

Investigate Reported Areas of Water Infiltration

For
25 Sigourney Street
Hartford, CT 06106
DPW Project Number B1-2B-033L

Prepared For
STATE OF CONNECTICUT
Department of Public Works

September 21, 2007



Prepared by:

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TABLE OF CONTENTS

• Executive Summary	3
• Project Purpose	4
• Existing Conditions	5
• Observations	6-8
• Leak Location Plans	9-12
• Recommendations	13-15
• Estimates of Probable Cost	16-17

EXECUTIVE SUMMARY

At the request of Connecticut Department of Public Works, Silver Petrucelli & Associates, Architects and Engineers was retained to conduct a water infiltration study at 25 Sigourney Street Hartford, Connecticut. Field work was conducted by Silver Petrucelli & Associates, Architects and Engineers as well as Kelly Enterprises, during June and July, 2007, to evaluate and determine the cause of repeated leaks in the 16th, 17th, 18th and 19th floors of the office building at 25 Sigourney Street. Observations were made by a team from Silver Petrucelli & Associates, Architects and Engineers in late June on the existing condition of areas of reported water infiltration. In many of these locations signs of water infiltration was found and documented. The team returned to the site in early July with several members from Kelly Enterprises to flood test walls and windows in an attempted to pin point areas where water penetration of the building skin was occurring. Leaking was observed at many of the locations in question. All leaks were observed with water infiltrating the interior of the building at the same location just above the window metal cap flashing and below the brick coursing. (See diagram on page 8 for the area of water penetration).

Silver Petrucelli & Associates, Architects and Engineers recommend two solutions to remedy the water infiltration:

- The first step is to add a small bead of sealant on the exterior of the building to close the gap between the bottom of the flashing paper membrane and the top of the steel angle. (See flashing detail on page 14 for area where sealant is to be added) If the leaking persists after this has been completed then more reconstructive measures need to be taken. Also the flashing above the window in the “zipper” (seen on page 5 picture 3) should be removed and replaced.
- The second step would be to replace the flashing above all windows reported leaking and insure proper installation with the interior side of flashing turned upward and then again adding sealant on the exterior of the building between the bottom of the flashing paper membrane and the top of the steel angle. (See flashing detail on page 15 for recommended improvements)

The estimates for building improvements are as follows:

- **Step One:** Apply thin bead of sealant between flashing paper membrane and the top of the steel angle - **\$15,858.92**
Estimated Time Frame: Two days of construction
- **Step Two:** Replace the flashing above all windows reported leaking and insure proper installation with the interior side of flashing turned upward - **\$44,515.90**
Estimated Time Frame: Two weeks of construction

PROJECT PURPOSE

Silver Petrucelli and Associate, Inc. was retained by Connecticut Department of Public Works to conduct an investigation of recurring water infiltration at 25 Sigourney Street, Hartford Connecticut. This report will document the degree and location of several leaks found on the 16th, 17th, 18th, and 19th floors of the facility.

The first phase of this project is to conduct a detailed survey of the existing conditions at the facility and locate all recurring leaks. Once the suspected leaks have been located and examined in their current state they may be flood tested to determine if they are still leaking or if the problem has been resolved by prior corrective work. If the flood testing is conclusive recommendations will be made based upon our observations, posing the most feasible solution to stop water infiltration problems from occurring in the future. The culmination of this phase of work is a report, with estimates, which will enable the Connecticut Department of Public Works to determine the best possible solution in which corrective repairs can be made, after which a design team if required can be hired to complete the following phases of work:

- Design Development Documents with detailed estimates
- Construction Documents with Specifications ready for competitive bidding
- Tracings & Masters Development & Bidding
- Construction Administration Phase: Overseeing the actual corrective work and improvements

EXISTING CONDITIONS

GENERAL

The office building located at 25 Sigourney Street, Hartford Connecticut is just over 20 years old. The building stands 20 stories tall, approximately 200 feet above grade. The structural framing of the building is cast-in-place, reinforced concrete beams and columns. The building's facade is constructed of a masonry cavity wall comprised of standard size cored brick with a 2 - 2 ½ inch air cavity filled with 1 inch rigid insulation board tied to a 6 inch concrete masonry unit interior wall. Recent waterproofing repairs replacing masonry units at both the roof parapets and around window openings was designed in 2002 by Hoffman Architects, Inc., and completed in 2003 by Kelly Enterprises, Inc.

