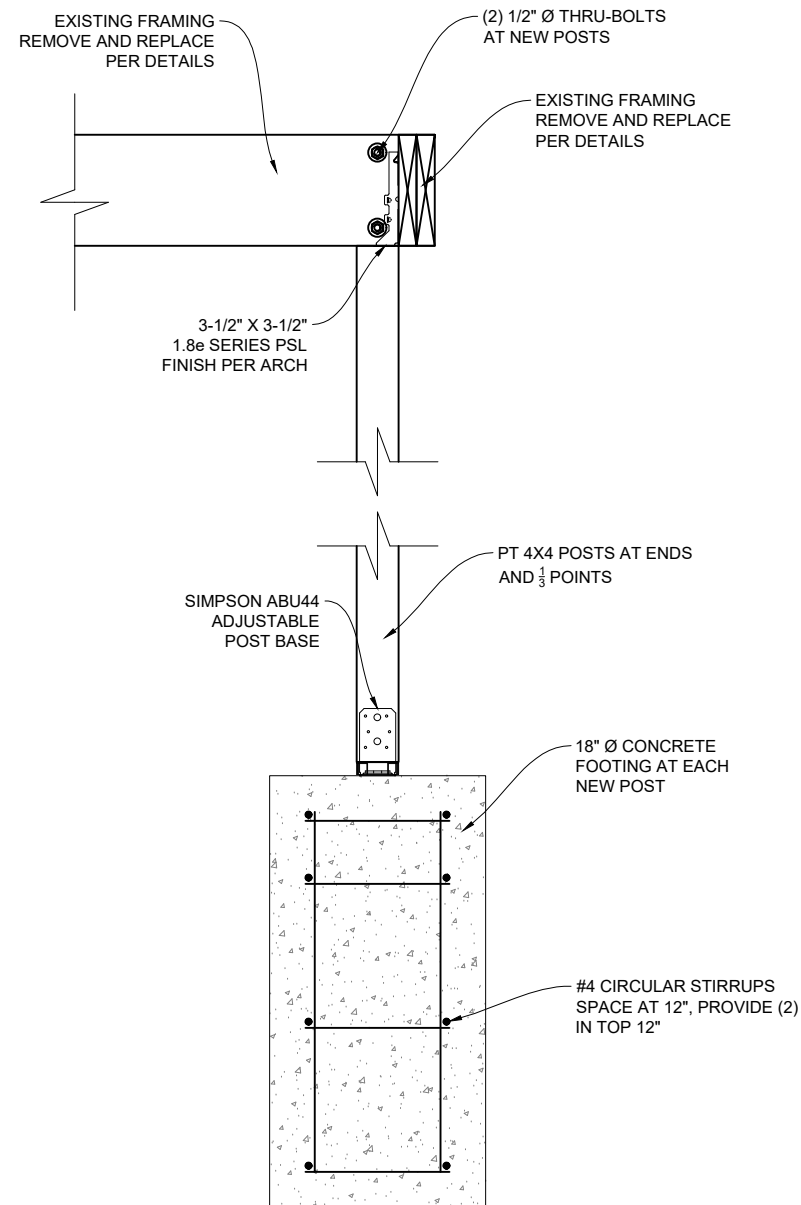
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STRUCTURAL REPAIR AND CRAWLSPACE STABILIZATION PROJECT

SHEET SCOPE: CRACK REPAIR AT FOUNDATIONS

Project No. QUAIL RUN HOA
Date 4.17.2026
Sheet

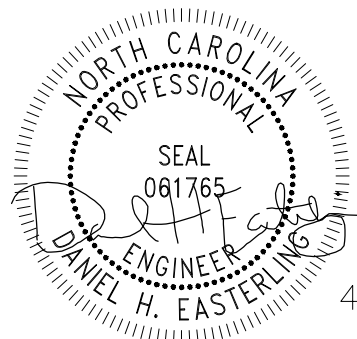
DTL. 11



1 TYPICAL POST AND FOOTING
Scale: 1" = 1'-0"

DETAIL NOTES:

1. INSTALLATION OF POSTS AT THE REAR DECKS WILL PROVIDE ADDITIONAL SUPPORT AND STABILIZATION.
2. IF DEFLECTIONS ARE MEASURED OVER $\frac{1}{4}$ ", COMPLETE REBUILDS MAY BE REQUIRED.
3. FOOTINGS SHALL BE CROWNED TO PROMOTE DRAINAGE.
4. DETAIL 2 MAY BE USED IN CONJUNCTION WITH THIS REPAIR SCENARIO.
5. ALL EXTERIOR LUMBER SHALL BE PRESSURE-TREATED.
6. ALL FASTENERS TO BE HOT-DIPPED GALVANIZED OR STAINLESS STEEL



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STRUCTURAL REPAIR AND CRAWLSPACE STABILIZATION PROJECT

SHEET SCOPE: DECK POST/EXT SUPPORT STABILIZATION

Project No.
QUAIL RUN HOA
Date
4.17.2026
Sheet

DTL. 12



APPENDIX B

Applicable Code References and Limitations

APPENDIX B

CODE REFERENCE

STRUCTURAL REPAIR AND CRAWLSPACE STABILIZATION PROJECT

STATE OF NORTH CAROLINA

1.0 APPLICABLE CODES AND STANDARDS

ALL WORK SHALL COMPLY WITH THE FOLLOWING CODES AND STANDARDS, LATEST ADOPTED EDITIONS BY THE STATE OF NORTH CAROLINA:

1.1 GOVERNING BUILDING CODE

- NORTH CAROLINA RESIDENTIAL CODE (NCRC)

1.2 REFERENCED STANDARDS

- ASCE 7 – MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES
- ACI 318 – BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE
- ACI 332 – RESIDENTIAL CODE REQUIREMENTS FOR STRUCTURAL CONCRETE
- AWC NDS – NATIONAL DESIGN SPECIFICATION FOR WOOD CONSTRUCTION
- AWC SDPWS – SPECIAL DESIGN PROVISIONS FOR WIND AND SEISMIC

1.3 MANUFACTURER STANDARDS

- ICC-ES EVALUATION REPORTS FOR CONNECTORS AND ANCHORS
- MANUFACTURER INSTALLATION INSTRUCTIONS SHALL GOVERN WHERE APPLICABLE

2.0 GENERAL STRUCTURAL REQUIREMENTS

ALL STRUCTURAL ELEMENTS SHALL PROVIDE A CONTINUOUS LOAD PATH PER NCRC SECTION R301.

DESIGN LOADS SHALL COMPLY WITH ASCE 7.

WOOD DESIGN SHALL COMPLY WITH AWC NDS.

CONCRETE DESIGN SHALL COMPLY WITH ACI 318 OR ACI 332.

FIELD CONDITIONS SHALL BE VERIFIED PRIOR TO CONSTRUCTION.

3.0 FOUNDATION AND FOOTING REQUIREMENTS

FOOTINGS SHALL COMPLY WITH NCRC SECTION R403.

FOUNDATIONS SHALL COMPLY WITH NCRC SECTION R401.

SOIL BEARING VALUES SHALL FOLLOW TABLE R401.4.1.
FOOTINGS SHALL BEAR ON UNDISTURBED SOIL OR APPROVED STRUCTURAL FILL.

4.0 COLUMNS AND POSTS

COLUMNS SHALL COMPLY WITH NCRC SECTION R407.
WOOD POSTS SHALL BE PROTECTED PER R317.
POSTS SHALL HAVE POSITIVE CONNECTIONS AT TOP AND BOTTOM.

5.0 FLOOR FRAMING SYSTEMS

FLOOR FRAMING SHALL COMPLY WITH NCRC SECTION R502.
BEAMS AND GIRDERS SHALL FOLLOW AWC NDS.
CONNECTIONS SHALL FOLLOW APPROVED FASTENER SCHEDULES.

6.0 CRAWLSPACE AND MOISTURE CONTROL

CRAWLSPACES SHALL COMPLY WITH NCRC SECTION R408.
DRAINAGE SHALL COMPLY WITH SECTION R401.3.
FOUNDATION DRAINAGE SHALL COMPLY WITH SECTION R405.

7.0 FOUNDATION WALLS AND CRACK REPAIR

FOUNDATION WALLS SHALL COMPLY WITH NCRC SECTION R404.
CRACK REPAIR SHALL FOLLOW ENGINEERED METHODS.

8.0 DRAINAGE AND SITE CONDITIONS

SITE GRADING SHALL DIRECT WATER AWAY PER NCRC SECTION R401.3.
SWALES AND DRAINAGE FEATURES SHALL PREVENT WATER ACCUMULATION.

9.0 STRUCTURAL REPAIRS AND UNDERPINNING

STRUCTURAL REPAIRS SHALL FOLLOW ENGINEERED DETAILS.
UNDERPINNING SHALL BE PERFORMED IN CONTROLLED SEGMENTS.
JACKING SHALL BE PERFORMED IN CONTROLLED INCREMENTS.

