



STRUCTURAL ENGINEERING INSPECTION

APRIL 8, 2024



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SUMMARY



4.1.1 Foundation Observations - Foundation Investigation Conclusions: Foundation De ection Exceeds Limits



4.1.2 Foundation Observations - Foundation Investigation Conclusions: Conclusions - Remediation Required

1: INTRODUCTION

Information

Project Information: GreenWorks Project Information: Inspection		Project Information: Report Issue
Project Number	Date	Date
106936	04/08/2024	04/16/2024

Project Information: Purpose

GreenWorks Engineering has completed an evaluation of the foundation at the address referenced above to determine its condition and any necessary repairs. This evaluation is a Level B evaluation, as defined by the Texas Section of the American Society of Civil Engineers (ASCE).

Our evaluation involved collecting data and photographs of the structure to assess its performance and identify any signs of distress. Based on our findings, we will provide recommendations for repairs to ensure the long-term stability and safety of the structure.

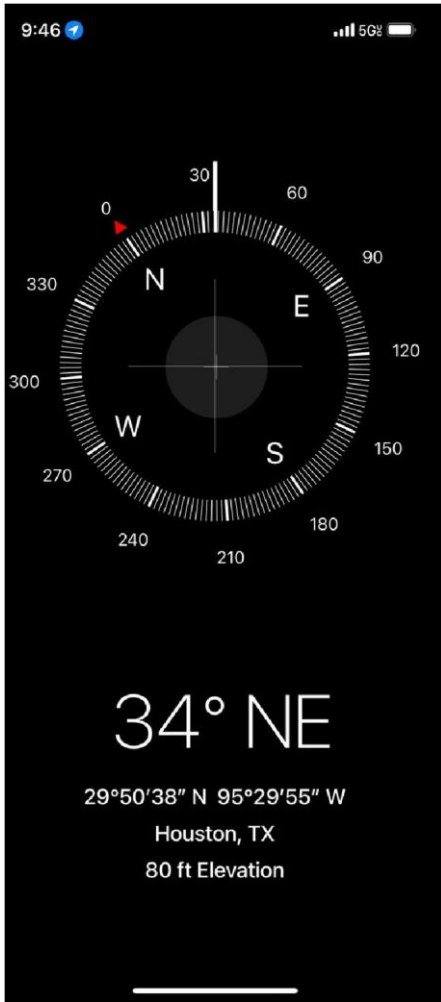
We understand that foundation issues can be a cause for concern for property owners, and we aim to provide clear and concise information to help you make informed decisions about any repairs needed for your property. The data and photographs presented in this report are intended to provide a representative sample of the types of distress observed throughout the structure, and are not a comprehensive catalog of all the distress present.

Project Information: Level B Evaluation

Per the Foundation Performance Association's 'Guidelines for the Evaluation of Foundation Movement for Residential and Other Low-Rise Buildings', a Level B Investigation includes:

- Documenting visual observations made during a physical walkthrough
- Observation of factors influencing the performance of the foundation
- If possible, an interview of occupants/owners/managers regarding a history of the property and foundation
- Review of pertinent documents including geotechnical reports, construction drawings, field reports, and repair documents
- Description and tilt calculations to assess foundation performance and establish a baseline
- Description of factors that affect soil moisture

General Structure Information:	General Structure Information:	General Structure Information:
Property Faces	Building Type	Framing Type
East	3 Story Hotel	Wood-framed



General Structure Information:

Foundation Type
Concrete Slab-on-Grade

General Structure Information:

Garage Type
No garage

General Structure Information:

Exterior Wall Type
Roofing Material
Stucco

General Structure Information:

Composite Asphalt Shingles

General Structure Information:

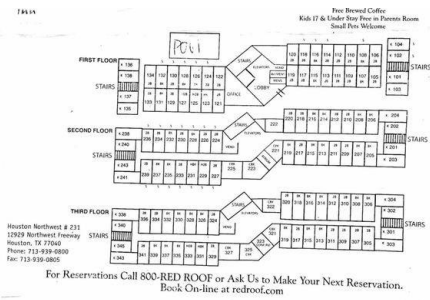
Original Construction Date
1990

Reference Documents: Applicable

Code
IRC 2021

Reference Documents: Additional

Documents Provided
Floorplan



Limitations

Project Information

PHOTOGRAPHS TAKEN ON-SITE

Some data collected in the form of photographs is presented in this report. These photographs are included for reference and are intended only to represent the distress generally found throughout the structure. They do not represent a comprehensive catalog of all of the distress present in the structure.

2: OBSERVATIONS - EXTERIOR

Information

General: Exterior Pictures





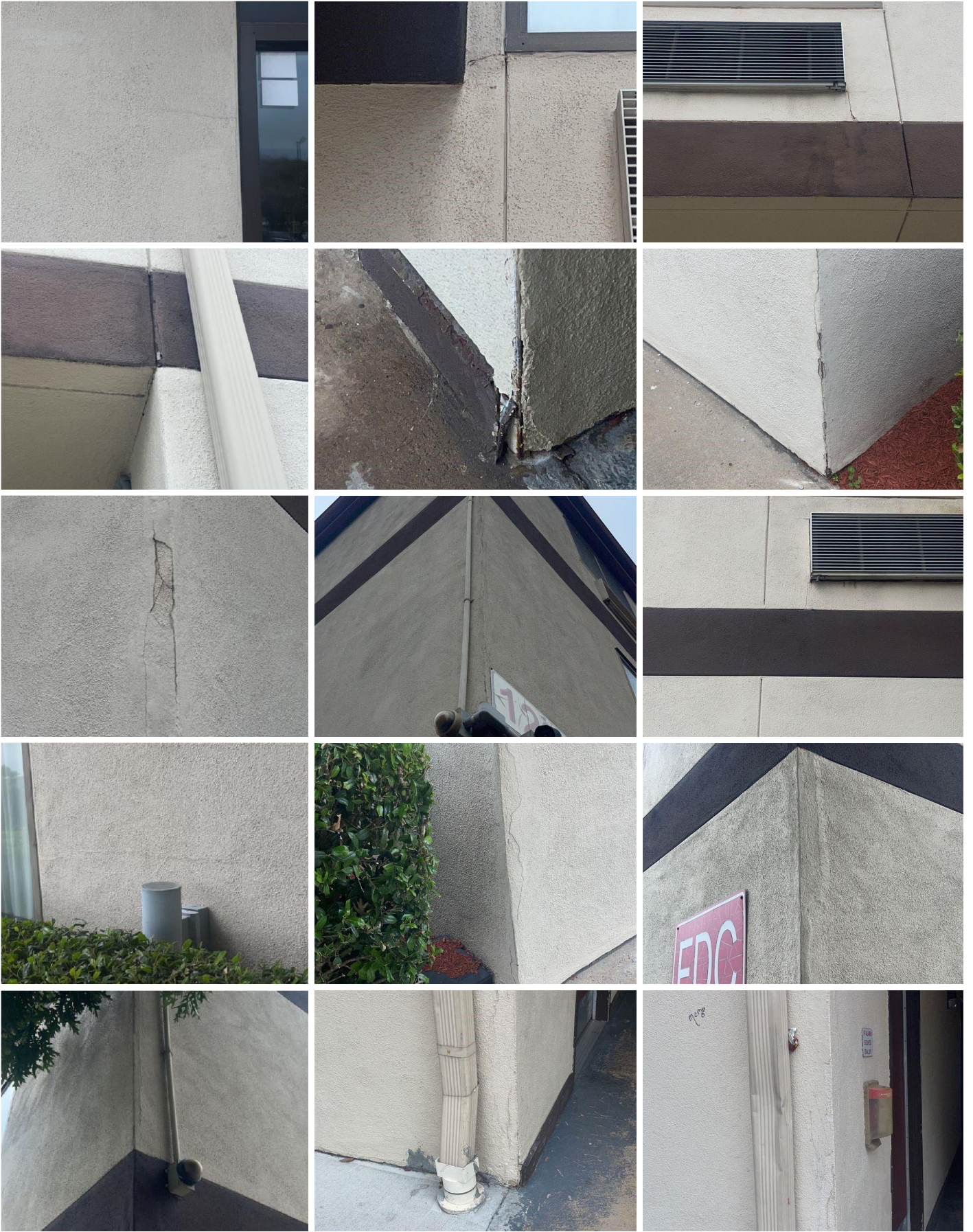


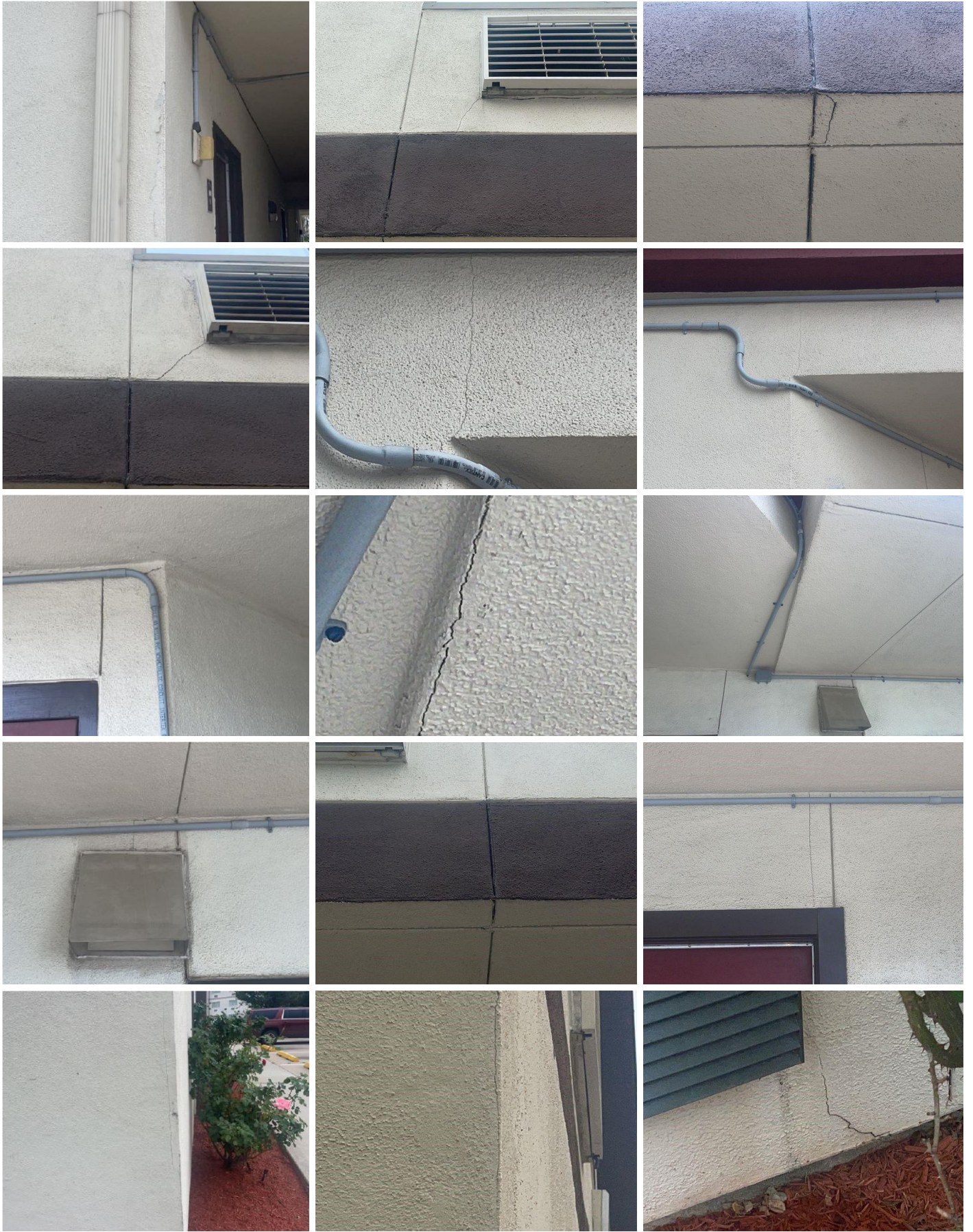


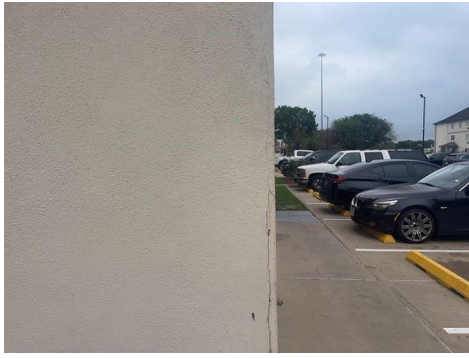
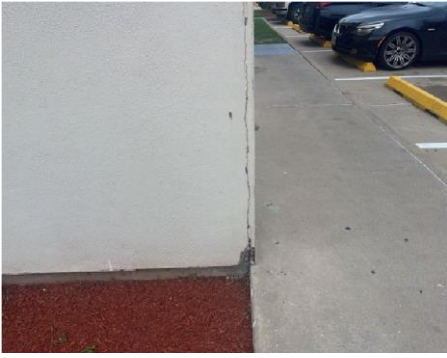