WATER INFILTRATION

Since the completion of the building in the mid 80's till present day, this building has experienced problems involving water infiltration. Many of the major issues were solved after the completion of the masonry repairs by Kelly Enterprises, Inc., in 2003. However, there are several locations that infiltration has continued to occur. There is evidence of recent water infiltration on the 16th, 17th, 18th, and 19th floors. There are reports of these leaks being active over the past few years. These leaks appear to occur during extreme weather conditions and are still causing inconveniences to the workers of the facility. (See floor plans for leak locations)



1. 25 Sigourney Ave. Building Facade



2. Representative Areas of Masonry Repairs Done by Kelly Enterprises (19th floor)



3. Moss Growing on Flashing above Window Sign of Water Pooling and Possible Infiltration (18th floor "zipper")

OBSERVATIONS

FIRST OBSERVATIONS

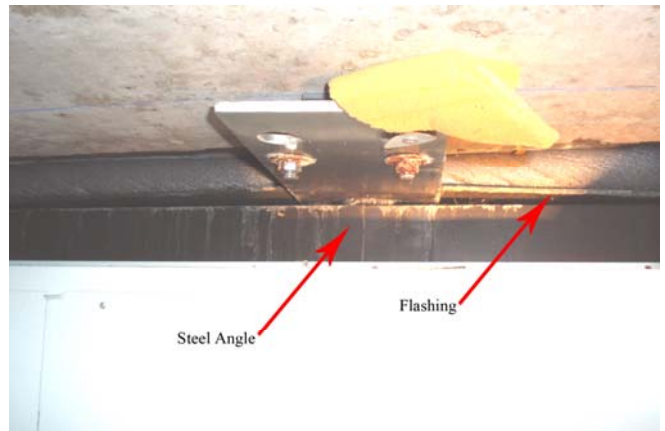
When first visiting the site several areas of the building were reported as having active leaks after the completion of masonry rehabilitation performed by Kelly Enterprises, Inc., in 2003. (These areas can be seen circled in red on floor plans for floors 9-12.) These areas were investigated by our team to determine if any active leaks or damages were visible. There was little proof of any active and recent problems. In several cases we witness examples of water damage, such as water stained ceiling tiles, rusted steel angles, and stained window frames. However, we could not determine that these were caused by recent leaks or by past problems with water infiltration. This first visit however did clue us in to one of the problems that may be linked to the reoccurrence of water infiltration. The flashing detail drawn by Hoffman Architects in 2002 called for the aluminum window head flashing on the inside of the wall cavity to be turned up to stop any water from being able to spill over the interior side of the flashing. This flashing was not turned up and it was cut straight across the back. This may be a deficiency in the installation of the flashing and could be contributing to the problems occurring throughout the facility.

FLOOD TESTING

After conversing with the Chief Building Engineer Nathan Cyr, we learned that the leaks are not frequent and only occur during storms that accompany extremely heavy, wind driven rain. With several heavy rain storms in the Hartford Area in the past few weeks and no reports of any leaks at the facility, flood testing the walls was the next step in the study. A team from Silver Petrucelli and Associates Inc., along with several members of Kelly Enterprises, Inc., water tested the walls of the facility to reenact the storm conditions believed to cause the wall systems to leak, allowing the team to pin point the deficiencies in the building's water proofing.