10.0 EXTERIOR DECKS AND POSTS

DECKS SHALL COMPLY WITH NCRC SECTION R507.
FOOTINGS SHALL COMPLY WITH R403.
WOOD SHALL BE PROTECTED PER R317.

11.0 SLOPE STABILIZATION AND SOIL SUPPORT

SLOPE CONDITIONS SHALL BE EVALUATED BASED ON FIELD OBSERVATIONS.
GEOTECHNICAL REVIEW MAY BE REQUIRED.

12.0 TEMPORARY SHORING AND CONSTRUCTION SEQUENCING

TEMPORARY SHORING SHALL BE PROVIDED BY THE CONTRACTOR.
STRUCTURAL STABILITY SHALL BE MAINTAINED AT ALL TIMES.

13.0 SPECIAL INSPECTIONS AND FIELD OBSERVATION

FIELD OBSERVATIONS MAY BE REQUIRED BY THE ENGINEER.
DEFICIENCIES SHALL BE CORRECTED PRIOR TO PROCEEDING.

14.0 LIMITATIONS

DETAILS ARE BASED ON OBSERVED CONDITIONS BY OTHERS, CONTRACTOR IS TO
SCHEDULE AND PRICE SITE VISIT(S) TO VERIFY CONSTRUCTION QUANTITIES.
DETAILS ARE APPROXIMATIONS AND FIELD CONDITIONS MAY VARY.
ENGINEER SHALL BE NOTIFIED OF DEVIATIONS.



APPENDIX C

Pricing Package

Detail Library

Detail ID	Detail Name	Unit Type	Material Costs	Labor Hours	Notes
1	Typical Crawlspace Support / Pier	EA			
2	Girder / Beam Repair & Sistering	EA			
3	Moisture Mitigation / Vapor Barrier	SF			
4	Perimeter Drainage / Swale	LF			
5	Underpinning (Segmental or Helical)	EA			
6	Footing Extension	EA			
7	Girder Realignment / Jacking	EA			
8	Full Post / Footing Replacement	EA			
9	Slope Stabilization	LF			
10	Crawlspace Drainage	LF			
11	Crack Repair / Foundation Wall	LF			
12	Deck Post / Exterior Support Stabilization	EA			

Detail Pricing Engine

Line	Building	Phase	Detail ID	Detail Name	Unit Type	Qty	Unit Costs	Materials Cost	Labor Hours	Labor Rate	Labor Cost	Base Costs	Base Costs/Hour	Material Contingency	Labor Contingency	Total Cost	Total Costs/Hour	Notes	
1	1	4	1	Typical Crawlspace Support / Pier	EA		-	-	-	-	-	-	-	-	-	-	-	Support points	
2	1	4	4	Perimeter Drainage / Swale	LF		-	-	-	-	-	-	-	-	-	-	-	Rear drainage / swale LF	
3	1	4	11	Crack Repair / Foundation Wall	LF		-	-	-	-	-	-	-	-	-	-	-	Minor crack repair LF	
4	2	3	5	Underpinning (Segmental or Helical)	EA		-	-	-	-	-	-	-	-	-	-	-	Underpinning LF	
5	2	3	1	Typical Crawlspace Support / Pier	EA		-	-	-	-	-	-	-	-	-	-	-	Additional crawlspace supports	
6	2	3	4	Perimeter Drainage / Swale	LF		-	-	-	-	-	-	-	-	-	-	-	Swale / drainage LF	
7	3	4	1	Typical Crawlspace Support / Pier	EA		-	-	-	-	-	-	-	-	-	-	-	Support points	
8	3	4	6	Footing Extension	EA		-	-	-	-	-	-	-	-	-	-	-	Footing extension count	
9	3	4	4	Perimeter Drainage / Swale	LF		-	-	-	-	-	-	-	-	-	-	-	Grade / drainage LF	
10	4	4	1	Typical Crawlspace Support / Pier	EA		-	-	-	-	-	-	-	-	-	-	-	Support points	
11	4	4	4	Perimeter Drainage / Swale	LF		-	-	-	-	-	-	-	-	-	-	-	Downspout / drainage LF	
12	5	1	8	Full Post / Footing Replacement	EA		-	-	-	-	-	-	-	-	-	-	-	Full replacements	
13	5	1	9	Slope Stabilization	LF		-	-	-	-	-	-	-	-	-	-	-	Slope stabilization LF	
14	5	1	10	Crawlspace Drainage	LF		-	-	-	-	-	-	-	-	-	-	-	Drainage trench LF	
15	5	1	11	Crack Repair / Foundation Wall	LF		-	-	-	-	-	-	-	-	-	-	-	Foundation crack repair LF	
16	6	2	1	Typical Crawlspace Support / Pier	EA		-	-	-	-	-	-	-	-	-	-	-	Support points	
17	6	2	2	Girder / Beam Repair & Sistering	EA		-	-	-	-	-	-	-	-	-	-	-	Girder sistering LF	
18	6	2	3	Moisture Mitigation / Vapor Barrier	SF		-	-	-	-	-	-	-	-	-	-	-	Moisture mitigation SF	
19	6	2	4	Perimeter Drainage / Swale	LF		-	-	-	-	-	-	-	-	-	-	-	Perimeter drainage LF	
20	7	2	12	Deck Post / Exterior Support Stabilization	EA		-	-	-	-	-	-	-	-	-	-	-	Deck / exterior support points	
21	7	2	11	Crack Repair / Foundation Wall	LF		-	-	-	-	-	-	-	-	-	-	-	Crack repair LF	
22	7	2	6	Footing Extension	EA		-	-	-	-	-	-	-	-	-	-	-	Footing extension count	
23							-	-	-	-	-	-	-	-	-	-	-		
24							-	-	-	-	-	-	-	-	-	-	-		
25							-	-	-	-	-	-	-	-	-	-	-		
26							-	-	-	-	-	-	-	-	-	-	-		
27							-	-	-	-	-	-	-	-	-	-	-		
28							-	-	-	-	-	-	-	-	-	-	-		
29							-	-	-	-	-	-	-	-	-	-	-		
30							-	-	-	-	-	-	-	-	-	-	-		
SPECIFICATION BASED REPAIRS (NO APPLICABLE DETAIL)																			
1	ALL	ALL	SPECS	CLEANING AND TREATING STEEL	EA		-	-	-	-	-	-	-	-	-	-	-	-	Follow specification for cleaning (blasting) and treatment
2	ALL	ALL	SPECS	DAMAGED INULATION REPAIR	SF		-	-	-	-	-	-	-	-	-	-	-	-	Insulation to be replaced per code requirements, see specs
3	ALL	ALL	SPECS	REPLACEMENT OF SIDING AT DAMAGES	SF		-	-	-	-	-	-	-	-	-	-	-	-	Replace 1 to 2 courses of siding, inspect sheathing and framing for signs of moisture
4							-	-	-	-	-	-	-	-	-	-	-	-	
5							-	-	-	-	-	-	-	-	-	-	-	-	
6							-	-	-	-	-	-	-	-	-	-	-	-	
7							-	-	-	-	-	-	-	-	-	-	-	-	
8							-	-	-	-	-	-	-	-	-	-	-	-	

Totals

0.0

Building Rollup

Building	Unit Range	Units	Phase	Detail Rows	Material Cost	Labor Hrs	Labor Cost	Contingency	Total Cost	Cost / Unit
1	1-12	12	4	3	-	0.0	-	-	-	-
2	13-28	16	3	3	-	0.0	-	-	-	-
3	29-40	12	4	3	-	0.0	-	-	-	-
4	41-52	12	4	2	-	0.0	-	-	-	-
5	53-68	16	1	4	-	0.0	-	-	-	-
6	69-84	16	2	4	-	0.0	-	-	-	-
7	85-100	16	2	3	-	0.0	-	-	-	-

Project Total

100

22

-

0.0

-

-

-

-

Detail Rollup (Tasks 1-12)

Detail ID	Detail Name	Unit Type	Total Qty	Occurrences	Material Cost	Labor Hrs	Labor Cost	Total Cost
1	Typical Crawlspace Support / Pier	EA	0.0	5	-	0.0	-	-
2	Girder / Beam Repair & Sistering	EA	0.0	1	-	0.0	-	-
3	Moisture Mitigation / Vapor Barrier	SF	0.0	1	-	0.0	-	-
4	Perimeter Drainage / Swale	LF	0.0	5	-	0.0	-	-
5	Underpinning (Segmental or Helical)	EA	0.0	1	-	0.0	-	-
6	Footing Extension	EA	0.0	2	-	0.0	-	-
7	Girder Realignment / Jacking	EA	0.0	0	-	0.0	-	-
8	Full Post / Footing Replacement	EA	0.0	1	-	0.0	-	-
9	Slope Stabilization	LF	0.0	1	-	0.0	-	-
10	Crawlspace Drainage	LF	0.0	1	-	0.0	-	-
11	Crack Repair / Foundation Wall	LF	0.0	3	-	0.0	-	-
12	Deck Post / Exterior Support Stabilization	EA	0.0	1	-	0.0	-	-

Totals

0 22 - 0.0 - -

Phase Rollup & Funding Need

Phase	Label	Start Month	End Month	Months from Start	Total Cost
1	Critical / Immediate	0	0	0.0	-
2	High	0	0	0.0	-
3	Moderate	0	0	0.0	-
4	Low	0	0	0.0	-

Total

-

HOA Structural Repair Pricing & Assessment Model

Purpose	This workbook prices repair details, rolls costs up by building/detail/phase, and allocates unit assessments over the project life.
How to Use	<ol style="list-style-type: none">1) General - updates cells in yellow and add any relevant notes in grey.2) Buildings - information only in this for analysis of Risk Rating for work prioritization.3) Detail_Library - update material costs and labor hours for each project detail.4) Detail_Pricing - update cells in yellow to provide verified quantities, material costs, and labor hours as required.
Time Phasing	Project phasing is of utmost importance for the Homeowners' Association financial planning. Indicate time frames for start to finish of each phase on the General sheet.
Risk Scheduling	Buildings are prioritized by weighted risk score and consequence-of-delay so the HOA can repair worst-case conditions first instead of sequencing by unit number.