Exterior Distress: Stucco Veneer Cracks





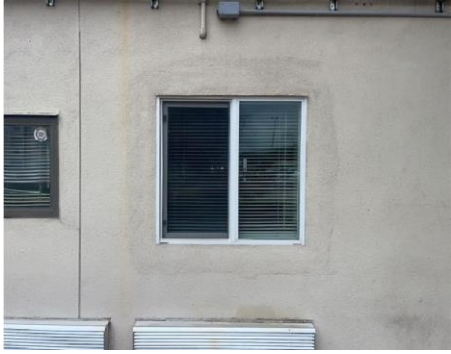


Exterior Distress: Expansion Joint Separation



Exterior Distress:

Previous Repair



Exterior Distress:

Sidewalk Cracks



Wall/Ceiling Separation

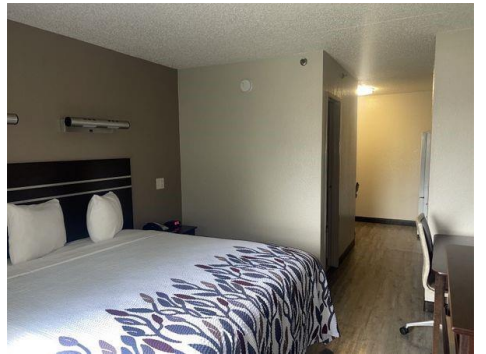
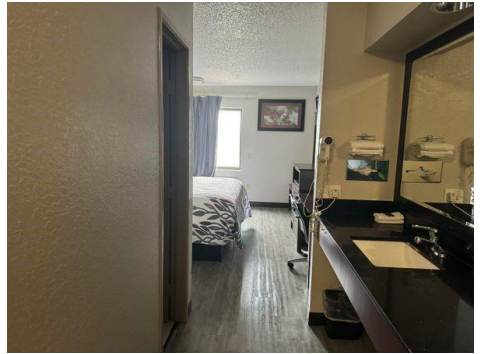
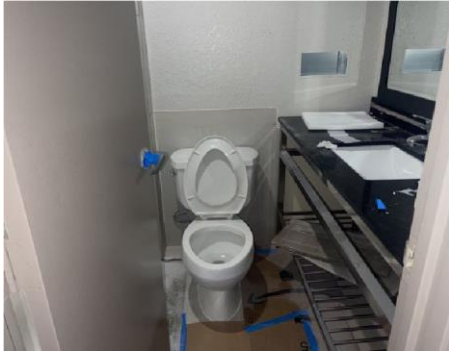
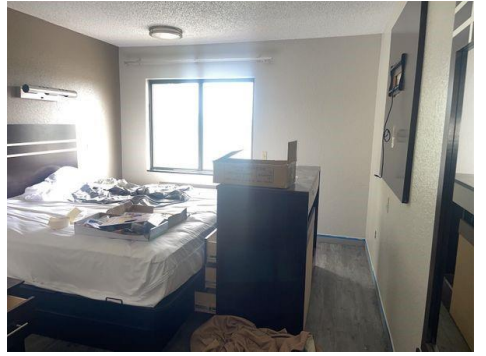
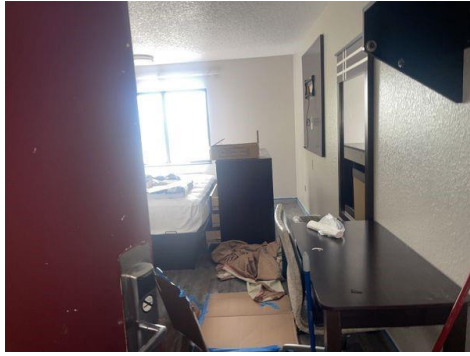
Exterior Distress:



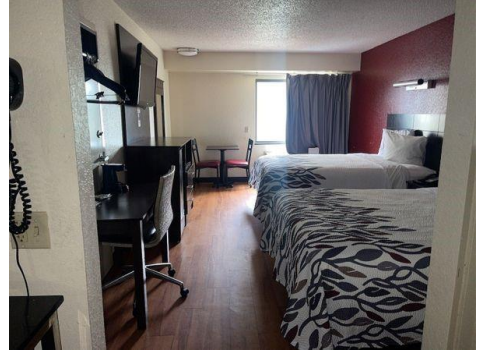
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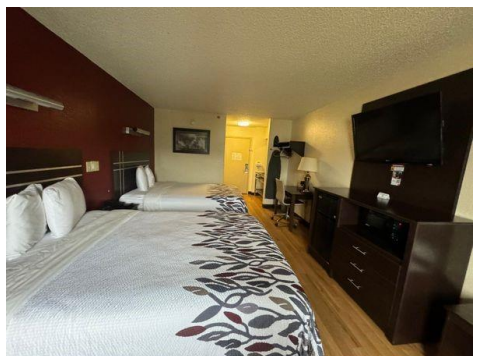
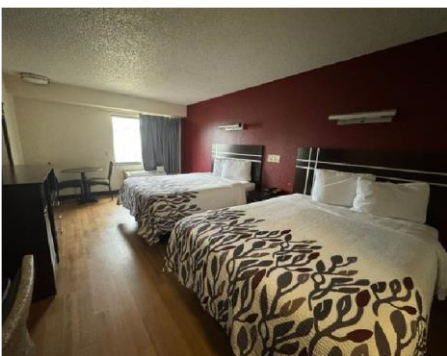
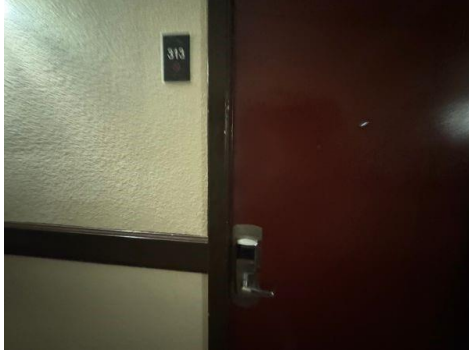
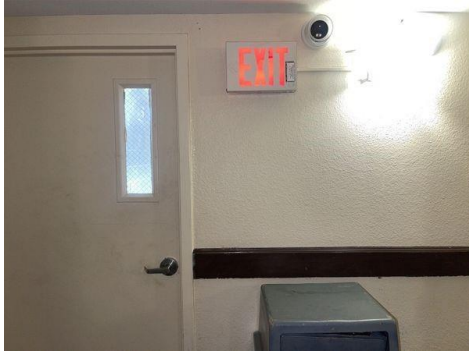
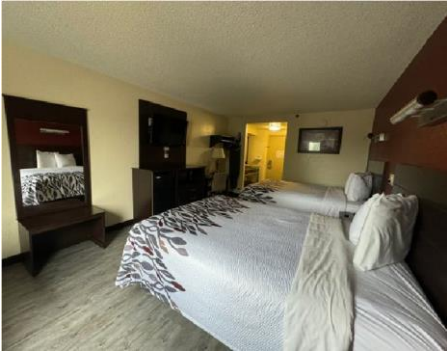
Information

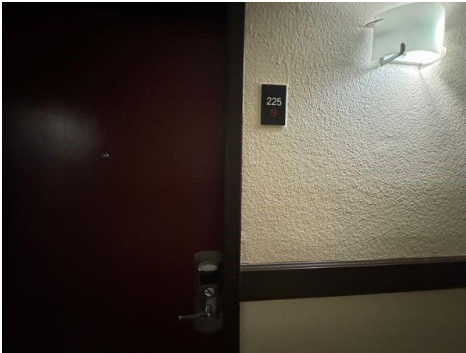
Interior Photos: General Pictures

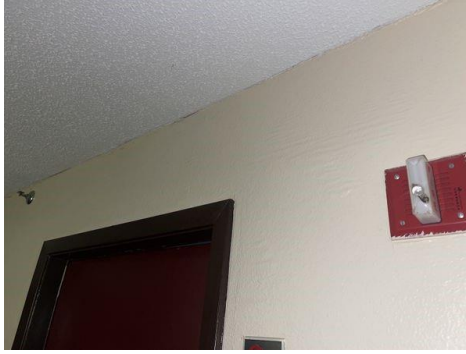
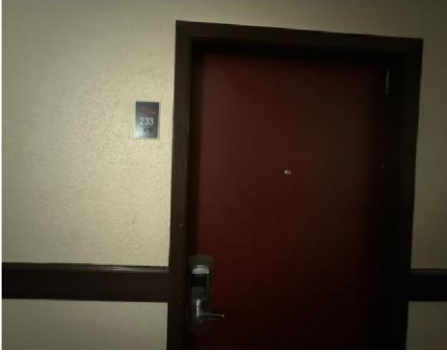
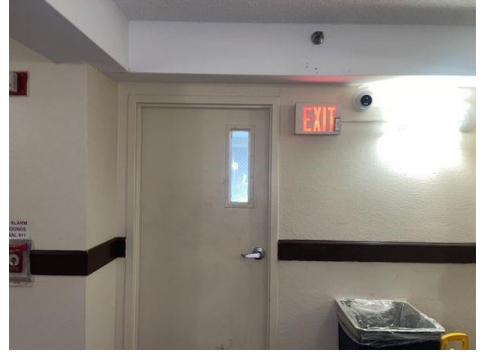




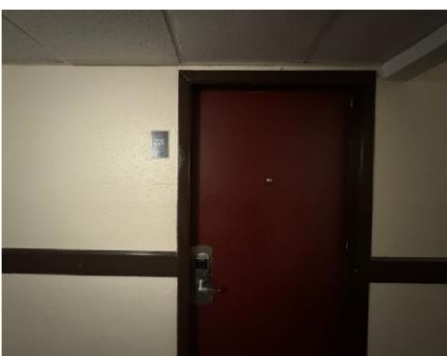


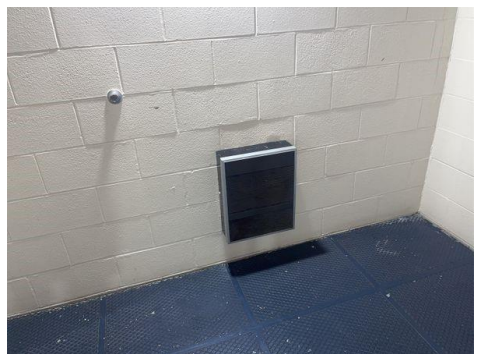
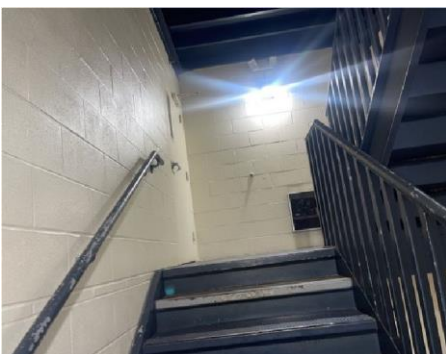
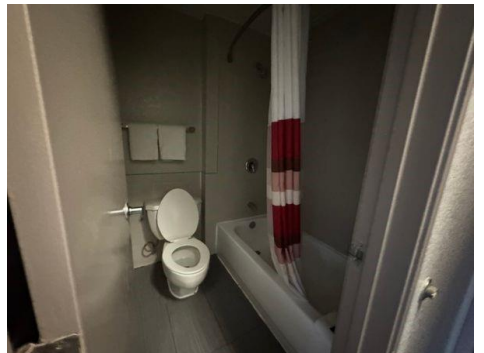
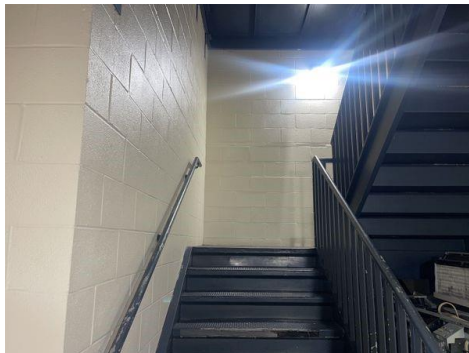
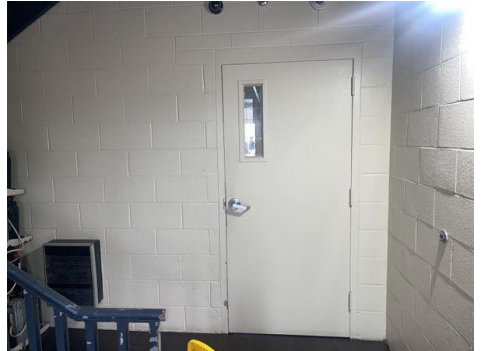
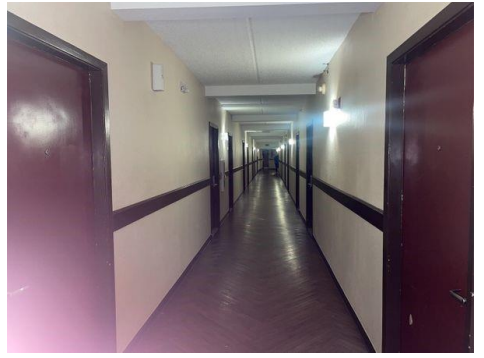
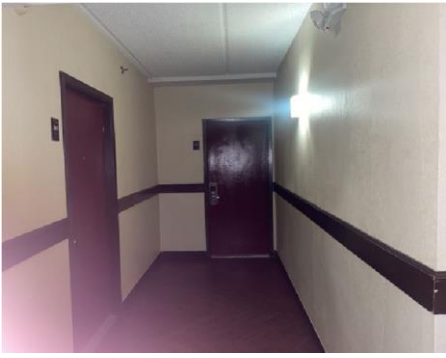


