# Paul Ferreras, PE
## Structural Engineer

March 19, 2013

Director Smith
Department of Planning and Natural Resources
CEK Airport
St. Thomas, USVI 00802

Subject: American Yacht Harbor
        Emergency Repairs to Columns
        Red Hook, St. Thomas, USVI

Director Smith:

I had been notified of a structural problem at the subject premises yesterday. I did make a site visit and observed two columns that had been structurally distressed.

I was informed that on Sunday (the previous day) that occupants had been on the upper level and felt a drop in the structure. The upper level was at that point cleared of the occupants and it has not been occupied since that time.

I observed at the main level (above the parking garage) that on the rear of the building that 4 inch diameter steel columns support the upper level. Two of these columns have a problem at the base. It appears that water has caused a corrosion issue at the base of the column and reduced the column section to a point that the base has failed and collapsed about 2 inches in height (see attached photo).

I have conducted a load analysis on the two columns in question and determined that each of the columns have about 331 square feet of tributary support area from the floor above. The column has about 9 feet of un-braced height. My evaluation is that these columns each support about 29,800 pounds of dead load and 33,100 pounds of live load. My evaluation is based on assumed concrete thickness, floor finishes, approximate steel framing and a live load of 100 pounds per square foot. This evaluation uses assumptions that have not been verified but are to be expected for construction of this type.

The repair procedure (without considering finishes) is as follows and shown on the attached detail:

1) Support the column on each side.
2) Jack the structure back to level (about 2 inches)
3) Cut out the damaged column section from a few inches below the top girder to the base plate on the lower support.
4) Bevel cut the existing column section to remain and weld a new top plate to the existing section.
5)Inspect the lower base plate and either replace or reuse the base plate.
6) Install the new 4 inch diameter, X-Strong steel pipe column by bevel welding the pipe to the top plate and base plate.

We are requesting that DPNR provide an emergency repair permit for this work. I have asked that the welder start by obtaining all the necessary materials and fully supporting the column in place.

I will ask that the owner come to DPNR to pay whatever permit is necessary for this emergency repair permit.

If you have any questions with this submission please contact me.