Assumptions & Phase Timing

Core Inputs	Value	Notes
Labor Rate (\$/hr)		
Material Contingency %		
Labor Contingency %		
Annual Escalation %		
Total Units	100	

Phase Timing

Phase	Label	Start Month	End Month	Months from Start	Notes
1	Critical / Immediate			0.0	
2	High			0.0	
3	Moderate			0.0	
4	Low			0.0	

Project Duration -



APPENDIX D

Material and Technical Specs

*SPECIFICATIONS ARE PROVIDED TO
OUTLINE OVERALL REPAIR INTENT,
EQUIVALENT MATERIALS, METHODS,
AND TECHNICAL INFORMATION IS
APPLICABLE WITH ENGINEERING
APPROVAL.*

POLYMER MODIFIED STRUCTURAL REPAIR

DIVISION 303 01 00 Maintenance of Concrete
03 31 00 Structural Concrete**PRODUCT NO. 1241-25, -58****PRODUCT DESCRIPTION**

QUIKRETE® Polymer Modified Structural Repair is a polymer modified, shrinkage-compensated, rapid setting, high strength repair material designed to make horizontal, vertical, and overhead structural repairs to any concrete surface. QUIKRETE® Polymer Modified Structural Repair consists of special fast-setting hydraulic cement, graded sands, and other proprietary ingredients. Exceeds the requirements of ASTM C928 R2.

PRODUCT USE

QUIKRETE® Polymer Modified Structural Repair demonstrates low sag, making it ideal for vertical or overhead repairs. Its unique properties allow it to be used for partial-depth repairs and can be sculpted to match the contour of existing concrete surfaces. Use to repair concrete cracks, curbs, steps, loading docks, retaining walls, decorative moldings, and virtually any vertical or overhead concrete surface. This product can be built up to at least 1-1/2 in (38 mm) in one application. For full-depth repairs, the product should be extended with up to 10 lb (4.5 kg) of clean, high quality -1/2 inch (-13 mm) gravel per 20 lb (9 kg) pail, or 25 lb (11.3 kg) of gravel per 50 lb (22.6 kg) bag.

SIZES

- 20 lb (9 kg) pails
- 50 lb (22.6 kg) bags

YIELD

- Each 20 lb (9 kg) pail of QUIKRETE® Polymer Modified Structural Repair will yield approximately 0.18 ft³ (5.0 L) of material.
- Each 50 lb (22.6 kg) bag of QUIKRETE® Polymer Modified Structural Repair will yield approximately 0.45 ft³ (12.7 L) of material.

TECHNICAL DATA**APPLICABLE STANDARDS**

- ASTM C109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or [50-mm] Cube Specimens)
- ASTM C143 Standard Test Method for Slump of Hydraulic-Cement Concrete
- ASTM C191 Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle
- ASTM C928 Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete

PHYSICAL/CHEMICAL

Typical results obtained for QUIKRETE® Polymer Modified Structural Repair, when tested in accordance with the referenced ASTM test methods, are shown in Table 2.

**INSTALLATION****SURFACE PREPARATION**

All surfaces should be clean and free of foreign substances including corrosion present on reinforcing steel. Remove all spalled areas and areas of unsound concrete. The appropriate personal protective equipment should be worn. Large vertical or overhead patches deeper than 2 in (50 mm) should contain reinforcing steel. If none is present, new steel should be inserted using appropriate techniques. Dampen the repair area with clean water before patching. No standing water should be left in the repair area.

MIXING

Refer to Table 1 for water quantities. Begin by using a mid-range water quantity, then adjust, if needed, to achieve a placeable, gel-like consistency. The water demand of the product may vary based upon environmental conditions. Starting with the maximum quantity of water is not recommended. Add the water to the mixer or mixing container first, followed by the QUIKRETE® Polymer Modified Structural Repair. Mix by hand, or mechanically using a standard mortar mixer, for a minimum of 3 minutes. Adding excessive water that causes a flowable consistency is not recommended, because this will cause a reduction in performance of the product. Where large quantities of material are needed for patches deeper than 2 in (50 mm) QUIKRETE® Polymer Modified Structural Repair may be extended with 10 lb (4.5 kg) of -1/2 inch (-13 mm) gravel per 20 lb (9 kg) pail, or 25 lb (11.3 kg) gravel per 50 lb (22.6 kg) bag. The gravel used should be clean, high quality, and in a damp condition. Adjust water, if needed, to achieve a placeable consistency. Exceeding an ASTM C143 slump of 5 inches (125 mm) is not recommended. This may cause a reduction in performance of the product.

TABLE 1 TYPICAL WATER CONTENT

<u>Amount of Material</u>	<u>Minimum</u>	<u>Maximum</u>
20 lb (9 kg)	2-3/4 pt (1.3 L)	3 pt (1.4 L)
50 lb (22.6 kg)	7 pt (3.3 L)	7-1/2 pt (3.5 L)

APPLICATION

QUIKRETE® Polymer Modified Structural Repair should be trowel applied to the damp surface. Apply a thin layer with heavy trowel pressure, and then go back and build up to the desired thickness. QUIKRETE® Polymer Modified Structural Repair obtains high bond strength without the use of bonding adhesives or acrylic additives. After initial set, the material may be trimmed and shaped to match the existing contours of the patch area.

CURING

During the first 24 hours, it is best to keep the patch covered or damp to prevent excessive loss of water. Under hot, dry and windy placing conditions, all concrete tends to lose moisture unevenly and may develop plastic shrinkage cracks. The use of sheeting, as well as application of a very fine fog spray of water, has been quite successful in limiting shrinkage cracking. Curing compounds such as QUIKRETE® Acrylic Concrete Cure and Seal (No. 8730) provide the easiest and most convenient method of curing. Curing compounds should be applied via appropriate methods, once final set has been reached.

PRECAUTIONS

- Mix no more than can be used in 15 minutes.
- Do not apply as a coating.
- Do not use if temperatures are below 40 °F (4 °C) or are expected to go below 32 °F (0 °C) within a 24 hour period.
- Use cold water in hot weather or hot water in cold weather to help maintain sufficient working time of the mixed product.
- In most cases, concrete repair materials will not be an exact color match to surrounding concrete.
- For best results, do not overwork the material or remix the material with additional water after it starts to harden.

SAFETY

IMPORTANT: Read Safety Data Sheet carefully before using. **WEAR IMPERVIOUS GLOVES**, such as nitrile, mask, and eye protection.

DANGER: Causes severe skin burns and serious eye damage. Prolonged or repeated inhalation of dust may cause lung damage or cancer.

Keep out of reach of children

WARRANTY

NOTICE: Obtain the applicable **LIMITED WARRANTY** at www.quikrete.com/product-warranty or send a written request to The Quikrete Companies, LLC, Five Concourse Parkway, Atlanta, GA 30328, USA. Manufactured by or under the authority of The Quikrete Companies, LLC. © 2024 Quikrete International, Inc.