4. Visible Stains on Ceiling Tile & Fascia
(18th floor)



5. Rusted Steel Angle & Missing Bend in Flashing
(Typical Throughout Building)



6. Flood Testing
(19th Floor Interior Balcony)

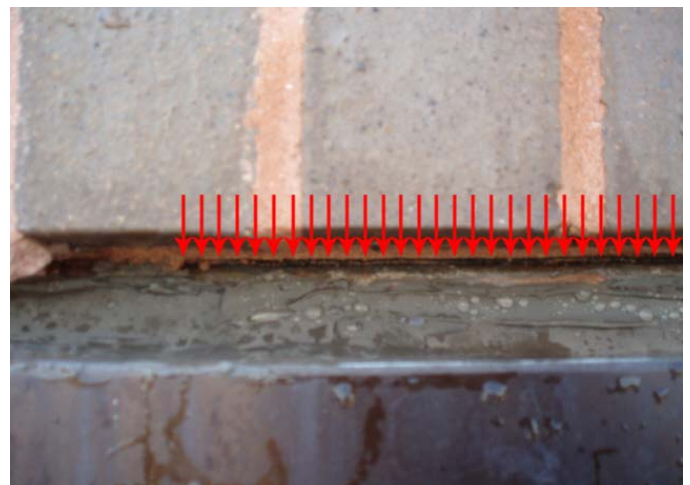
Several of the leak locations were tested by flooding the tops of the windows and bricks above the lintels with heavy streams of water sprayed downward duplicating natural rain as much as possible. After testing several of the areas with no results the team first observed interior leaking in the North West corner office on the 19th floor. After soaking the top of the window for nearly a half hour, small drops of water became visible inside the ceiling cavity. Water was dripping from above the carrying lintel flashing and below the steel angle and mortar. The leak was very slow but once the team knew where to concentrate the water they were able to clearly pin point the failure. Minutes after the water began dripping onto the metal window flashing it began to flow off the back of the flashing (due to the missing upturn of the metal window flashing) and was observed running down the inside of the window and pooling on the interior window sill. The team tested several other areas along the same office window and replicated the same results. The team returned to several of the windows tested earlier in the day and applied water directly above the window flashing, in an identical location of failure observed in the corner office. In areas where the team had soaked the windows and walls for thirty minutes or more with no results, leaking occurred in seconds once water was applied at the suspected open joint. The team tested several other locations throughout the facility with the same results. When water was sprayed directly to the area of failure there was instant water penetration. These leaks are very unusual which explains the inability to pin point them in the past and also the reason why they only leak during extreme weather conditions. All reported leak locations were not tested due to the extensive amount of work involved in relocating the building's scaffolding. Also the results were nearly identical at each location tested and it was safe to assume the cause of the problem had been identified.



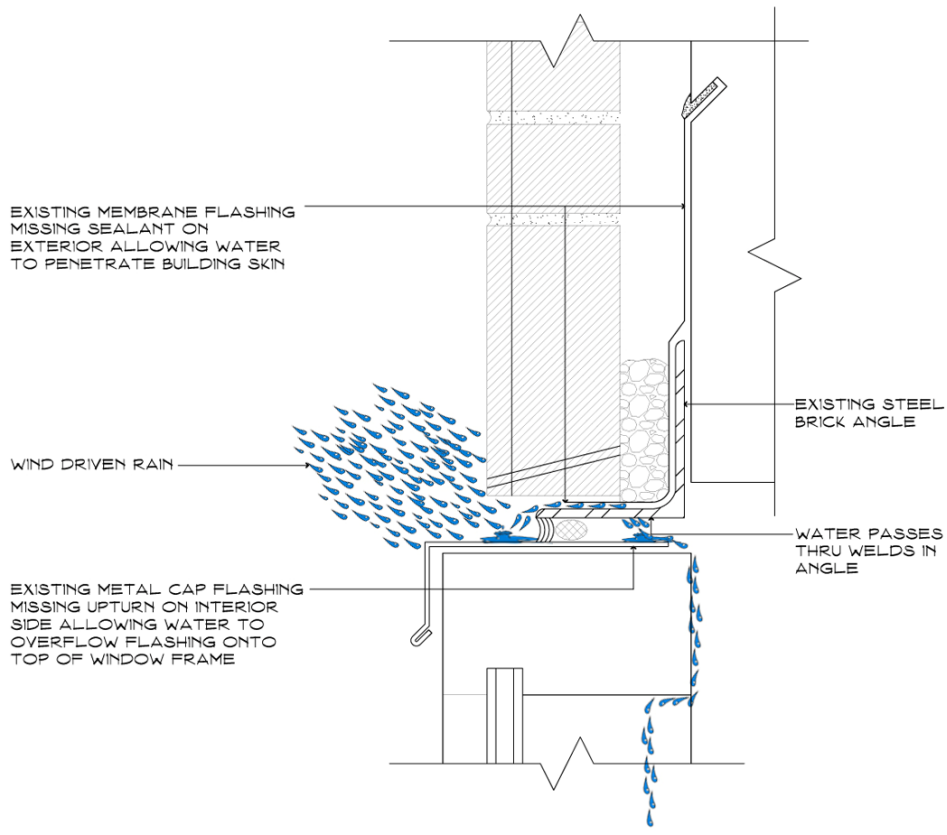
7. Water Leaking Thru Sealant and Backer Rod (19th Floor North West Corner Office)