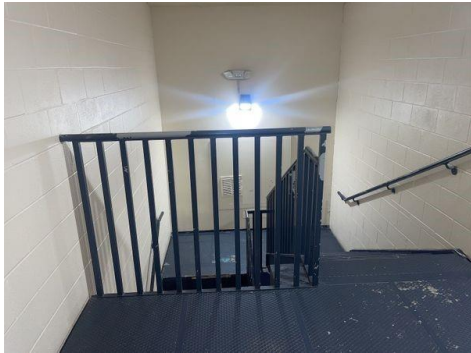
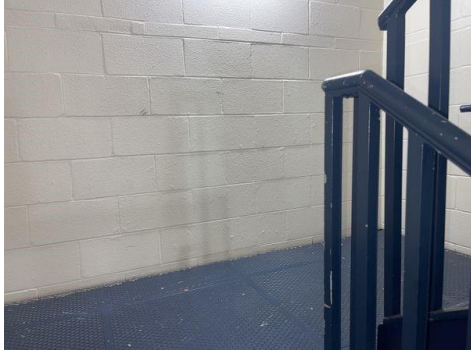
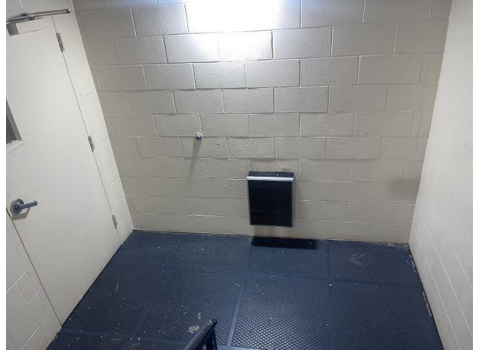
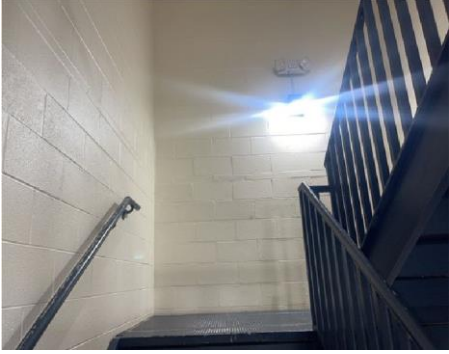
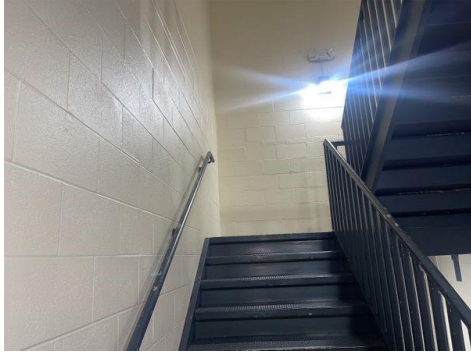


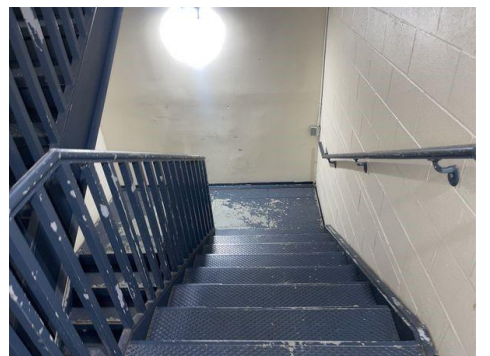
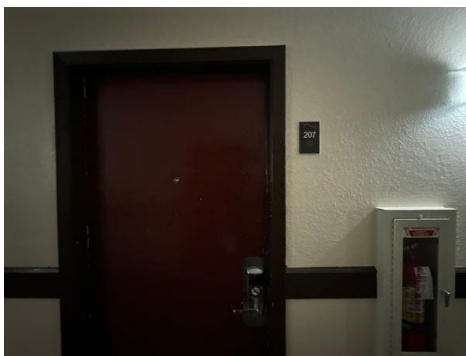
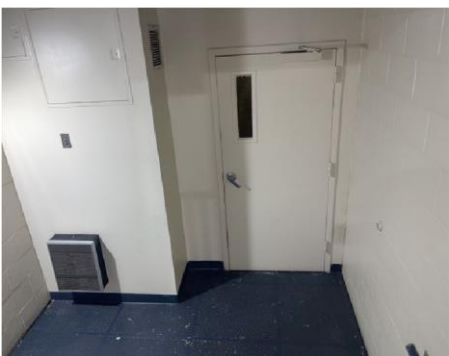
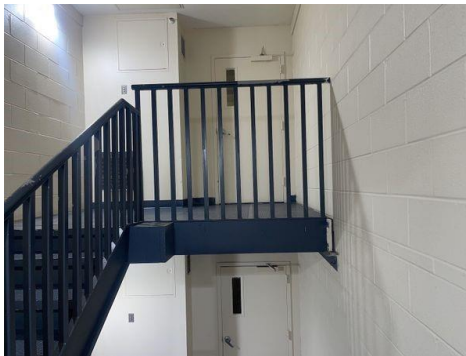
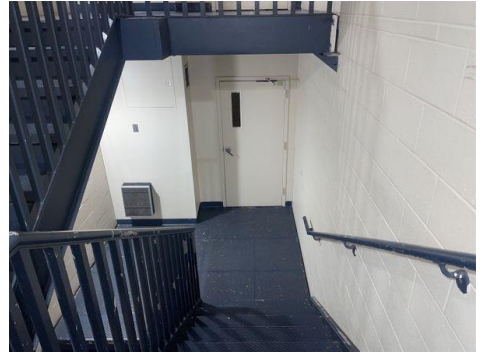
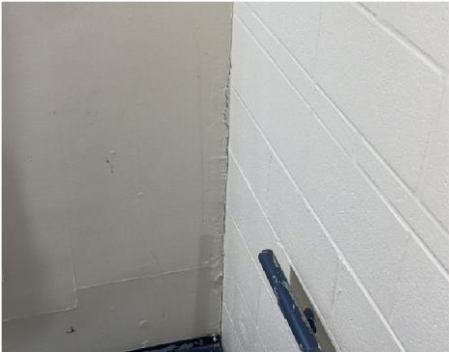
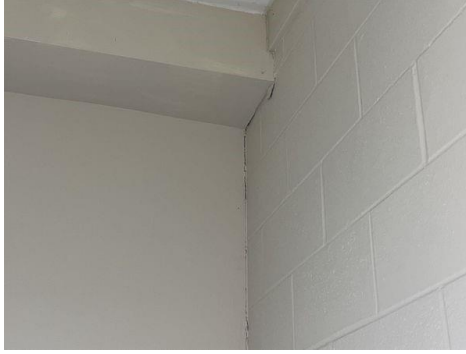
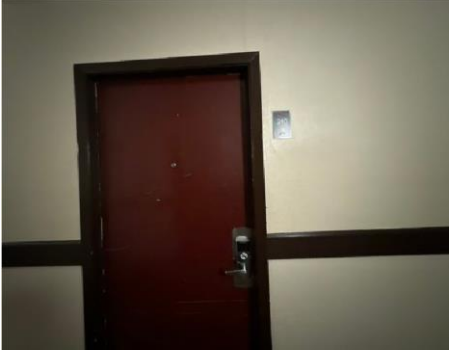
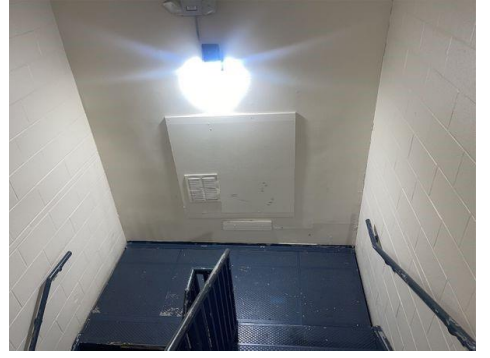
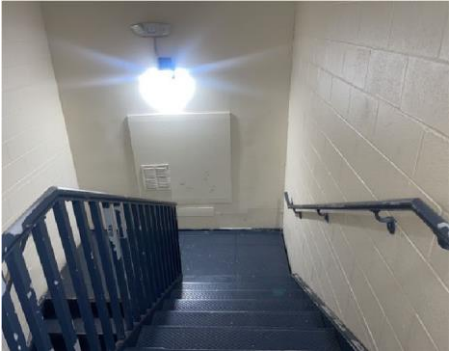


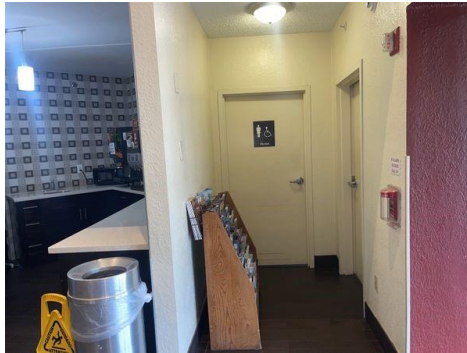
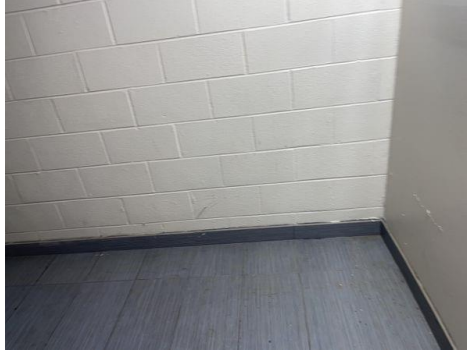
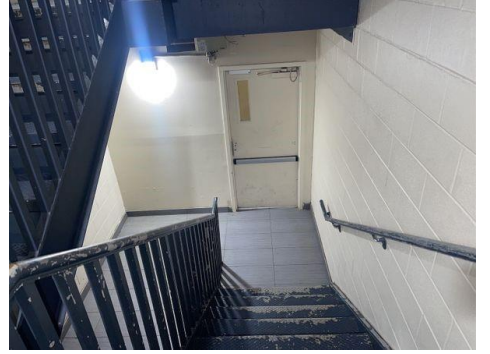
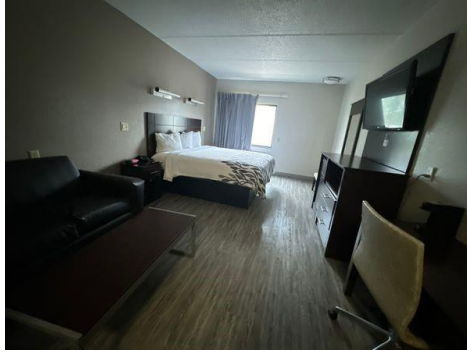
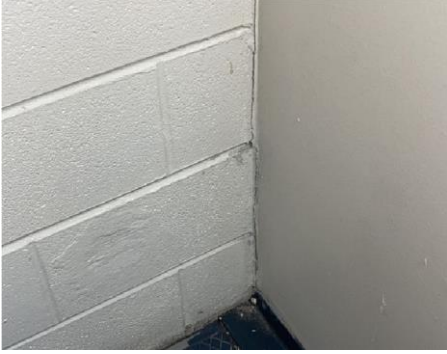
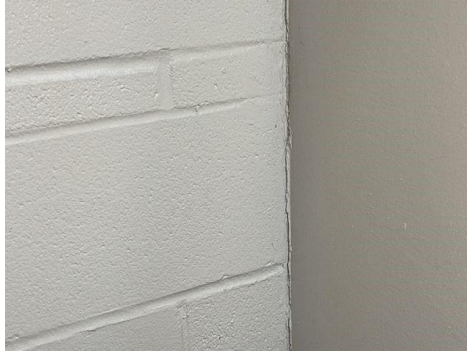