TABLE 2 TYPICAL PHYSICAL PROPERTIES

<u>Setting Time, ASTM C191</u>	
Initial	Approx. 20 minutes
Final	20 to 40 minutes
<u>Compressive Strength, ASTM C109 (Modified)</u>	
<i>Age</i>	<i>PSI (MPa)</i>
3 hours	2000 (13.7)
24 hours	4000 (27.5)
7 days	5000 (34.4)
28 days	6000 (41.3)

SSPC: The Society for Protective Coatings

JOINT SURFACE PREPARATION STANDARD

SSPC-SP 6/NACE NO. 3

Commercial Blast Cleaning

This The Society for Protective Coatings (SSPC)/NACE International (NACE) standard represents a consensus of those individual members who have reviewed this document, its scope, and provisions. It is intended to aid the manufacturer, the consumer, and the general public. Its acceptance does not in any respect preclude anyone, whether he has adopted the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not addressed in this standard. Nothing contained in this SSPC/NACE standard is to be construed as granting any right, by implication or otherwise, to manufacture, sell, or use in connection with any method, apparatus, or product covered by Letters Patent, or as indemnifying or protecting anyone against liability for infringement of Letters Patent. This standard represents current technology and should in no way be interpreted as a restriction on the use of better procedures or materials. Neither is this standard intended to apply in all cases relating to the subject. Unpredictable circumstances may negate the usefulness of this standard in specific instances. SSPC and NACE assume no responsibility for the interpretation or use of this standard by other parties and accept responsibility for only those official interpretations issued by SSPC or NACE in accordance with their governing procedures and policies which preclude the issuance of interpretations by individual volunteers.

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CAUTIONARY NOTICE: SSPC/NACE standards are subject to periodic review, and may be revised or withdrawn at any time in accordance with technical committee procedures. SSPC and NACE require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of initial publication. The user is cautioned to obtain the latest edition. Purchasers may receive current informa-

tion on all standards and other publications by contacting the organizations at the addresses below:

©SSPC: The Society for Protective Coatings
40 24th Street, Sixth Floor
Pittsburgh, PA 15222
(telephone +1 877/281-7772)

©NACE International
1440 South Creek
Houston, TX 77084-4906
(telephone +1 281/228-6200)

Foreword

This joint standard covers the use of blast cleaning abrasives to achieve a defined degree of cleaning of steel surfaces prior to the application of a protective coating or lining system. This standard is intended for use by coating or lining specifiers, applicators, inspectors, or others who may be responsible for defining a standard degree of surface cleanliness.

The focus of this standard is commercial blast cleaning. White metal blast cleaning, near-white metal blast cleaning, industrial blast cleaning, and brush-off blast cleaning are addressed in separate standards.

Commercial blast cleaning provides a greater degree of cleaning than industrial blast cleaning (SSPC-SP 14/NACE No. 8¹) but less than near-white metal blast cleaning (SSPC-SP 10/NACE No. 2²).

Commercial blast cleaning is used when the objective is to remove all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter, leaving staining or shadows on no more than 33 percent of each unit area of surface.

The difference between a commercial blast cleaning and a near-white metal blast cleaning is in the amount of staining permitted to remain on the surface. Commercial blast cleaning allows stains or shadows on 33 percent of each unit area of surface. Near-white metal blast cleaning allows staining or shadows on only 5 percent of each unit area of surface.

The difference between a commercial blast cleaning and an industrial blast cleaning is that a commercial blast cleaning removes all visible oil, grease, dust, dirt, mill scale, rust, coating,

oxides, corrosion products, and other foreign matter from all surfaces and allows stains to remain on 33 percent of each unit area of surface, while industrial blast cleaning allows defined mill scale, coating, and rust to remain on less than 10 percent of each unit area of surface and allows defined stains to remain on all surfaces.

This joint standard was originally prepared in 1994 and reaffirmed in 2000 by the SSPC/NACE Task Group A on Surface Preparation by Abrasive Blast Cleaning. This joint task group includes members of both the SSPC Surface Preparation Committee and the NACE Unit Committee T-6G on Surface Preparation. It was reaffirmed in 2006 by the SSPC Surface Preparation Committee and NACE Specific Technology Group (STG) 04, Protective Coatings and Linings: Surface Preparation.

In SSPC/NACE standards, *shall* and *must* are used to state mandatory requirements. *Should* is used to state that which is considered good and is recommended but is not absolutely mandatory. *May* is used to state that which is considered optional.

Section 1: General

1.1 This joint standard covers the requirements for commercial blast cleaning of uncoated or coated steel surfaces by the use of abrasives. These requirements include the end condition of the surface and materials and procedures necessary to achieve and verify the end condition.

1.2 The mandatory requirements are described in Sections 1 to 9. Section 10, "Comments," and Appendix A, "Explanatory Notes," are not mandatory requirements of this standard.

1.3 Information about the function of commercial blast cleaning is in Paragraph A1 of Appendix A.

1.4 Information about use of this standard in maintenance coating work is in Paragraph A2 of Appendix A.

Section 2: Definitions

2.1 Commercial Blast Cleaned Surface: A commercial blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter. Random staining shall be limited to no more than 33 percent of each unit area of surface (approximately 5,800 mm² [9.0 in.²]) (i.e., a square 76 mm x 76 mm [3.0 in. x 3.0 in.]) and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating.

2.1.1 Acceptable variations in appearance that do not affect surface cleanliness as defined in Paragraph 2.1 include

variations caused by type of steel, original surface condition, thickness of the steel, weld metal, mill or fabrication marks, heat treating, heat-affected zones, blasting abrasives, and differences because of blasting technique.

2.1.2 SSPC-VIS 1³ may be specified to supplement the written definition. In any dispute, the written definition set forth in this standard shall take precedence over reference photographs and comparators. Additional information on reference photographs and comparators is in Paragraph A3 of Appendix A.

Section 3: Associated Documents

3.1 The latest issue, revision, or amendment of the documents listed in Paragraph 3.3 in effect on the date of invitation to bid shall govern unless otherwise specified.

3.2 If there is a conflict between the requirements of any of the documents listed in Paragraph 3.3 and this standard, the requirements of this standard shall prevail.

3.3 Documents cited in the mandatory sections of this standard include:

Document	Title
SSPC-AB 1 ⁴	Mineral and Slag Abrasives
SSPC-AB 2 ⁵	Cleanliness of Recycled Ferrous Metallic Abrasives
SSPC-AB 3 ⁶	Ferrous Metallic Abrasives
SSPC-SP 1 ⁷	Solvent Cleaning
SSPC-VIS 1	Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

Section 4: Procedures Before Cleaning

4.1 Before blast cleaning, visible deposits of oil, grease, or other contaminants shall be removed in accordance with SSPC-SP 1 or other agreed-upon methods.

4.2 Before blast cleaning, surface imperfections such as sharp fins, sharp edges, weld spatter, or burning slag should be removed from the surface to the extent required by the procurement documents (project specification). Additional information on surface imperfections is in Paragraph A4 of Appendix A.

4.3 If reference photographs or comparators are specified to supplement the written standard, the condition of the steel prior to blast cleaning should be determined before the blasting commences. Additional information on reference photographs and comparators is in Paragraph A3 of Appendix A.

Section 5: Blast Cleaning Methods and Operation

5.1 Clean, dry compressed air shall be used for nozzle blasting. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve this requirement.

5.2 Any of the following methods of surface preparation may be used to achieve a commercial blast cleaned surface:

5.2.1 Dry abrasive blasting using compressed air, blast nozzles, and abrasive.

5.2.2 Dry abrasive blasting using a closed-cycle, recirculating abrasive system with compressed air, blast nozzle, and abrasive, with or without vacuum for dust and abrasive recovery.

5.2.3 Dry abrasive blasting using a closed-cycle, recirculating abrasive system with centrifugal wheels and abrasive.

5.3 Other methods of surface preparation (such as wet abrasive blast cleaning) may be used to achieve a commercial blast cleaned surface by mutual agreement between those responsible for establishing the requirements and those responsible for performing the work. Information on the use of inhibitors to prevent the formation of rust immediately after wet abrasive blast cleaning is in Paragraph A5 of Appendix A.

Section 6: Blast Cleaning Abrasives

6.1 The selection of abrasive size and type shall be based on the type, grade, and surface condition of the steel to be cleaned, the type of blast cleaning system used, the finished surface to be produced (cleanliness and surface profile [roughness]), and whether the abrasive will be recycled.

6.2 The cleanliness and size of recycled abrasives shall be maintained to ensure compliance with this standard.

6.3 The blast cleaning abrasive shall be dry and free of oil, grease, and other contaminants as determined by the test methods found in SSPC-AB 1, SSPC-AB 2, and SSPC-AB 3.

6.4 Any limitations on the use of specific abrasives, the quantity of contaminants, or the degree of allowable embedment shall be included in the procurement documents (project specification) covering the work, because abrasive embedment and abrasives containing contaminants may not be acceptable for some service requirements. Additional information on abrasive selection is in Paragraph A6 of Appendix A.

6.5 When a coating is specified, the cleaned surface shall be roughened to a degree suitable for the specified coating system. Additional information on surface profile and

the film thickness of coating applied over the surface profile is in Paragraphs A7 and A8 of Appendix A.

Section 7: Procedures Following Blast Cleaning and Immediately Prior To Coating

7.1 Visible deposits of oil, grease, or other contaminants shall be removed according to SSPC-SP 1 or another method agreed upon by those parties responsible for establishing the requirements and those responsible for performing the work.

7.2 Dust and loose residues shall be removed from prepared surfaces by brushing; blowing off with clean, dry air; vacuum cleaning; or other methods agreed upon by those responsible for establishing the requirements and those responsible for performing the work.