Sincerely,
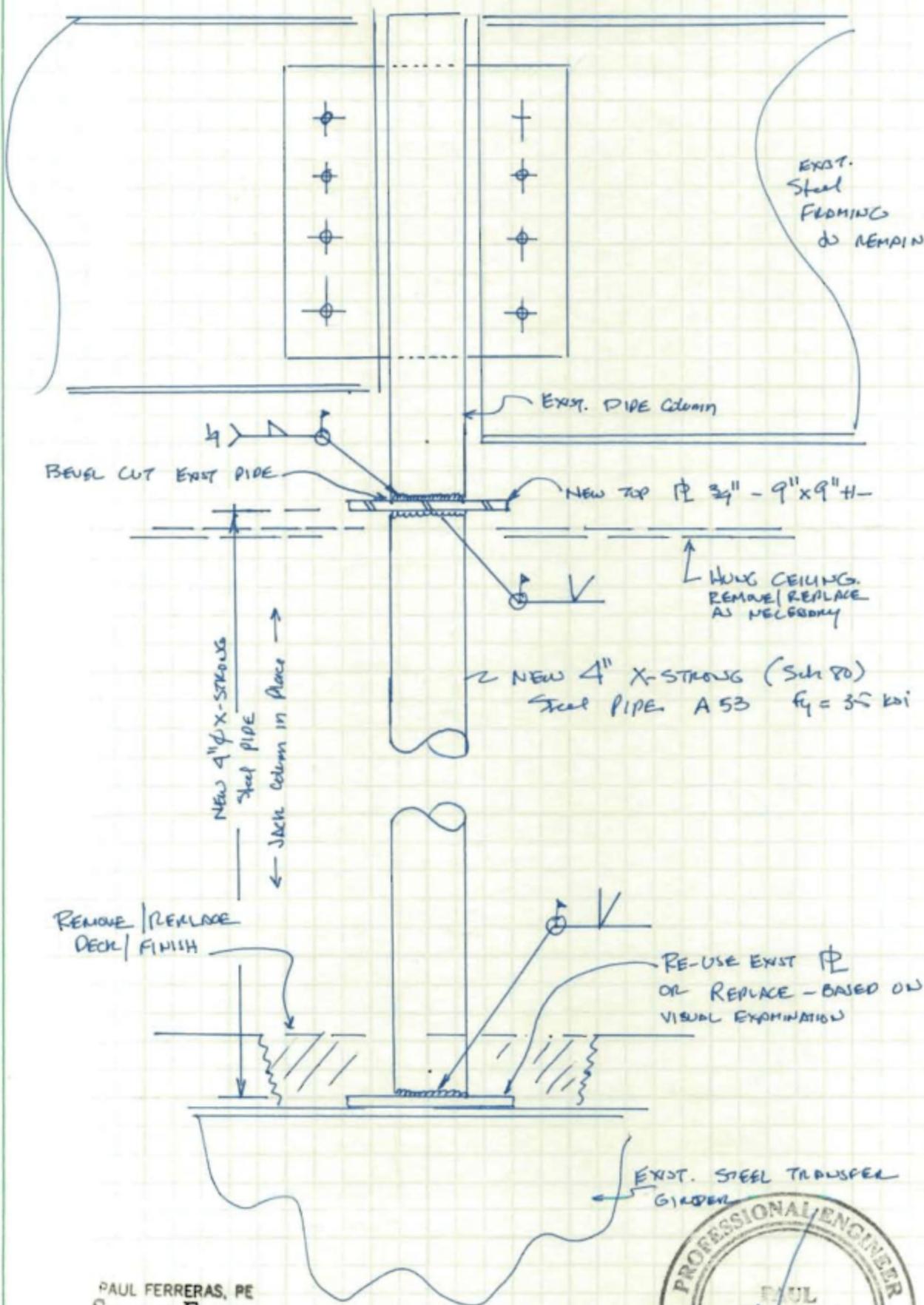
Paul Ferreras, PE

Attachments:

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## Disclaimer:

It should be noted that the above report is based on a visual observation and that there is no claim, either stated or implied, that all conditions were observed.

The opinions and comments in this report are based on visual observation only. Architectural, mechanical, electrical or plumbing conditions are not included and no warranty expressed or implied as to the condition of the structure is intended.
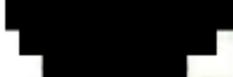
The engineer shall not be responsible for the means, methods, procedures, techniques or sequences of construction, nor the safety on the job site, nor shall the engineer be responsible for the Contractors failure to carry out the work in accordance with the contract documents.

Photo of Column Base - note corrosion at base and crushed base section.

EXIST.
Steel
FRAMING
du REMAIN

EXIST. PIPE COLUMN

BEVEL CUT EXIST PIPE

NEW TOP ℔ ¾" - 9"x9" H—

HUNG CEILING.
REMOVE/REPLACE
AS NECESSARY

← NEW 4" X-STRONG (Sch 80)
Steel PIPE A 53   $F_y = 35$ ksi

NEW 4" ⌀ X-STRONG
Steel PIPE
← Jack Column in Place →

REMOVE/REPLACE
DECK/FINISH

RE-USE EXIST ℔
OR REPLACE - BASED ON
VISUAL EXAMINATION

EXIST. STEEL TRANSFER
GIRDER

PAUL FERRERAS, PE
Structural Engineer

PROFESSIONAL ENGINEER
PAUL
FERRERAS
PE
U.S. VIRGIN ISLANDS

TOPS.
35502

EFTA00619841

Paul Ferreras, PE
Structural Engineer

# Steel Column

Lic. # : KW-06009109

Licensee : Paul Ferreras, PE

Description :    Column Replacement

## Code References

Calculations per AISC 360-05, IBC 2006, CBC 2007, ASCE 7-05

Load Combinations Used : ASCE 7-05

## General Information

| | | | |
|---|---|---|---|
| Steel Section Name : | **Pipe4 x-Strong** | Overall Column Height | 9.0 ft |
| Analysis Method : | Allowable Strength | Top & Bottom Fixity | **Top & Bottom Pinned** |
| Steel Stress Grade | | Brace condition for deflection (buckling) along columns : | |
| Fy : Steel Yield | 35.0 ksi | X-X (width) axis : | |
| E : Elastic Bending Modulus | 29,000.0 ksi | Unbraced Length for X-X Axis buckling = 9 ft, K = 1.0 | |
| Load Combination : | **ASCE 7-05** | Y-Y (depth) axis : | |
| | | Unbraced Length for Y-Y Axis buckling = 9 ft, K = 1.0 | |

## Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 126.684 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 9.0 ft, D = 29.80, L = 33.10 k