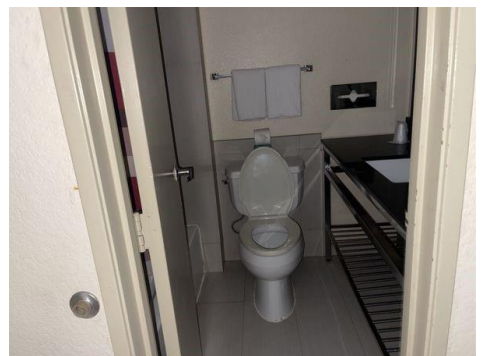
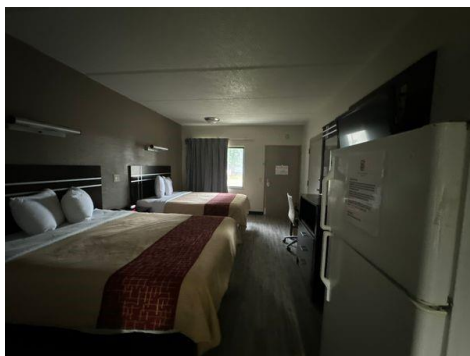
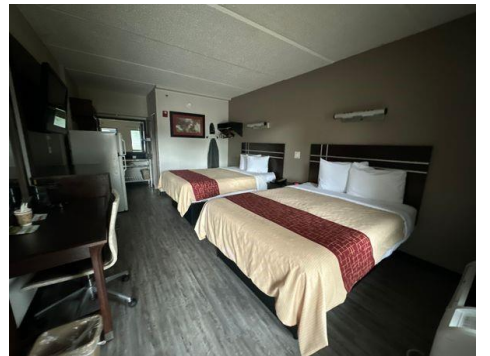
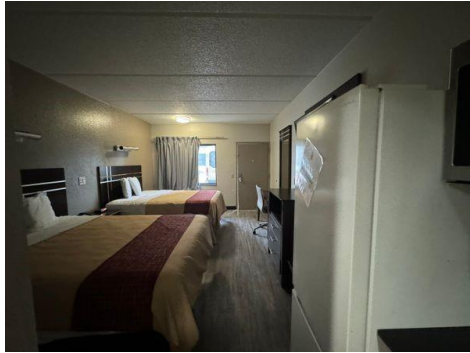
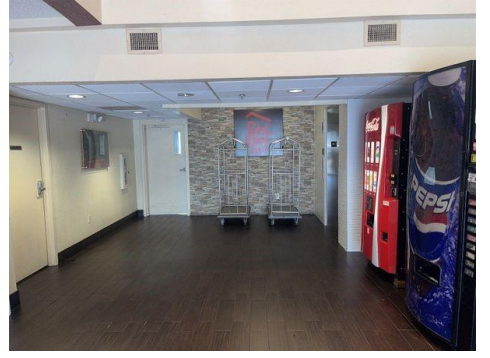
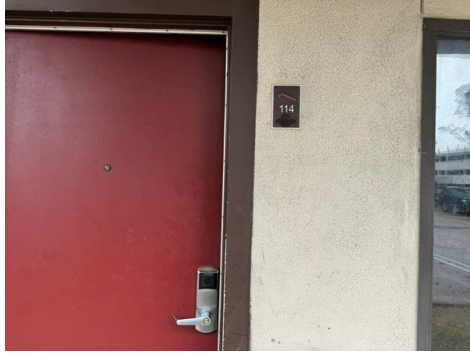


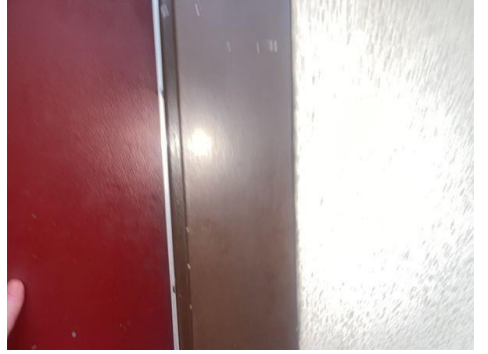
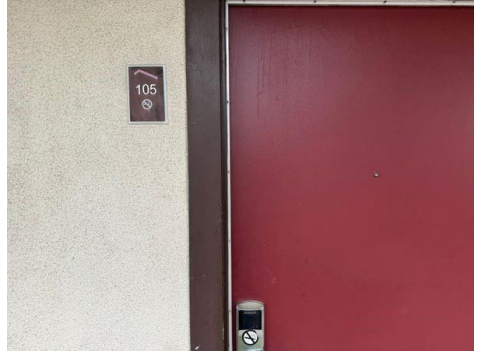


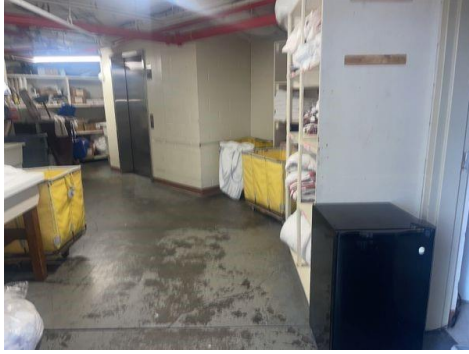


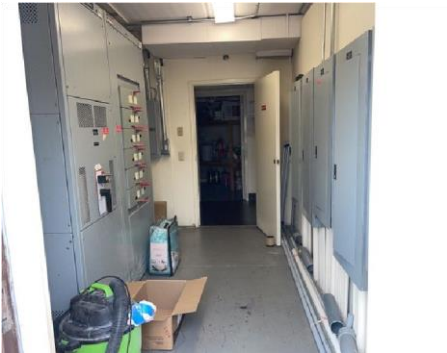
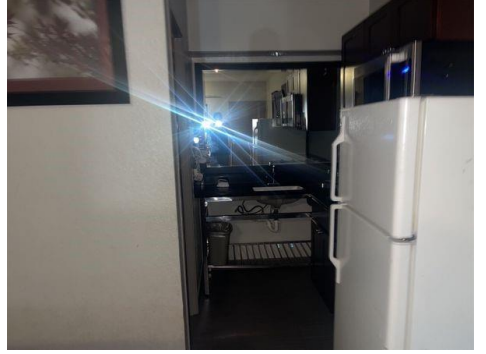
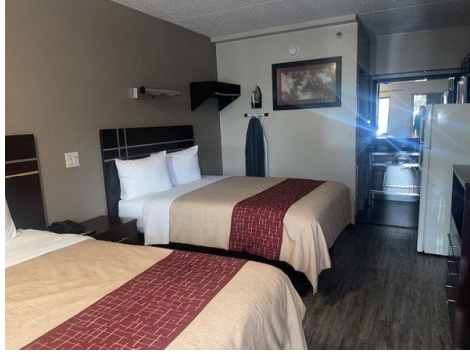
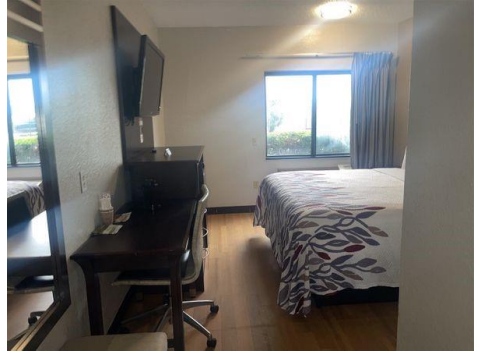


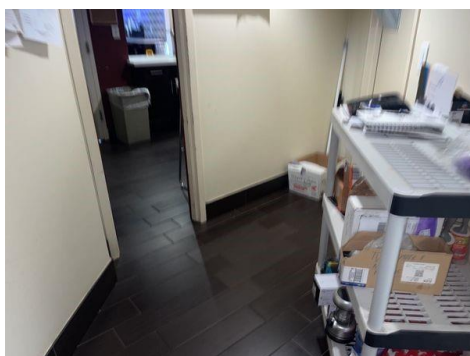
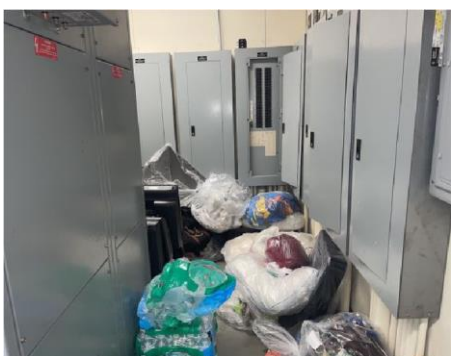
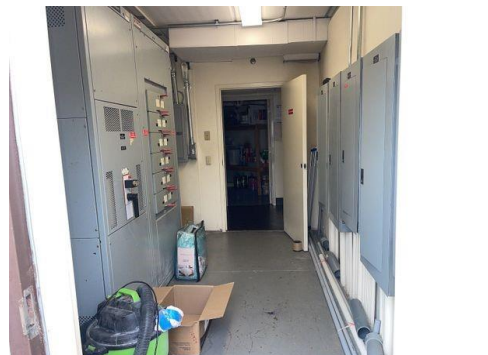
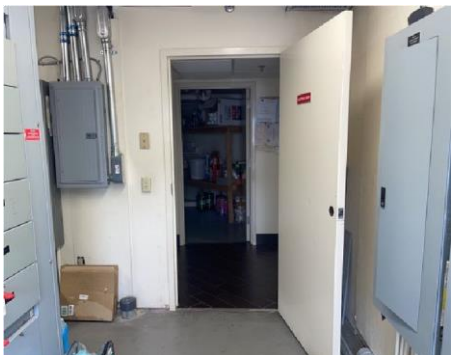
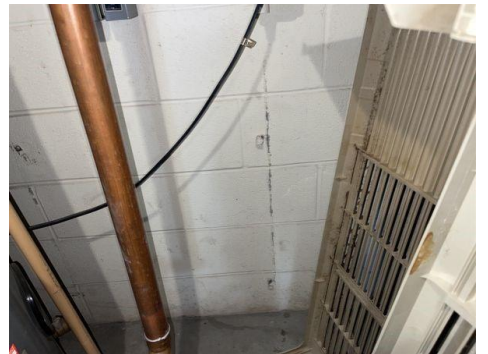
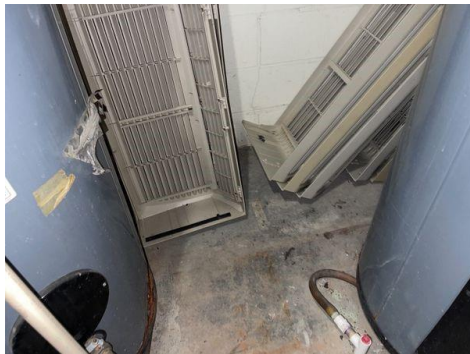


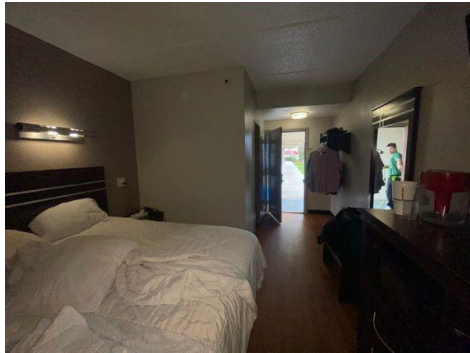
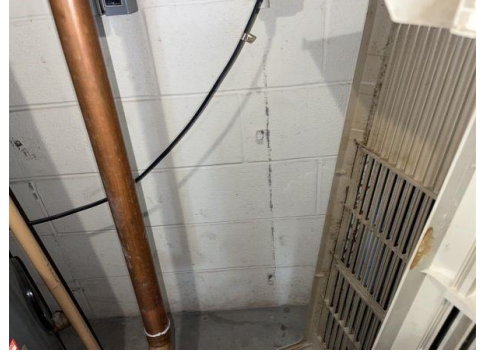