7.2.1 The presence of toxic metals in the abrasives or coating being removed may place restrictions on the methods of cleaning permitted. The chosen method shall comply with all applicable regulations.

7.2.2 Moisture separators, oil separators, traps, or other equipment may be necessary to achieve clean, dry air.

7.3 After blast cleaning, any remaining surface imperfections (e.g., sharp fins, sharp edges, weld spatter, burning slag, scabs, slivers) shall be removed to the extent required by the procurement documents (project specification). Any damage to the surface profile resulting from the removal of surface imperfections shall be corrected to meet the requirements of Paragraph 6.5. Additional information on surface imperfections is in Paragraph A4 of Appendix A.

7.4 Immediately prior to coating application, the entire surface shall comply with the degree of cleaning specified in this standard. Any visible rust that forms on the surface of the steel after blast cleaning shall be removed by recleaning the rusted areas before coating. Information on chemical contamination, rust-back (rerusting), and the effect of dew point (surface condensation) is in Paragraphs A9, A10, and A11 of Appendix A.

Section 8: Inspection

8.1 Work performed and materials supplied under this standard are subject to inspection by a representative of those responsible for establishing the requirements. Materials and work areas shall be accessible to the inspector. The procedures and times of inspection shall be as agreed upon by those responsible for establishing the requirements and those responsible for performing the work.

8.2 Conditions not complying with this standard shall be corrected. In the case of a dispute, an arbitration or settlement

procedure established in the procurement documents (project specification) shall be followed. If no arbitration or settlement procedure is established, a procedure mutually agreeable to purchaser and supplier shall be used.

8.3 The procurement documents (project specification) should establish the responsibility for inspection and for any required affidavit certifying compliance with the specification.

Section 9: Safety and Environmental Requirements

9.1 Because abrasive blast cleaning is a hazardous operation, all work shall be conducted in compliance with applicable occupational and environmental health and safety rules and regulations.

Section 10: Comments (Nonmandatory)

10.1 Additional information and data relative to this standard are in Appendix A. Detailed information and data are presented in SSPC-SP COM.⁸ The recommendations in Appendix A and SSPC-SP COM are believed to represent good practice, but are not to be considered requirements of the standard. The sections of SSPC-SP COM that discuss subjects related to commercial blast cleaning are listed below.

Subject	Commentary Section
Abrasive Selection.....	6
Film Thickness	10
Maintenance Repainting.....	4.2
Reference Photographs	11
Rust-Back (Rerusting).....	4.5
Surface Profile.....	6.2
Weld Spatter.....	4.4.1
Wet Abrasive Blast Cleaning.....	8.2

References

- SSPC-SP 14/NACE No. 8 (latest revision), "Industrial Blast Cleaning" (Pittsburgh, PA: SSPC, and Houston, TX: NACE).
- SSPC-SP 10/NACE No. 2 (latest revision), "Near-White Metal Blast Cleaning" (Pittsburgh, PA: SSPC, and Houston, TX: NACE).
- SSPC-VIS 1 (latest revision), "Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning" (Pittsburgh, PA: SSPC).
- SSPC-AB 1 (latest revision), "Mineral and Slag Abrasives" (Pittsburgh, PA: SSPC).

5. SSPC-AB 2 (latest revision), "Cleanliness of Recycled Ferrous Metallic Abrasives" (Pittsburgh, PA: SSPC).

6. SSPC-AB 3 (latest revision), "Ferrous Metallic Abrasives" (Pittsburgh, PA: SSPC).

7. SSPC-SP 1 (latest revision), "Solvent Cleaning" (Pittsburgh, PA: SSPC).

8. SSPC-SP COM (latest revision), "Surface Preparation Commentary for Steel and Concrete Substrates" (Pittsburgh, PA: SSPC).

9. SSPC-PA Guide 4 (latest revision), "Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems" (Pittsburgh, PA: SSPC).

10. NACE Standard SP0178 (formerly RP0178-2003) (latest revision), "Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service" (Houston, TX: NACE).

11. NACE Standard RP0287 (latest revision), "Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape" (Houston, TX: NACE).

12. ASTM⁽¹⁾ D 4417 (latest revision), "Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel" (West Conshohocken, PA: ASTM).

13. SSPC-PA2 (latest revision), "Measurement of Dry Coating Thickness with Magnetic Gages" (Pittsburgh, PA: SSPC).

14. SSPC-SP 12/NACE No. 5 (latest revision), "Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating" (Pittsburgh, PA: SSPC, and Houston, TX: NACE).

15. SSPC-Guide 15 (latest revision), "Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates" (Pittsburgh, PA: SSPC).

Appendix A: Explanatory Notes (Nonmandatory)

A1 FUNCTION: Commercial blast cleaning (SSPC-SP 6/NACE No. 3) provides a greater degree of cleaning than industrial blast cleaning (SSPC-SP 14/NACE No. 8) but less than near-white metal blast cleaning (SSPC-SP 10/NACE No. 2). It should be specified only when a compatible coating will be applied. The primary functions of blast cleaning before coating are (a) to remove material from the surface that can cause early failure of the coating and (b) to obtain a suitable surface profile (roughness) to enhance the adhesion of the

⁽¹⁾ ASTM International (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

new coating system. The hierarchy of blasting standards is as follows: white metal blast cleaning, near-white metal blast cleaning, commercial blast cleaning, industrial blast cleaning, and brush-off blast cleaning.

A2 MAINTENANCE COATING WORK: When this standard is used in maintenance coating work, specific instructions should be provided on the extent of surface to be blast cleaned or spot blast cleaned to this degree of cleanliness. In these cases, this degree of cleaning applies to the entire specified area. For example, if all weld seams are to be cleaned in a maintenance operation, this degree of cleaning applies to 100 percent of all weld seams. If the entire structure is to be prepared, this degree of cleaning applies to 100 percent of the entire structure. SSPC-PA Guide 4⁹ provides a description of accepted practices for retaining old sound coating, removing unsound coating, feathering, and spot cleaning.

A3 REFERENCE PHOTOGRAPHS AND COMPARATORS: SSPC-VIS 1 provides color photographs for the various grades of surface cleaning as a function of the initial condition of the steel. The photographs B SP 6, C SP 6, D SP 6, G₁ SP 6, G₂ SP 6, and G₃ SP 6 depict surfaces cleaned to commercial grade. Other available reference photographs and comparators are described in Section 11 of SSPC-SP COM.

A4 SURFACE IMPERFECTIONS: Surface imperfections can cause premature coating failure when the service is severe. Coatings tend to pull away from sharp edges and projections, leaving little or no coating to protect the underlying steel. Other features that are difficult to cover and protect properly include crevices, weld porosities, laminations, etc. The high cost of the methods to remedy surface imperfections (such as edge rounding and weld spatter removal) should be weighed against the costs of a potential coating failure.

Poorly adhering contaminants, such as weld slag residues, loose weld spatter, and some minor surface laminations, may be removed during the blast cleaning operation. Other surface defects (steel laminations, weld porosities, or deep corrosion pits) may not be evident until the surface cleaning has been completed. Repair of such surface defects should be planned properly because the timing of the repairs may occur before, during, or after the blast cleaning operation. Section 4.4 of SSPC-SP COM and NACE Standard SP0178¹⁰ contain additional information on surface imperfections.

A5 WET ABRASIVE BLAST CLEANING: Steel that is wet abrasive blast cleaned may rust rapidly. Clean water should be used for rinsing. It may be necessary to add inhibitors to the water or apply them to the surface immediately after blast cleaning to temporarily prevent rust formation. The use of inhibitors or the application of coating over slight discoloration should be in accordance with the requirements of the coating manufacturer. **CAUTION:** Some inhibitive treatments may interfere with the performance of certain coating systems.

A6 ABRASIVE SELECTION: Types of metallic and nonmetallic abrasives are discussed in SSPC-SP COM. Blasting abrasives may become embedded in, or leave residues on, the surface of the steel during cleaning. While such embedment or residues are normally not detrimental, care should be taken to ensure that the abrasive is free from detrimental amounts of water-soluble, solvent-soluble, acid-soluble, or other soluble contaminants (particularly if the cleaned steel is to be used in an immersion environment). Criteria for selecting and evaluating abrasives are in SSPC-AB 1, SSPC-AB 2, and SSPC-AB 3.

A7 SURFACE PROFILE: Surface profile is the roughness of the surface that results from abrasive blast cleaning. The profile height is dependent on the size, shape, type, and hardness of the abrasive, particle velocity and angle of impact, hardness of the surface, amount of abrasive recycling, and the proper maintenance of working mixtures of grit and/or shot.