## DESIGN SUMMARY

### Bending & Shear Check Results

**PASS**  Max. Axial+Bending Stress Ratio =  **0.9540** : 1

| | | | Maximum SERVICE Load Reactions . . | |
|---|---|---|---|---|
| Load Combination | +D+L+H | | Top along X-X | 0.0 k |
| Location of max.above base | 0.0 ft | | Bottom along X-X | 0.0 k |
| At maximum location values are . . . | | | Top along Y-Y | 0.0 k |
| Pa : Axial | 63.027 k | | Bottom along Y-Y | 0.0 k |
| Pn / Omega : Allowable | 66.067 k | | | |
| Ma-x : Applied | 0.0 k-ft | | **Maximum SERVICE Load Deflections . . .** | |
| Mn-x / Omega : Allowable | 9.658 k-ft | | Along Y-Y    0.0 in  at    0.0 ft  above base | |
| Ma-y : Applied | 0.0 k-ft | | for load combination : | |
| Mn-y / Omega : Allowable | 9.658 k-ft | | Along X-X    0.0 in  at    0.0 ft  above base | |
| | | | for load combination : | |

**PASS**  Maximum Shear Stress Ratio =  **0.0** : 1

| | |
|---|---|
| Load Combination | |
| Location of max.above base | 0.0 ft |
| At maximum location values are . . . | |
| Va : Applied | 0.0 k |
| Vn / Omega : Allowable | 0.0 k |

## Load Combination Results

| Load Combination | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|---|---|---|---|---|---|---|
| | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.453 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+L+H | 0.954 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+Lr+H | 0.453 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+S+H | 0.453 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+0.750Lr+0.750L+H | 0.829 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+0.750L+0.750S+H | 0.829 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+W+H | 0.453 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+0.70E+H | 0.453 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+0.750Lr+0.750L+0.750W+H | 0.829 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+0.750L+0.750S+0.750W+H | 0.829 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+0.750Lr+0.750L+0.5250E+H | 0.829 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+0.750L+0.750S+0.5250E+H | 0.829 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +0.60D+W+H | 0.272 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +0.60D+0.70E+H | 0.272 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |

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Paul Ferreras, PE
Structural Engineer

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# Steel Column

Lic. # : KW-06009109 | Licensee : Paul Ferreras, PE

Description :     Column Replacement

## Maximum Reactions - Unfactored

Note: Only non-zero reactions are listed.

| Load Combination | X-X Axis Reaction @ Base | X-X Axis Reaction @ Top | Y-Y Axis Reaction @ Base | Y-Y Axis Reaction @ Top | Axial Reaction @ Base |
|---|---|---|---|---|---|
| D Only |  | k |  | k | 29.927 k |
| L Only |  | k |  | k | 33.100 k |
| D+L |  | k |  | k | 63.027 k |

## Maximum Deflections for Load Combinations  - Unfactored Loads

| Load Combination | Max. X-X Deflection | Distance | Max. Y-Y Deflection | Distance |
|---|---|---|---|---|
| D Only | 0.0000 in | 0.000 ft | 0.000 in | 0.000 ft |
| L Only | 0.0000 in | 0.000 ft | 0.000 in | 0.000 ft |
| D+L | 0.0000 in | 0.000 ft | 0.000 in | 0.000 ft |
| D Only | 0.0000 in | 0.000 ft | 0.000 in | 0.000 ft |
| L Only | 0.0000 in | 0.000 ft | 0.000 in | 0.000 ft |
| D+L | 0.0000 in | 0.000 ft | 0.000 in | 0.000 ft |

## Steel Section Properties  :          Pipe4 x-Strong

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Depth | = | 4.500 in | I xx | = | 9.12 in^4 | J | = | 18.200 in^4 |
| | | | S xx | = | 4.05 in^3 | | | |
| Diameter | = | 4.500 in | R xx | = | 1.480 in | | | |
| Wall Thick | = | 0.338 in | Zx | = | 5.530 in^3 | | | |
| Area | = | 4.140 in^2 | I yy | = | 9.120 in^4 | | | |
| Weight | = | 14.076 plf | S yy | = | 4.050 in^3 | | | |
| | | | R yy | = | 1.480 in | | | |

Ycg     =     0.000 in



62.90k

Height = 9.0 ft

4.50in

Loads are total entered value. Arrows do not reflect absolute direction.

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