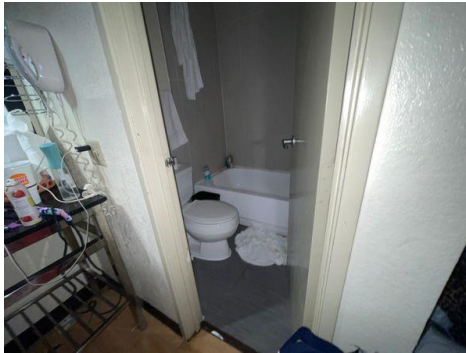
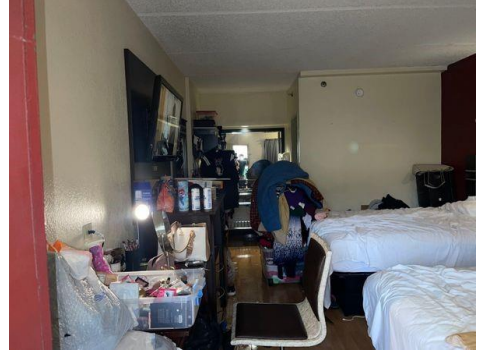
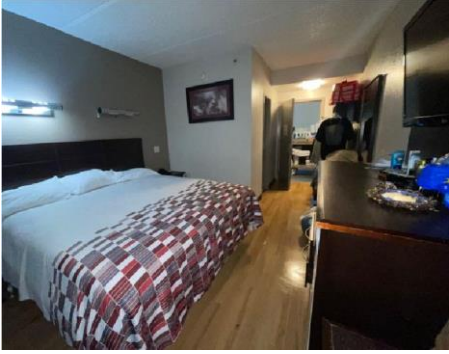
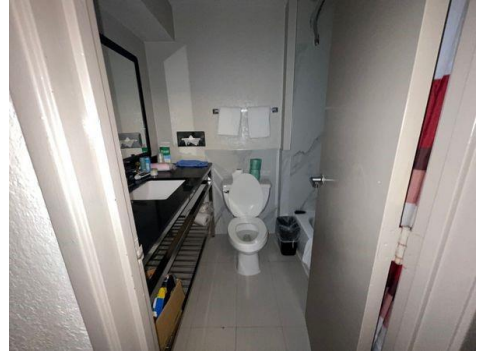


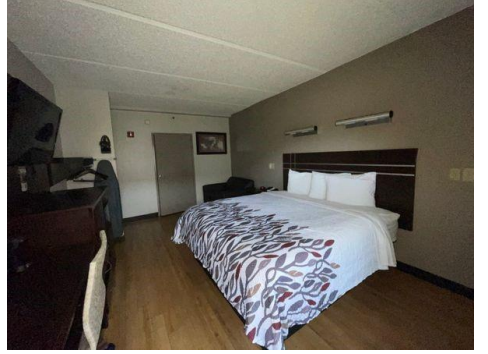
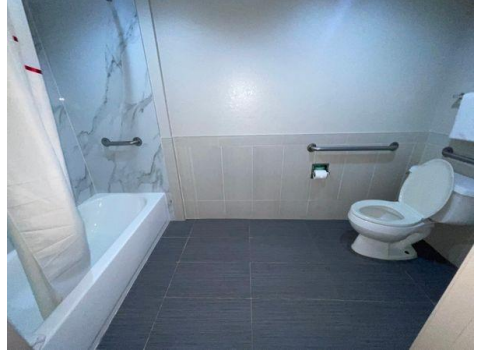
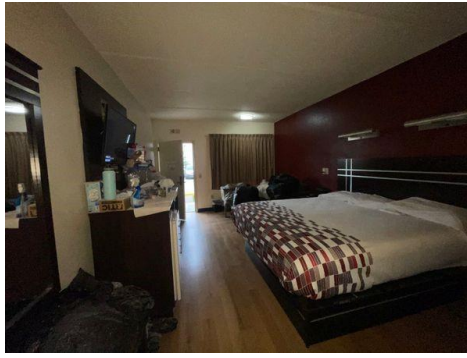


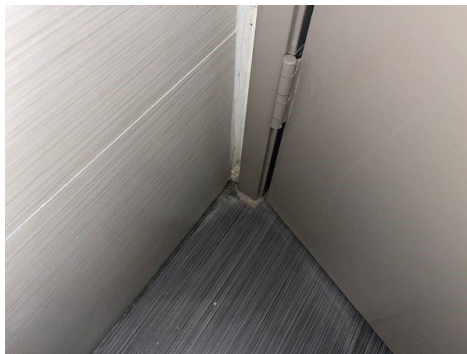
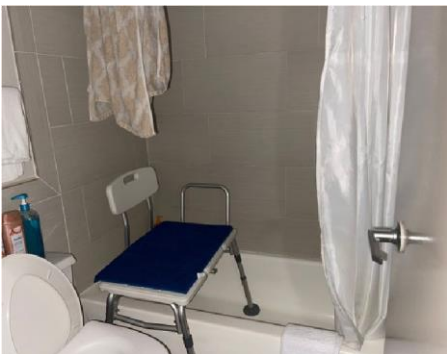
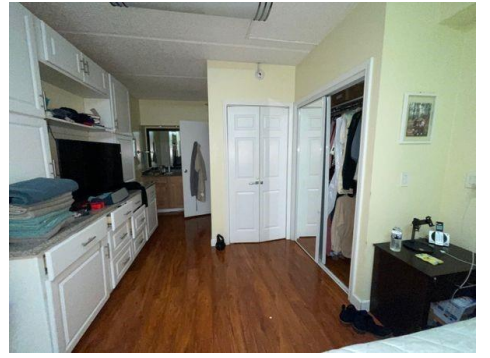
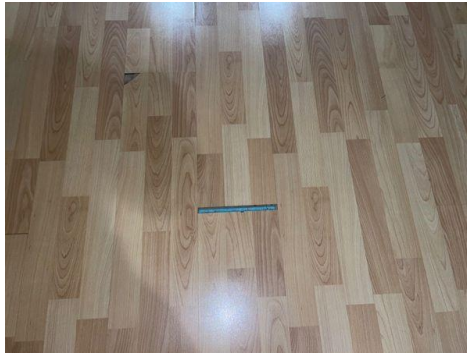


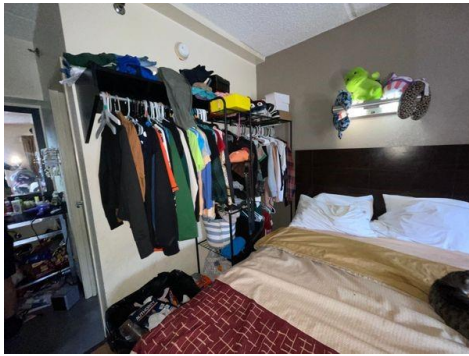
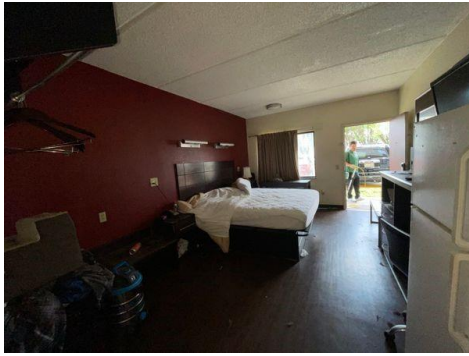
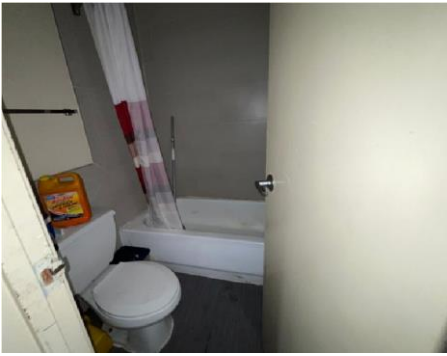
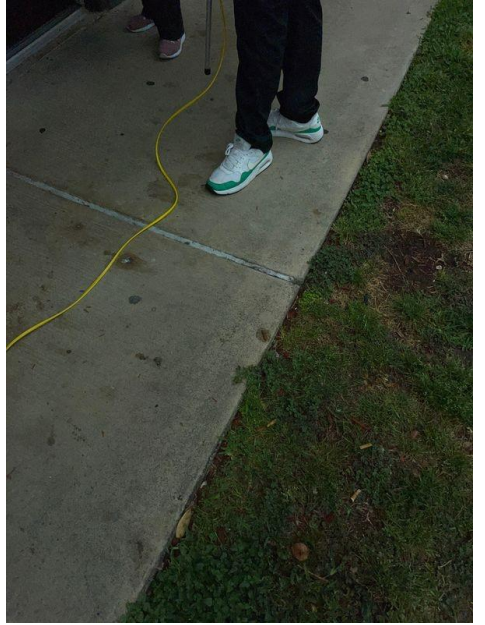
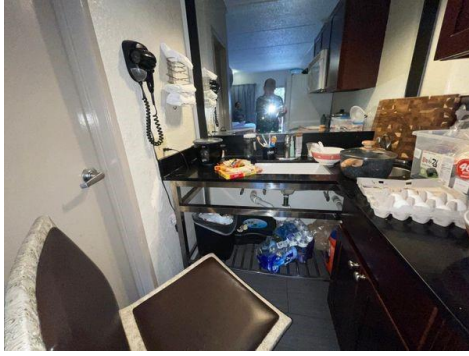


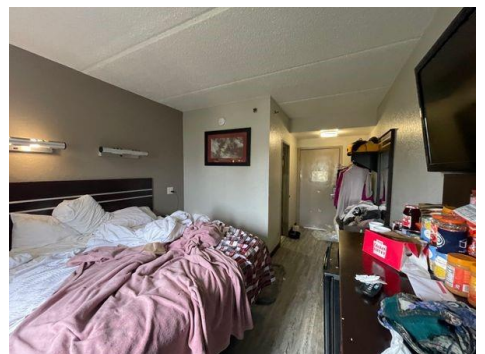
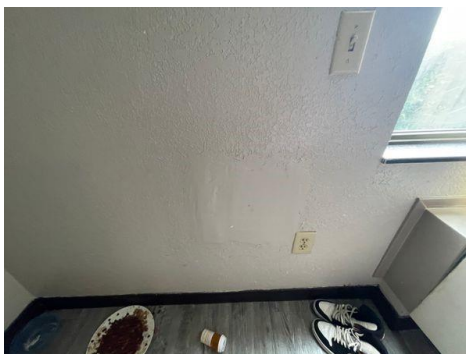
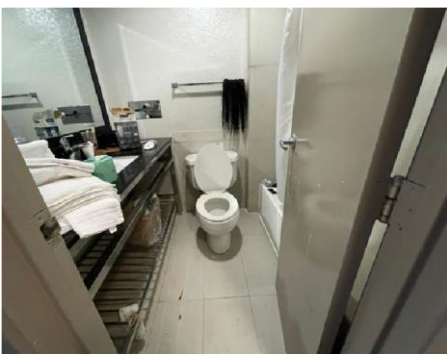
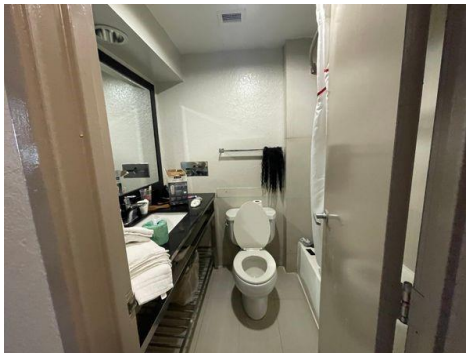
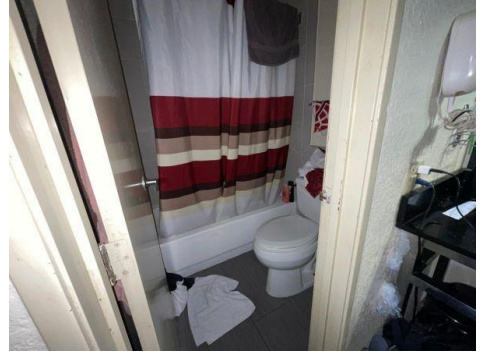