The allowable minimum/maximum height of profile is usually dependent on the thickness of the coating to be applied. Large particle-sized abrasives (particularly metallic) can produce a surface profile that may be too high to be adequately covered by a single thin-film coat. Accordingly, the use of larger abrasives should be avoided in these cases. However, larger abrasives may be needed for thick-film coatings or to facilitate removal of thick coatings, heavy mill scale, or rust. If control of surface profile (minimum/maximum) is deemed to be significant to coating performance, it should be addressed in the procurement documents (project specification). Typical surface profile heights achieved with commercial abrasive media are shown in Table 6 of SSPC-SP COM. Surface profile should be measured in accordance with NACE Standard RP0287¹¹ or ASTM D 4417.¹²

A8 FILM THICKNESS: It is essential that ample coating be applied after blast cleaning to adequately cover the peaks of the surface profile. The dry-film thickness of the coating above the peaks of the profile should equal the thickness known to be needed for the desired protection. If the dry-film thickness over the peaks is inadequate, premature rust-through or coating failure will occur. To ensure that coating thicknesses are properly measured, the procedures in SSPC-PA 2¹³ should be used.

A9 CHEMICAL CONTAMINATION: Steel contaminated with soluble salts (e.g., chlorides and sulfates) develops rust-back rapidly at intermediate and high levels of humidity. These soluble salts can be present on the steel surface prior to blast cleaning as a result of atmospheric contamination. In addition, contaminants can be deposited on the steel surface during blast cleaning if the abrasive is contaminated. Therefore, rust-back can be minimized by removing these salts from the steel surface and eliminating sources of recontamination during and after blast cleaning. Wet methods of removal are described in SSPC-SP 12/NACE No. 5.¹⁴ Identification of the contaminants

along with their concentrations may be obtained from laboratory and field tests as described in SSPC-Guide 15.¹⁵

A10 RUST-BACK: Rust-back (rerusting) occurs when freshly cleaned steel is exposed to moisture, contamination, or a corrosive atmosphere. The time interval between blast cleaning and rust-back varies greatly from one environment to another. Under mild ambient conditions, if chemical contamination (see Paragraph A9) is not present, it is best to blast clean and coat a surface on the same day. Severe conditions may require a more expeditious coating application to avoid contamination from fallout. Chemical contamination should be removed prior to coating.

A11 DEW POINT: Moisture condenses on any surface that is colder than the dew point of the surrounding air. It is therefore recommended that the temperature of the steel surface be at least 3 °C (5 °F) above the dew point during dry blast cleaning operations. It is advisable to visually inspect for moisture and periodically check the surface temperature and dew point during blast cleaning operations and to avoid the application of coating over a damp surface.

12 oz Non-Woven Geotextile Fabric

Series: Non-Woven Geotextile Fabric

Recommended Applications: Drainage, Erosion Control

Fabric Property	Test Method	Units	Minimum Average Roll Value
Grab Tensile	ASTM D 4632	lbs.	305 (1.357 kN)
Grab Elongation	ASTM D 4632	lbs.	50
Trap-Tear Strength	ASTM D 4533	lbs.	115 (.511 kN)
CBR Puncture	ASTM D 6241	lbs.	850 (3.78 kN)
Permittivity	ASTM D 4491	sec ⁻¹	1
Water Flow	ASTM D 4491	gpm/ft ²	75 (3055 l/min/sm)
UV Resistance	ASTM D 4355	%	70
AOS	ASTM D 4751	US Sieve	#100 (.150 mm)

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Please note: Pro Fabric Supply is a distributor of geotextile fabric, not the manufacturer. We source material from a number of different United States based geotextile manufacturers.

CHANCE® Type RS2875.276 Helical Piles

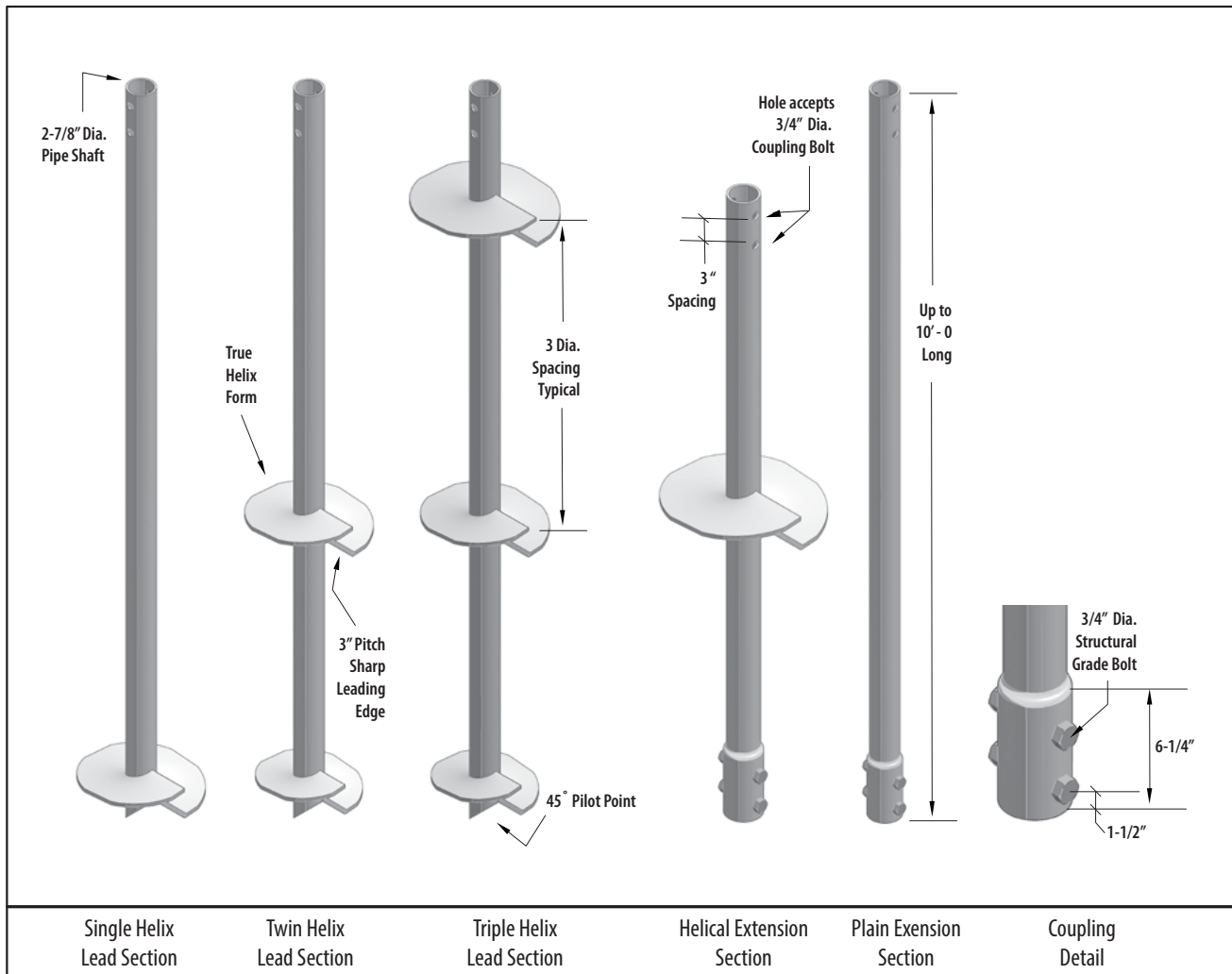
72 kip Ultimate – 36 kip Allowable Capacity

Installation Torque Rating – 8,000 ft-lb

Multi-Purpose 2-7/8" Diameter, 0.276" Wall, Round HSS Shaft with integrally formed upset sockets

Description:

Hubbell Power Systems, Inc., CHANCE Type RS2875.276 Helical Piles have 72 kip ultimate capacity and 36 kip working or allowable capacity in compression or tension. This capacity is based on well documented correlations with installation torque, which is recognized as one method to determine capacity per IBC Section 1810.3.3.1.9. Lead sections and extensions couple together to extend the helix bearing plates to the required load bearing stratum. Round shaft helical piles offer increased lateral and buckling resistance compared to solid square shafts with similar torque strength. Strength calculations are based on a design corrosion level of 50 years for most soil conditions. CHANCE Type RS Helical Piles can be coupled with square shaft lead sections (Combo Piles) to provide greater penetration into bearing soils. CHANCE Type RS Helical Piles and Anchors feature sharpened leading edge helix plates that are circular in plan to provide uniform load bearing in most soil conditions. Helix plates can be equipped with "sea-shell" cuts on the leading edge to enhance penetration through dense soils with occasional cobbles and debris. Custom lengths and helix configurations are available upon request. See below for additional information and other sections of this Technical Manual for specifications and design details.



All Hubbell Power Systems, Inc. CHANCE Helical Products are MADE IN THE U.S.A.

DRAWINGS & RATINGS

RS2875.276 Helical Pile Specifications & Available Configurations

Shaft – HSS 2-7/8 inch OD x 0.276 inch (schedule 80) wall steel shaft produced exclusively for CHANCE products.

Coupling – forged as an integral part of the plain and helical extension material as round deep sockets connected with multiple structural bolts.

Helix – 3/8 inch Thick: ASTM A656, or A1018 with minimum yield strength of 80 ksi. 3 inch Helix Pitch – a standard established by Hubbell Power Systems, Inc. for CHANCE Helical Piles and Anchors.

Available Helix Diameters: 8, 10, 12, or 14 inches.

All helix plates are spaced 3 times the diameter of the preceding (lower) helix unless otherwise specified.

The standard helix plate has straight sharpened leading edges or can be ordered with a “sea shell” cut. The “sea shell” cut is best suited when it is necessary to penetrate soils with fill debris, cobbles, or fractured rock.

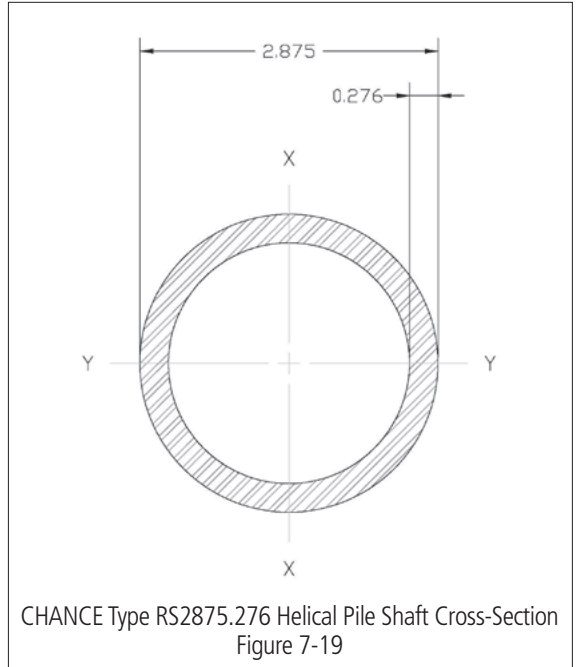
Configurations:

Single, double, and triple and quad helix Lead Sections, 3.5, 5, 7, and 10 feet long
Plain Extensions, 3, 5, 7, and 10 feet long

Extensions with Helix Plates, 3 feet long

Helical products are Hot Dip Galvanized per ASTM A153 Class B-1.

NOTE: Helical piles shall be installed to appropriate depth in suitable bearing stratum as determined by the geotechnical engineer or local jurisdictional authority. Torque correlated capacities are based on installing the pile to its torque rating, using consistent rate of advance and RPM. A minimum factor of safety of 2 is recommended for determining allowable capacity from correlations. Deflections of 0.25 to 0.50 inches are typical at allowable capacity.



Nominal, LRFD Design and ASD Allowable Strengths of RS2875.276 Helix Plates for Shaft Axial Tension and Compression¹

Helix Diameter in (mm)	Thickness in (mm)	Nominal Strength kip (kN)	LRFD Design Strength kip (kN)	ASD Allowable Strength kip (kN)
8 (200)	0.375 (9.5)	121.4 (540.0)	91.1 (378)	60.7 (270.0)
10 (250)	0.375 (9.5)	98.9 (439.9)	74.2 (330)	49.5 (220.2)
12 (300)	0.375 (9.5)	85.3 (379.4)	63.9 (284.6)	42.7 (189.9)
14 (350)	0.375 (9.5)	53.7 (238.9)	40.3 (179.2)	26.9 (119.7)

For SI: 1 kip = 4.448 kN.

¹Capacities based on a design corrosion level of 50-years.

Nominal and LRFD Design Compression Strengths of CHANCE® Type RS2875.276 Helical Pile Lead & Extension Sections^{1,2}

Section Type & Helix Count	Nominal & LRFD Design Compression Strengths kips (kN)							
	Firm Soil				Soft Soil			
	Fixed		Pinned		Fixed		Pinned	
	Nominal	Design	Nominal	Design	Nominal	Design	Nominal	Design
Lead, Single Helix	92.9 (413.2)	83.6 (371.9)	86.3 (383.9)	77.7 (345.6)	73.9 (328.7)	66.5 (295.8)	55.2 (245.5)	49.7 (221.1)
	See Helix Table Above For Single 12" & 14"				See Helix Table Above For Single 14"			
Lead, Multi-Helix	92.9 (413.2)	83.6 (371.9)	86.3 (383.9)	77.7 (345.6)	73.9 (328.7)	66.5 (295.8)	55.2 (245.5)	49.7 (221.1)
Extension	92.9 (413.2)	83.6 (371.9)	86.3 (383.9)	77.7 (345.6)				

For SI: 1 kip = 4.448 kN.

¹ Refer to Section 4.1.3 of ESR-2794 for descriptions of fixed condition, pinned condition, soft soil and firm soil.

² Strength ratings are based on a design corrosion level of 50-years and presume the supported structure is braced in accordance with IBC Section 1808.2.5, and the lead section with which the extension is used will provide sufficient helix capacity to develop the full shaft capacity.

RS2875.276 HELICAL PILE AND ANCHOR PRODUCT SPECIFICATIONS				
SHAFT	Hot Rolled HSS 2-1/2 inch Nominal Schedule 80 (0.276 inch nominal wall) per ASTM A500 Grade B/C with 50 ksi minimum yield strength			
Shaft Size, OD	2.875 in	73 mm	Corroded	
			2.862 in	72.7 mm
Shaft Size, ID*	2.36 in	60 mm	Corroded	
			2.375 in	60.3 mm
Moment of Inertia (I)*	1.83 in ⁴	76.2 cm ⁴	Corroded	
			1.733 in ⁴	72.1 cm ⁴
Shaft Area (A)*	2.11 in ²	13.6 cm ²	Corroded	
			2.0 in ²	12.9 cm ²
Section Modulus (S _{x-x})*	1.27 in ³	20.8 cm ³	Corroded	
			1.21 in ³	19.8 cm ³
Perimeter	9.0 in	22.8 cm	Corroded	
			8.99 in	22.8 cm
Coupling	Integral Forged Round Deep Socket Sleeve			
Coupling Bolts	Two ¾ in Diameter SAE J429 Grade 5 Hex Head Bolts with Threads Excluded from Shear Planes			
Helix Plates	0.375 inch Thick, Formed on Matching Metal Dies, ASTM A656 Grade 80 or better			
Coatings	Hot Dip Galvanized per ASTM A153 Class B-1, 3.1 mil minimum thickness or Bare Steel			
TORQUE PROPERTIES				
Torque Correlation Factor	9 ft ⁻¹		30 m ⁻¹	
Torque Rating	8,000 ft-lb		10,846 N-m	
STRUCTURAL CAPACITY				
Tension Strength	Nominal		LRFD Design	
	90 kip	400 kN	67.5 kip	300 kN
Allowable Tension Strength	45 kip		200 kN	
TORQUE CORRELATED CAPACITY				
Capacity Limit Based on Torque Correlation, Tension / Compression	Ultimate		Allowable	
	72 kip	320 kN	36 kip	160 kN

* computed with 93% of wall thickness per AISC 360-10, B4.2



Assembly of RS2875.276
Figure 7-20

ASD Allowable Compression Strengths of CHANCE® Type RS2875.276 Helical Pile Lead & Extension Sections^{1,2}

Section Type & Helix Count	ASD Allowable Axial Compression Strength kips (kN)			
	Firm Soil		Soft Soil	
	Fixed	Pinned	Fixed	Pinned
Lead, Single Helix	For Single 8" – 55.6 (247.3)	For Single 8" – 51.7 (230.0)	44.3 (197.1)	33.0 (146.8)
	See Helix Strength Table Above for 10", 12" & 14"	See Helix Strength Table Above for 10", 12" & 14"	See Helix Strength Table Above for 12" & 14"	For Single 14" – 26.9
Lead, 2-Helix 8"-10"	55.6 (247.3)	51.7 (230.0)	44.3 (197.1)	33.0 (146.8)
Lead, 2-Helix 10"-12"				
Lead, 2-Helix 12"-14"				
Lead, 2-Helix 14"-14"				
Lead, Multi-Helix	55.6 (247.3)	51.7 (230.0)	44.3 (197.1)	33.0 (146.8)
Extension	55.6 (247.3)	51.7 (230.0)	44.3 (197.1)	33.0 (146.8)

For SI: 1 kip = 4.448 kN.

¹ Refer to Section 4.1.3 of ESR-2794 for descriptions of fixed condition, pinned condition, soft soil and firm soil.

² Strength ratings are based on a design corrosion level of 50-years and presume the supported structure is braced in accordance with IBC Section 1808.2.5, and the lead section with which the extension is used will provide sufficient helix capacity to develop the full shaft capacity.



Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings¹

This standard is issued under the fixed designation A 780; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This practice describes methods which may be used to repair damaged hot-dip galvanized coatings on hardware, structural shapes, and other products fabricated prior to hot-dip galvanizing, and uncoated areas remaining after initial hot-dip galvanizing. The damage may be the result of welding or cutting (flame), in which case the coating will be damaged predominantly by burning. This practice can also be used to repair hot-dip galvanized coatings damaged by excessively rough handling during shipping or erection. Requirements concerning the renovation of uncoated areas remaining after initial hot-dip galvanizing are contained within the applicable material specification.