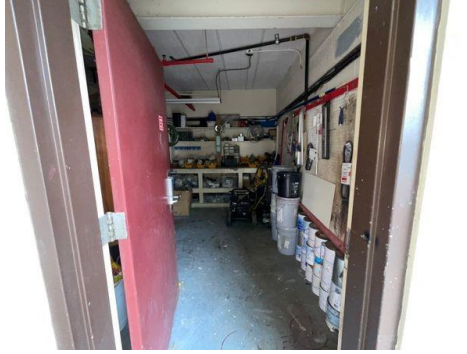
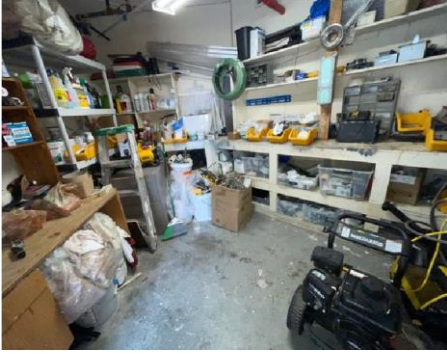
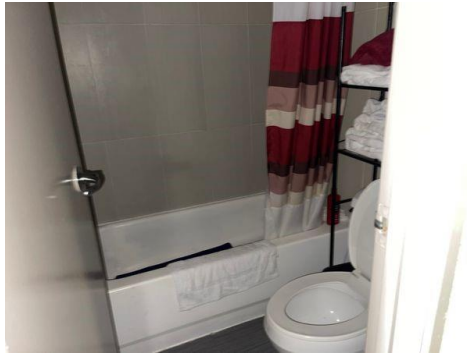
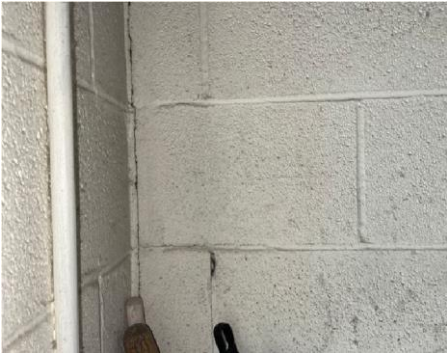


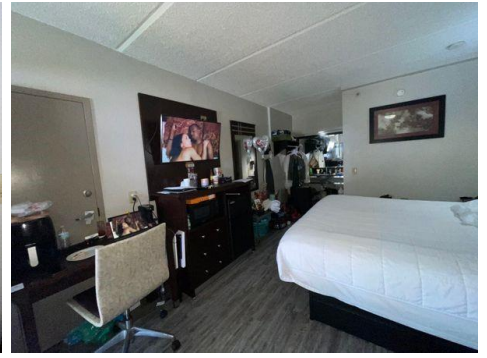
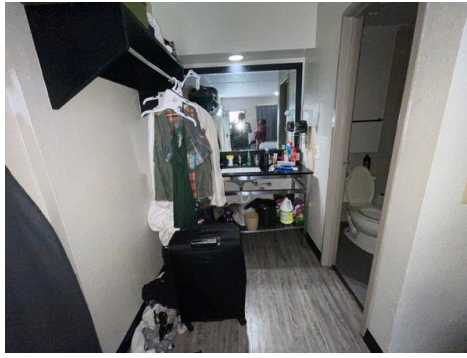
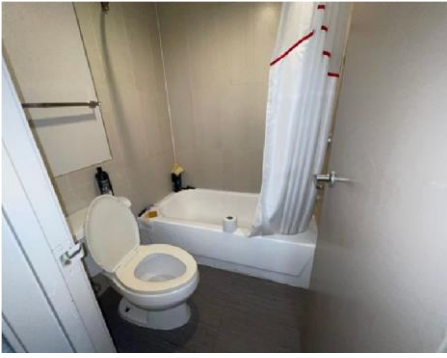












Interior Distress: Repaired Cracks



128



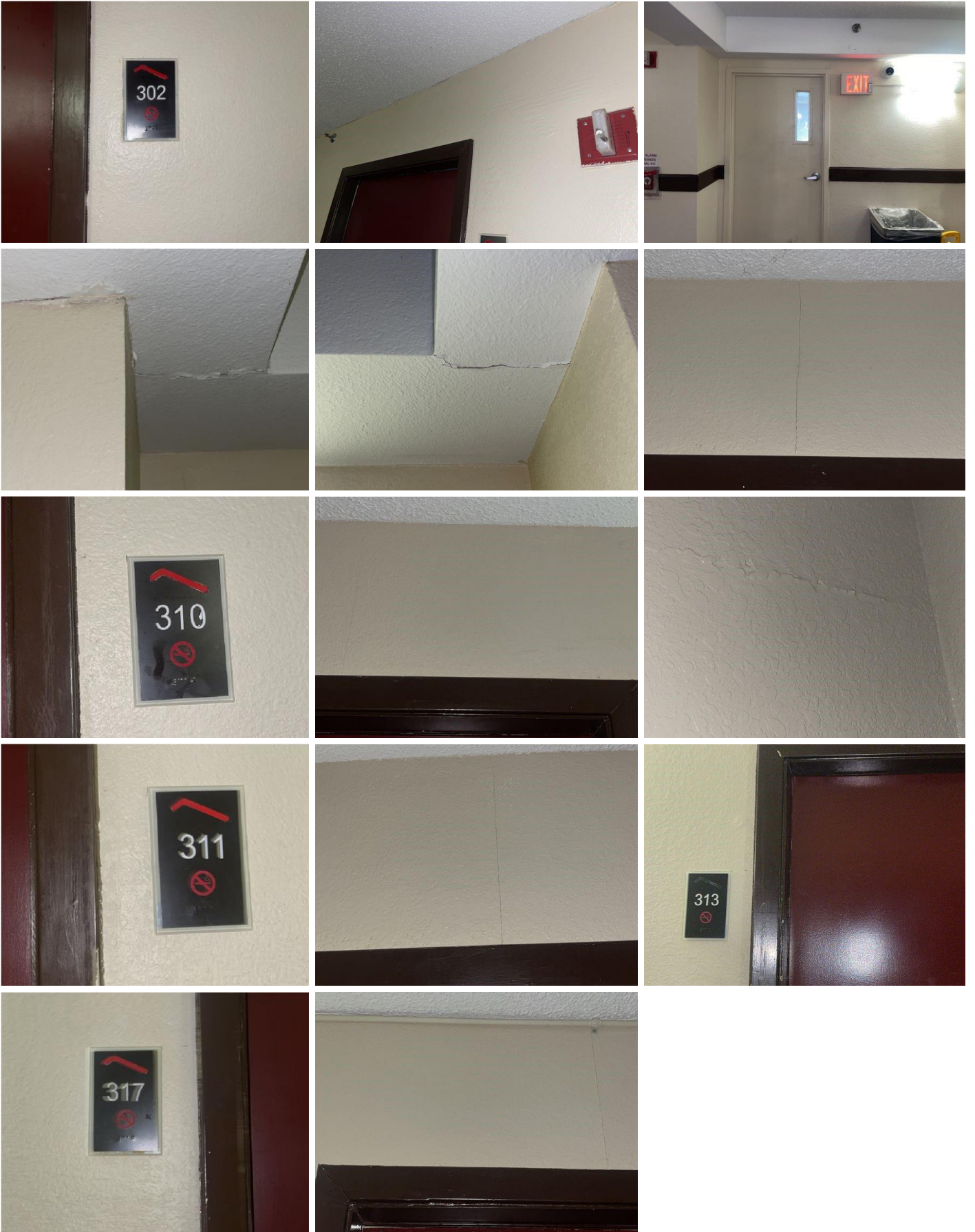
104

Interior Distress: Wall Tile
Cracking



128

Drywall Distress: Wall Cracks Present



Drywall Distress: Ceiling Cracks Present

304



302



Floor Distress: Cracking at Top Surface of Slab

We recommend injecting slab cracks of about 1/16" and larger in width with epoxy repair cement to restore strength across the crack.



302



Laundry Room



Laundry Room



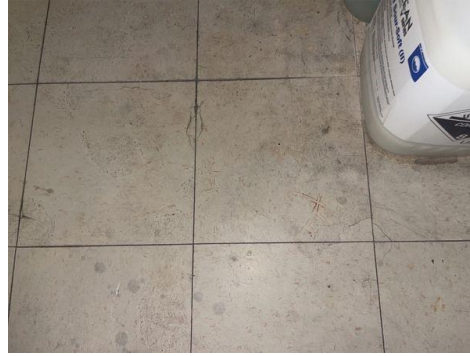
Laundry Room

Floor Distress: Flooring Cracking

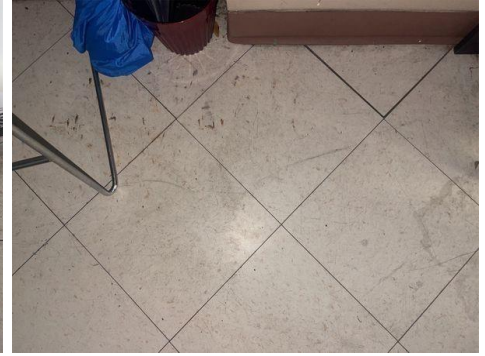
Isolation membranes that meet ANSI A118.12 may be installed under flooring to help resist cracking associated with foundation movement. We recommend contacting a flooring professional to determine which isolation membrane solution is best suited if desired.



128



Laundry Room



Laundry Room

4: FOUNDATION OBSERVATIONS

Information

Foundation Investigation Conclusions: Habitable and Safe for Occupancy

Based solely on our observation of the foundation, it is our opinion that the structure is habitable and safe for occupancy at this time.

Foundation Investigation Conclusions: Typical Distress

The interior and exterior of the structure showed typical signs of distress for a structure that has incurred differential foundation movement.

It should be noted that, while foundation movement can cause interior and exterior cosmetic distress, it is not the only reason that cracks and separations may appear in a structure. Cracking may weaken materials, although the majority of cracks do not compromise structural integrity. The normal and expected thermal expansion and contraction of dissimilar building materials (such as veneer, trim materials, windows, wood framing, and interior drywall on a typical exterior wall) can cause cracks and separations that are not an indication of structural failure. In addition, some building materials, such as sealants, deteriorate over time and require regular maintenance.

Foundation Investigation Conclusions: Foundation Movement Calculations

The below foundation movement calculations have been performed according # FPA-SC-13-1 'Guidelines for the Evaluation of Foundation Movement for Residential and Other Low-Rise Buildings.' The calculations separate foundation movement into foundation 'Deflection' (bending) and foundation 'Tilting' - straight line arithmetic of the elevation readings provided on the Elevation Survey will not yield the same results and should not be incorrectly compared.

The standard allowable differential deflection is based on 1.0 inch of vertical movement, up or down, over a horizontal distance of 30 feet; expressed as Length (in inches)/ 360. The standard allowable tilt is based on 1% slope over the entire length, width, or diagonal of the foundation.

Foundation Recommendations: Slab Foundation - Underpinning Repairs Required

1. To stabilize and lift the foundation, install 7 perimeter and 18 interior piles/piers as shown on Figures 1 through 5. The underpinning may be concrete cylinders, steel pipe, helical screws, or drilled concrete piers – refer to Figures 6 through 9. Underpinning will not improve the performance of the foundation in non-underpinned areas. Note, any foundation movement, even corrective, can cause additional cosmetic distress. The contractor shall determine the amount of elevation correction needed based on the reaction of the structure during the adjustment in order to minimize stress and additional cosmetic damages.
2. Obtain a leak detection test by a licensed plumber after the foundation has been repaired to verify the condition of the plumbing. If any discrepancies are determined they should be repaired immediately to preserve the foundation repair. Trenchless plumbing repair is preferred when feasible as it is minimally invasive to the foundation slab.
3. Comprehensively implement the foundation maintenance recommendations.
4. Following completion of the foundation underpinning installation, obtain a final elevation survey to provide a post-repair elevation baseline. Review the performance of the foundation every 6 to 12 months. Compare all future foundation evaluations to the pre-repair and post-repair elevation baselines.
5. Upon successful completion of the foundation repair, the interior and exterior cosmetic distress can be repaired.

If old conditions are discovered to differ, engineer to be contacted prior to repair implementation. Following underpinning installation, we recommend contacting our office to schedule a Foundation Repair Verification. The purpose of the Foundation Repair Verification is to produce a final elevation survey and post-repair baseline and to ensure that the repairs have been performed in general accordance with our recommendations and in line with the Texas Section of the American Society of Civil Engineers (ASCE) guidelines. The Foundation Repair Verification includes a sealed report that can be used for future proof of successful repair of the foundation.

Foundation Recommendations: Foundation Maintenance Recommendations

Good foundation maintenance practices are the most effective solution to minimizing soil activity. The primary goal of foundation maintenance methods is to maintain a relatively constant moisture content in the soil around and below the foundation. The movement and drainage of water is a critical maintenance element that interacts with the shrink/swell properties of the expansive soil that the structure is supported upon. The goal of proper drainage is to remove excess water from around the foundation to keep the soil around and under the foundation at a stable moisture content.

1. Gutters and downspouts are an effective method of directing rainwater away from the structure, but must be employed correctly. To better control the rainwater, ensure gutters, downspouts and extensions are present at each down-sloped area of the roof. Gutters should have a slope no less than 6 inches in 10 feet (5% slope) and all seams shall be made weather tight if applicable and shall be equipped with screens to allow leaves and other debris to be washed off the roof. Downspouts should be installed at a minimum every 40 feet. The downspouts should discharge the water a minimum of 6 feet from the foundation or into a drainage system.
2. To assist in the drainage of free water, the grade surrounding the foundation should be sloped away from the foundation for the first 10 feet around the perimeter where practicable. The slope should drop a minimum of 6 inches in 10 feet (5% slope). Swales should have longitudinal slopes of a minimum of 2 inches in 10 feet. If this cannot be done a French Drain may be required. Over-saturated soils can cause foundation heave and/or settlement and contribute to excessive foundation movement. Remediate ponding water immediately. If widespread drainage issues are present, our office may be contacted to perform a Drainage Inspection of the lot and provide Drainage Remediation plans if necessary.
3. Consider removing any trees or large bushes within 6 feet of the foundation. The large vegetation can consume vast amounts of water which can cause active soils to shrink, potentially causing damaging foundation movement. Tree roots can also extend below the foundation and cause damage. Tree roots can typically extend as far as the extent of the tree's canopy. If trees are not to be removed, a root barrier may be used between the tree and the foundation - root barrier installation may negatively affect the vegetation and it is recommended to contact an experienced arborist for recommendations to minimize these effects. Removal of trees or large bushes may stop shrinkage or lead to partial restoration of settled areas of the foundation. Removal may result in upheaval caused by soil moisture increase, especially if the tree predates construction. If trees are removed, a suitable waiting period may be recommended to allow for soil heave. Periodic tree pruning may reduce future downward foundation movement but may not lead to foundation elevation recovery. Tree pruning or additional watering may be a prudent alternative to removal.
4. Establish a watering program for the foundation soil to keep the soil moisture content constant during the dry months. Keeping the lawn healthy will help to reduce evaporation and dryness. Water the lawn and other vegetation consistently and evenly. Soil cracking/desiccation at the surface is a sign that the soil is too dry.

Subgrade Chemical Stabilization

If the above conventional methods for minimizing soil activity prove to be less effective than desired, while costly, a final option of subgrade chemical stabilization may be explored. If this option is pursued we recommend contacting a geotechnical engineer and an experienced repair professional to facilitate the project. The injection should be shaped to the approximate profile of the subgrade prior to spreading the chemical so as to permit the construction of a uniformly compacted course of chemically treated soil. The addition of the chemical may raise the subgrade profile within approximately 1 inch - remove this excess material during the final grading. Spread the chemical uniformly on the subgrade using a mechanical spreader at the approved rate and at a constant rate of speed. Subgrade chemical stabilization work is not to be performed when the air temperature is less than 40 degrees Fahrenheit, when the soil is frozen, or during wet or unsuitable weather.

Structural concerns

4.1.1 Foundation Investigation Conclusions

FOUNDATION DEFLECTION EXCEEDS LIMITS

Based on our observations of the interior and exterior cosmetic distress, the door elevations, and calculations, it is our opinion that the foundation has undergone an excessive amount of movement. The maximum differential deflection is 1.2 inches and occurred over an approximate distance of 25.0 feet. This amount of deflection exceeds the standard allowable deflection of 0.8 inches for a distance of 25.0 feet.

4.1.2 Foundation Investigation Conclusions

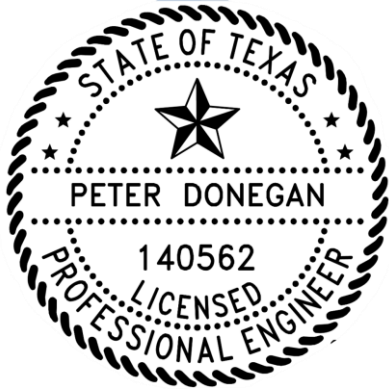
CONCLUSIONS - REMEDIATION REQUIRED

It is our opinion that remedial measures are required to bring the foundation to a more level condition. Furthermore, comprehensive implementation of the below foundation maintenance recommendations will help to moderate soil activity and minimize differential foundation movement and its resultant distress.

5: PROFESSIONAL ENGINEER STAMP

Information

Professional Engineer Stamp: Reviewed by Peter Donegan, P.E.



GreenWorks Service Company
Professional Engineer

Texas Registered Engineering Firm 20170

Reviews enable us to continue providing the best experience possible for you and they also help homeowners like you to make confident decisions about their engineering needs. [Click here to leave a review.](#)

Report Prepared By: Prepared by Brandon
Canterbury, E.I.T.

Limitations

Limitations

GENERAL





The opinions and recommendations contained in this report are based on the visual observation of the then current conditions of the structure and the knowledge and experience of the engineer. The evaluation was limited to visual observations and areas not visible, accessible, or hidden behind furniture and appliances were not included in the evaluation. The evaluation did not include any soil sampling or testing.

The evaluation did not include any assessment of the existing foundation, plumbing, or soil and no implication is made on the compliance or non-compliance of the house with old or current building codes. No verification was made of the existing concrete strength, thickness, reinforcement nor capacity to support any load.

No guarantee or warranty as to the future performance or need for repair of the structure is intended or implied. Limits of liability for any claims with respect to this report is limited to the fees paid for services and anyone relying on the content of this report agrees to indemnify GreenWorks Service Company for all costs exceeding this fee.

	+0.3"	+0.4"	0.0"
136	+0.4"	+0.6"	-0.1"
	+0.5"	+0.6"	+0.2"
	+0.7"	+0.7"	+0.5"
138	+0.7"	+0.7"	+0.2"
	+0.6"	+0.4"	+0.3"
	+0.8"	+0.5"	+0.2"
137	+0.8"	+0.9"	+0.3"
	+0.8"	+0.9"	+0.5"
	+0.8"	+0.5"	+0.2"
135	+0.8"	+0.3"	+0.1"
	+0.5"	+0.5"	+0.1"

FIGURE 1
NOT TO SCALE

LEGEND	
	Bench Mark Elevation, 0.0"
	0.0" Top of Floor Elevation
	Push Pile or Drilled Pier
	Interior Slab Pier