1.2 This practice describes the use of low melting point zinc alloy repair rods or powders made specifically for this purpose, the use of paints containing zinc dust, and the use of sprayed zinc (metallizing).

1.3 The extent of repair shall be limited to an area mutually agreeable to the contracting parties. Similarly, contracting parties shall agree to the repair method to be used.

1.4 *This standard does not purport to address the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.5 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 ASTM Standards:

A 902 Terminology Relating to Metallic Coated Steel Products²

D 520 Specification for Zinc Dust Pigment³

2.2 Society for Protective Coatings (SSPC) Documents:

SSPC-PA2 Measurement of Dry Paint Thickness with Magnetic Gages⁴

SSPC-SP2 Hand Tool Cleaning⁴

SSPC-SP5/NACE No.1 White Metal Blast Cleaning⁴

SSPC-SP10/NACE No.2 Near-White Blast Cleaning⁴

SSPC-SP11 Power Tool Cleaning to Bare Metal⁴

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology A 902.

4. Materials

4.1 *Properties*—The material used for repairs shall have the following characteristics:

4.1.1 One application of the material shall provide a coating thickness of at least 2.0 mils (50.8 μm).

4.1.2 The applied coating shall provide barrier protection and shall preferably be anodic to steel.

4.1.3 Application of the coating material shall be possible under shop or field conditions.

4.2 *Types*—There are three types of material that possess the required properties and may be used to repair damaged galvanized coatings, as follows:

4.2.1 *Zinc-Based Solders*—Zinc alloy solders are to be used for repairs. The most common types of solders are zinc-cadmium, zinc-tin-lead, and zinc-tin-copper alloys. Zinc-cadmium and zinc-tin-lead alloys have liquidus temperatures in the ranges from 518 to 527°F (270 to 275°C) and 446 to 500°F (230 to 260°C), respectively. (The liquidus temperature is that temperature above which an alloy is completely molten.) The zinc-tin-copper alloys have a liquidus temperature in the range from 660 to 670°F (349 to 354°C), but they are applied while in a semisolid state in the preferred application temperature range from 480 to 570°F (250 to 300°C). The solders can be used in rod form or as powders. Annex A1 describes the use of zinc-based solders.

4.2.2 *Paints Containing Zinc Dust*—These are usually based on organic binders, pre-mixed and formulated specifically for use on steel surfaces. These paints containing zinc dust are suitable for repairing damaged galvanized coatings,

¹ This practice is under the jurisdiction of ASTM Committee A05 on Metallic Coated Iron and Steel Products and is the direct responsibility of Subcommittee A05.13 on Structural Shapes and Hardware Specifications.

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² *Annual Book of ASTM Standards*, Vol 01.06.

³ *Annual Book of ASTM Standards*, Vol 06.03.

⁴ Available from Steel Structures Painting Council, 4400 Fifth Ave., Pittsburgh, PA 15213.

provided the dried film contains not less than 65 % zinc dust by weight. Corrosion resistance and service performance are very dependent on the properties of the paint system, the extent of surface preparation, and skills of individual applicators. Annex A2 describes the use of paints containing zinc dust.

4.2.3 *Sprayed Zinc*—This method involves the application of a zinc coating by spraying the surface to be repaired with droplets of molten metal using wire or ribbon, or powder processes. Annex A3 describes the use of sprayed zinc.

4.3 For further information, reference may be made to the papers, procedures, and specifications in Refs. (1) through (4) (see list of references at the end of this practice).

5. Keywords

5.1 coatings—zinc; galvanized coating repair; galvanized coatings; touch-up; zinc coating repair; zinc coatings

ANNEXES

(Mandatory Information)

A1. REPAIR USING ZINC-BASED ALLOYS

A1.1 Clean the surface to be reconditioned using a wire brush, a light grinding action, or mild blasting. To ensure that a smooth reconditioned coating can be effected, surface preparation shall extend into the surrounding, undamaged galvanized coating.

A1.2 If the area to be reconditioned includes welds, first remove all weld flux residue and weld spatter (of a size that cannot be removed by wire brushing or blast cleaning) by mechanical means, such as chipping, grinding, or power scaling, etc.

A1.3 Preheat the cleaned area to be reconditioned to at least 600°F (315°C). Do not overheat the surface beyond 750°F (400°C), nor allow the surrounding galvanized coating to be

burned. Wire brush the surface to be reconditioned during preheating. Pre-flux, if necessary.

A1.4 Rub the cleaned, preheated area with the repair stick to deposit an evenly distributed layer of the zinc alloy. When powdered zinc alloys are used, sprinkle the powder on the cleaned, preheated surface and spread out with a spatula or similar tool. The thickness of the applied coating shall be as agreed upon between the contracting parties.

A1.5 When the repair has been effected, remove flux residue by rinsing with water or wiping with a damp cloth.

A1.6 Take thickness measurements with either a magnetic, electromagnetic, or eddy-current gage to ensure that the applied coating is as specified.

A2. REPAIR USING PAINTS CONTAINING ZINC DUST

A2.1 Preparation of the damaged surface will be influenced by the type of paint selected and the anticipated service conditions. Experience shows that in general, organic zinc-rich systems are tolerant of marginal surface preparation. Most organic paints containing zinc dust are not critical of climatic or atmospheric conditions for curing. The following general guidelines shall apply:

A2.1.1 Surfaces to be reconditioned with paints containing zinc dust shall be clean, dry, and free of oil, grease, preexisting paint, and corrosion by-products.

A2.1.2 Where anticipated, field service conditions include immersion, blast clean the surface in accordance with SSPC-SP10/NACE No. 2 near white metal. For less critical field exposure conditions, clean the surface to bare metal, in accordance with SSPC-SP11, as a minimum. Where circumstances do not allow blast or power tool cleaning, it is permissible to hand tool areas clean in accordance with SSPC-SP2. To ensure that a smooth reconditioned coating can be effected, surface preparation shall extend into the undam-

aged galvanized coating. The method and extent of surface preparation shall be mutually agreeable to the contracting parties.

A2.1.3 If the area to be reconditioned includes welds, first remove all weld flux residue and weld spatter (of a size that cannot be removed by wire brushing or blast cleaning) by mechanical means, such as chipping, grinding, or power scaling, etc.

A2.1.4 Spray or brush-apply the paints containing zinc dust to the prepared area. Apply the paint as in accordance with the manufacturer's printed instructions in a single application employing multiple passes to achieve a dry film thickness to be agreed upon between the contracting parties. Allow adequate curing time before subjecting repaired items to service conditions in accordance with the manufacturer's printed instructions.

A2.1.5 Take thickness measurements with either a magnetic, electromagnetic, or eddy-current gage to ensure that the applied coating is as specified in accordance with SSPC-PA2.

A3. REPAIR USING SPRAYED ZINC (METALLIZING)

A3.1 Surfaces to be reconditioned by zinc metallizing shall be clean, dry and free of oil, grease, and corrosion products.

A3.2 If the area to be reconditioned includes welds, first remove all flux residue and weld spatter of a size or type that cannot be removed by blast cleaning by mechanical means, that is, chipping, etc.

A3.3 Blast clean the surface to be reconditioned in accordance with SSPC-SP5/NACE No. 1, white metal.

A3.4 To ensure that a smooth reconditioned coating can be effected, surface preparation shall be extended into the surrounding undamaged galvanized coating.

A3.5 Apply the coating to the clean and dry surface by means of metal-spraying pistols fed with either zinc wire or

zinc powder. Apply the sprayed coating as soon as possible after surface preparation and before visible deterioration of the surface has occurred.

A3.6 The surface of the sprayed coating shall be of uniform texture, free of lumps, coarse areas, and loosely adherent particles.

A3.7 The nominal thickness of the sprayed zinc coating shall be previously agreed upon between the contracting parties.

A3.8 Take thickness measurements with either a magnetic, electromagnetic, or eddy-current gage to ensure that the applied coating is as specified.

REFERENCES

- (1) Van Eijnsbergen, J. F. H., et al, "Reconditioning Damaged Galvanized Surfaces," 6th International Conference on Hot Dip Galvanizing, Interlaken, June 1961, pp. 128-141.
- (2) SSPC-Paint-20, "Zinc Rich Coatings, Type I Inorganic, Type II Organic," Steel Structures Painting Council, 4400 Fifth Ave., Pittsburgh, PA 15213, 1979.
- (3) MIL-P-21035 (Ships), Military Specification, "Paint, High Zinc Dust Content, Galvanizing Repair," Amendment 1, U.S. Government Printing Office, Washington, DC, 1970.
- (4) "Recommended Practices for Fused Thermal Sprayed Deposits," American Welding Society, Inc., 550 N.W. LeJeune Rd., Miami, FL 33135, 1975.

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