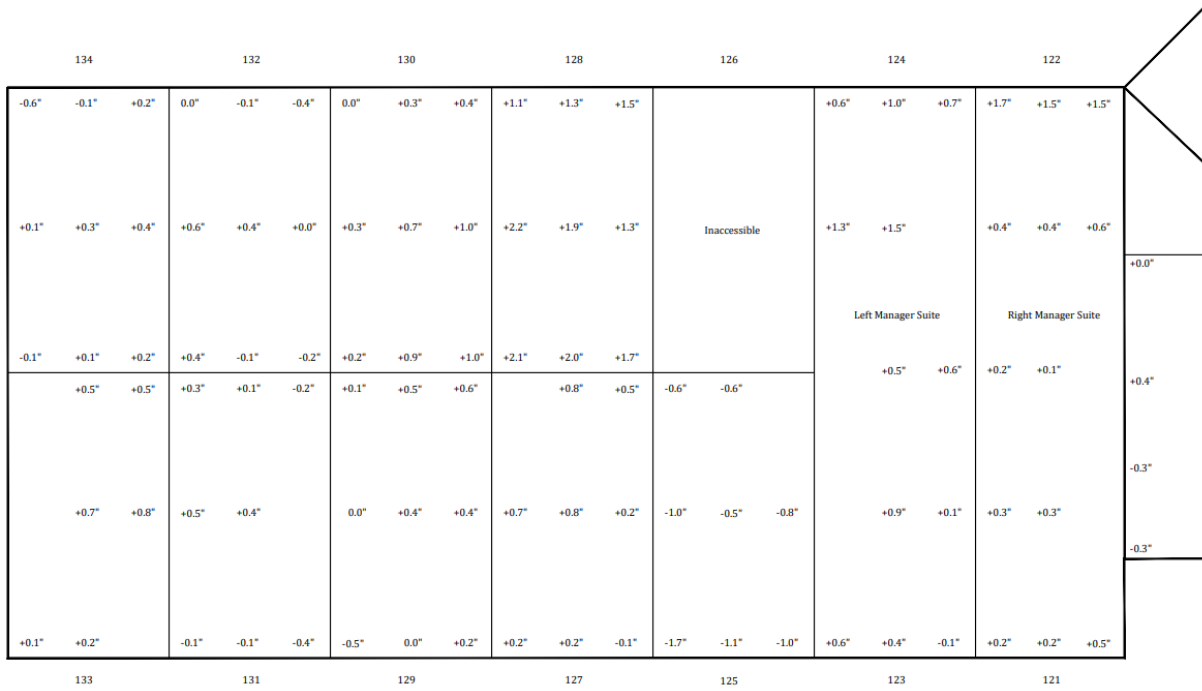


FIGURE 2
NOT TO SCALE

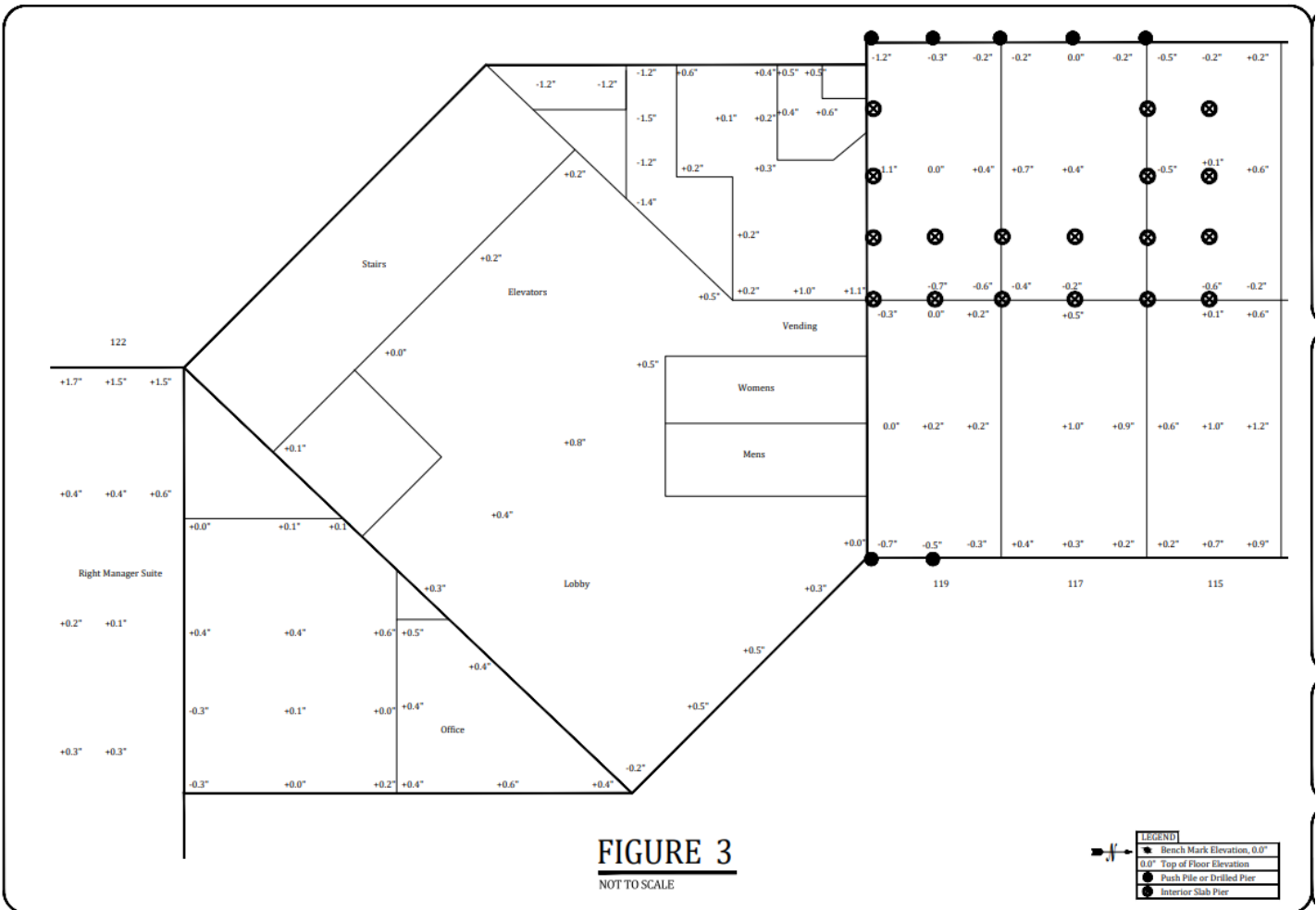


FIGURE 3
NOT TO SCALE

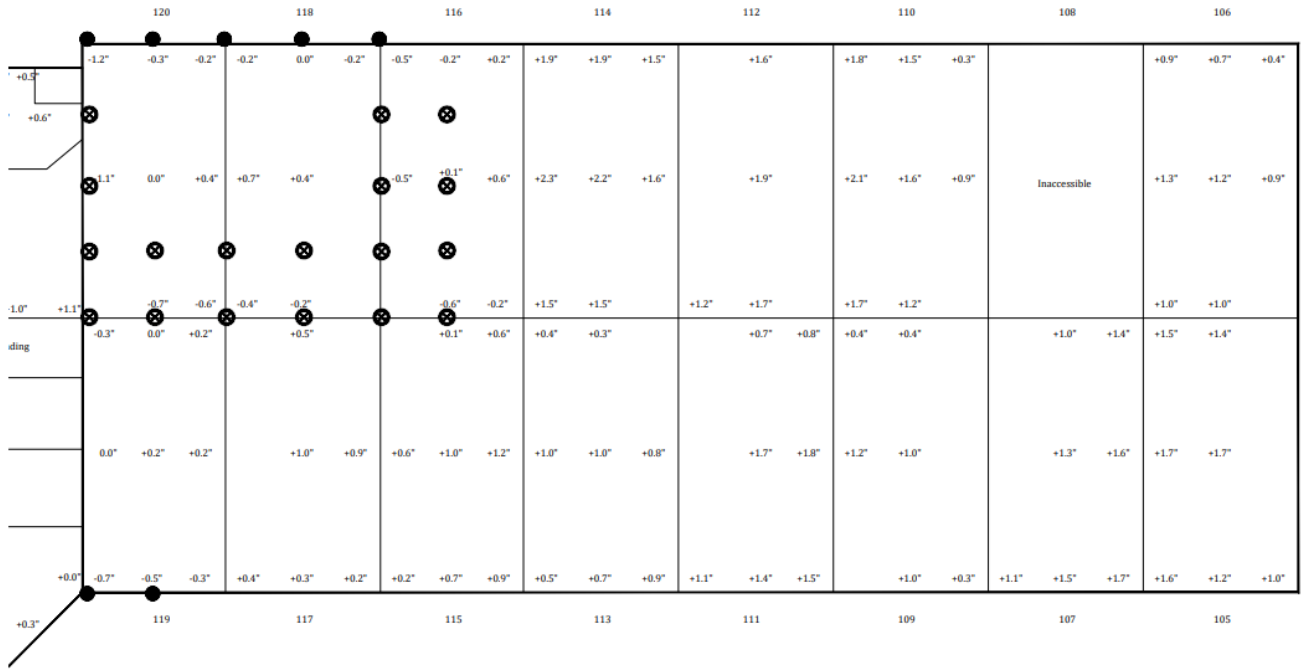


FIGURE 4
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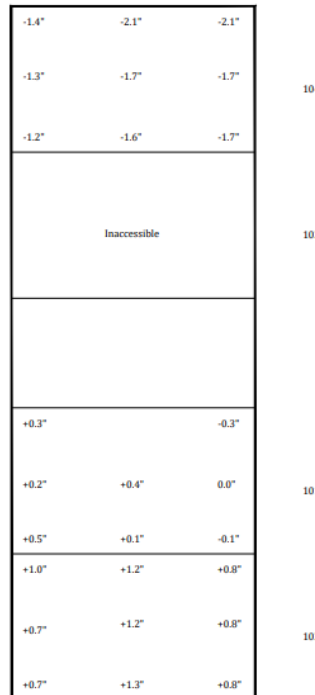
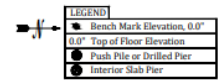


FIGURE 5
NOT TO SCALE



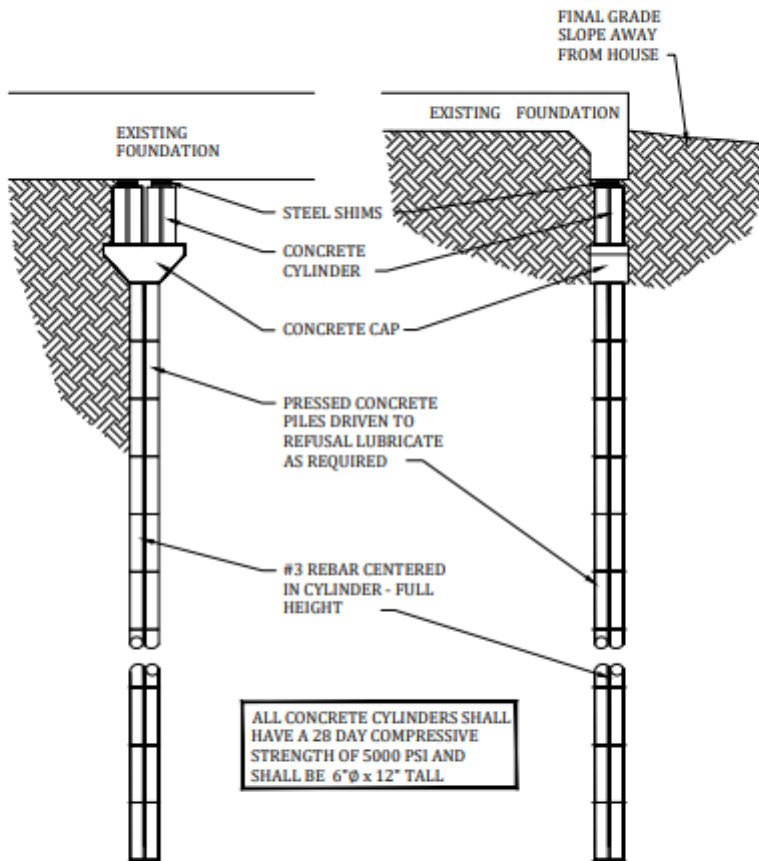


FIGURE 6

NOT TO SCALE

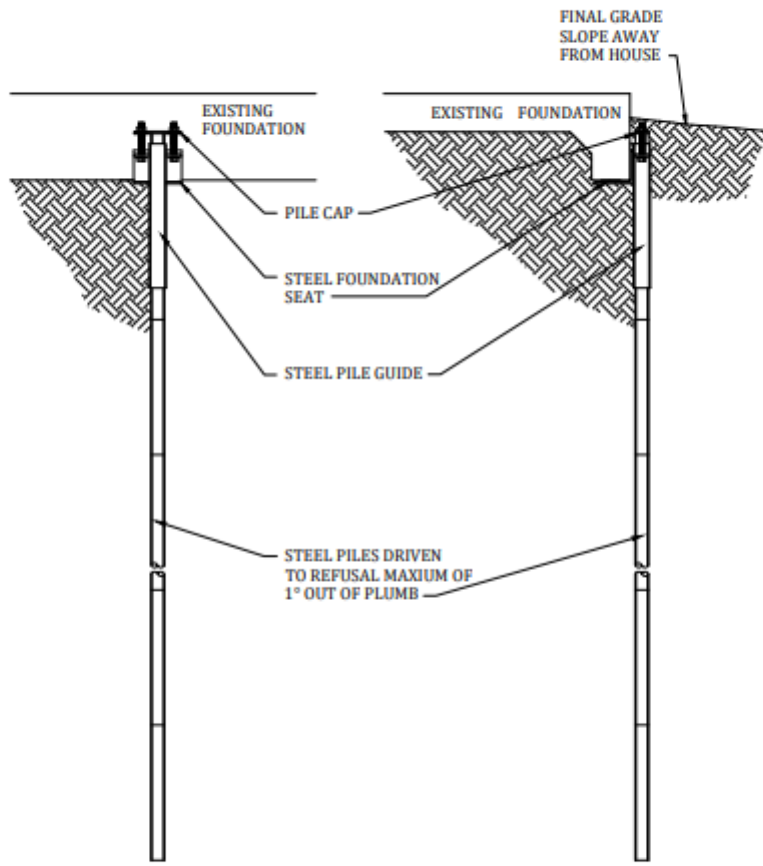


FIGURE 7

NOT TO SCALE

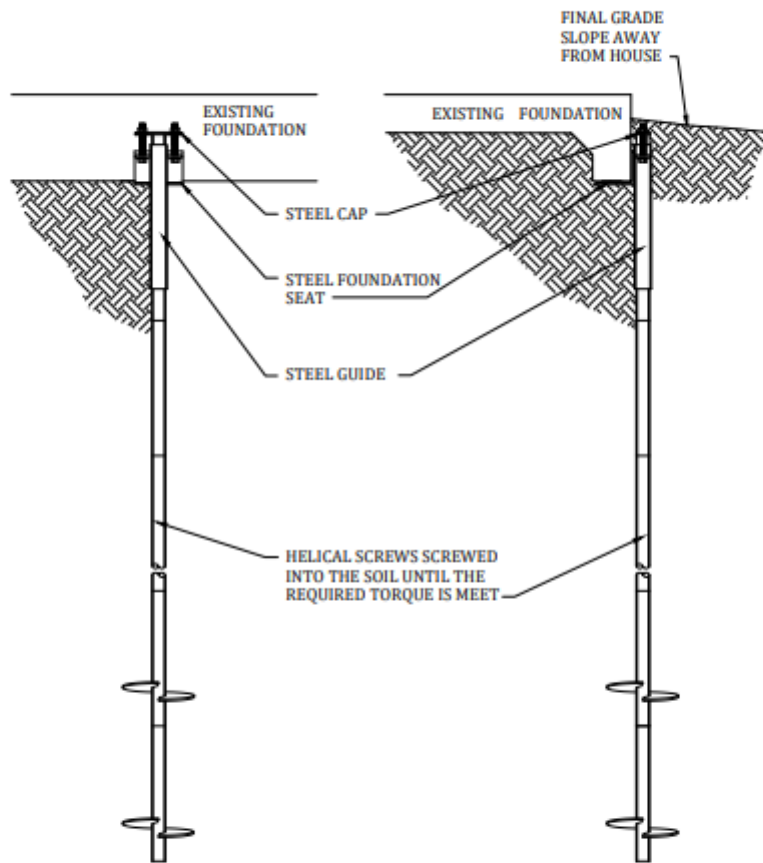
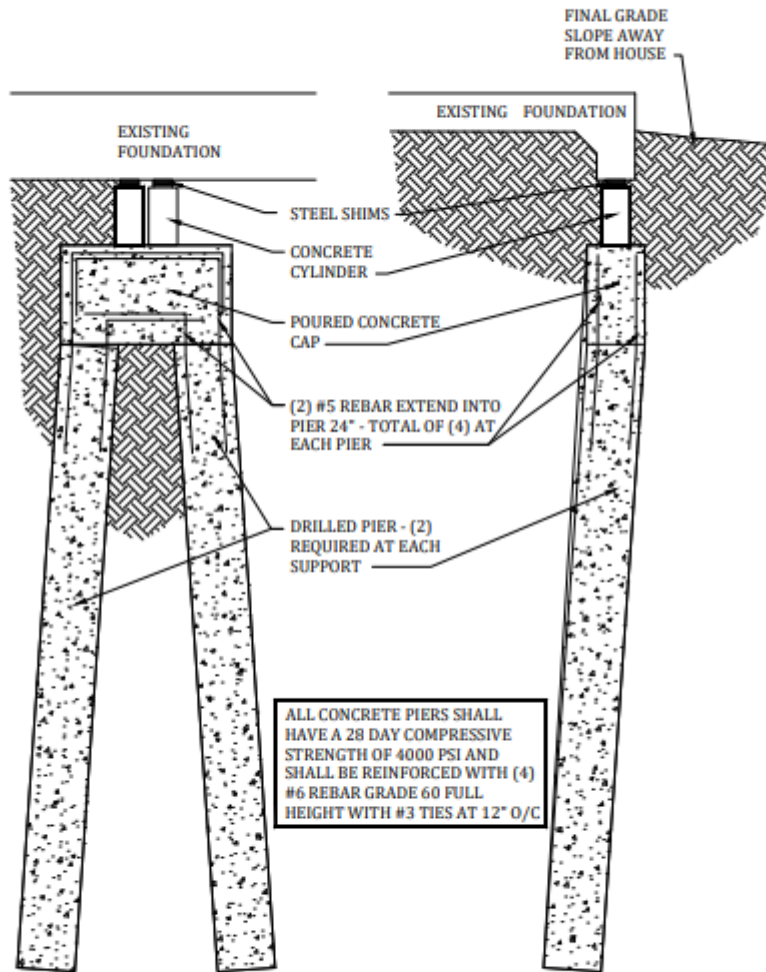


FIGURE 8

NOT TO SCALE

ALL CONCRETE CYLINDERS SHALL
HAVE A 28 DAY COMPRESSIVE
STRENGTH OF 5000 PSI AND
SHALL BE 6"Ø x 12" TALL



ALL CONCRETE PIERS SHALL
HAVE A 28 DAY COMPRESSIVE
STRENGTH OF 4000 PSI AND
SHALL BE REINFORCED WITH (4)
#6 REBAR GRADE 60 FULL
HEIGHT WITH #3 TIES AT 12" O/C

FIGURE 9

NTS