8. Water Pooling at Window Sill (19th Floor North West Corner Office)



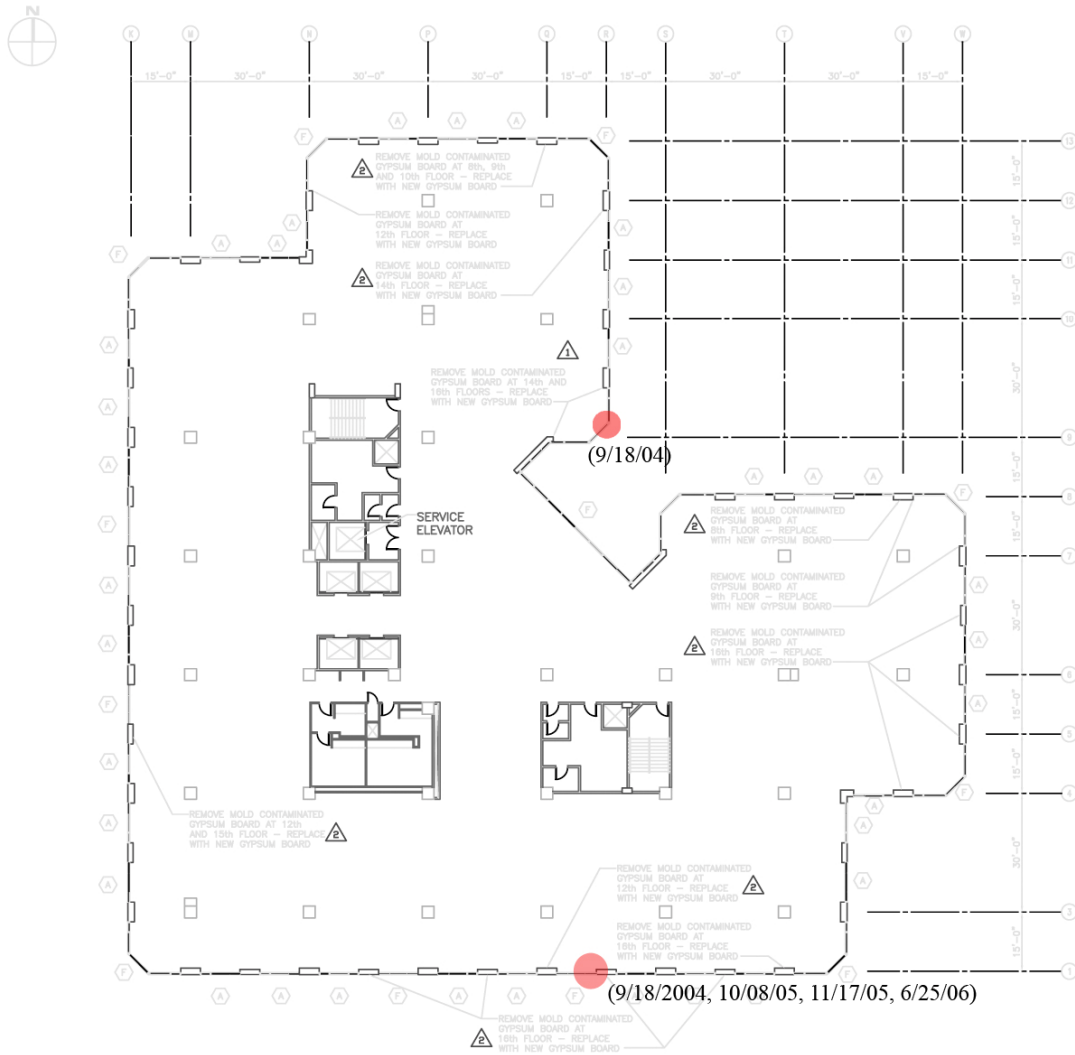
9. Area of Water Penetration on Exterior (Typical All Window Heads)



EXISTING FLASHING DETAIL



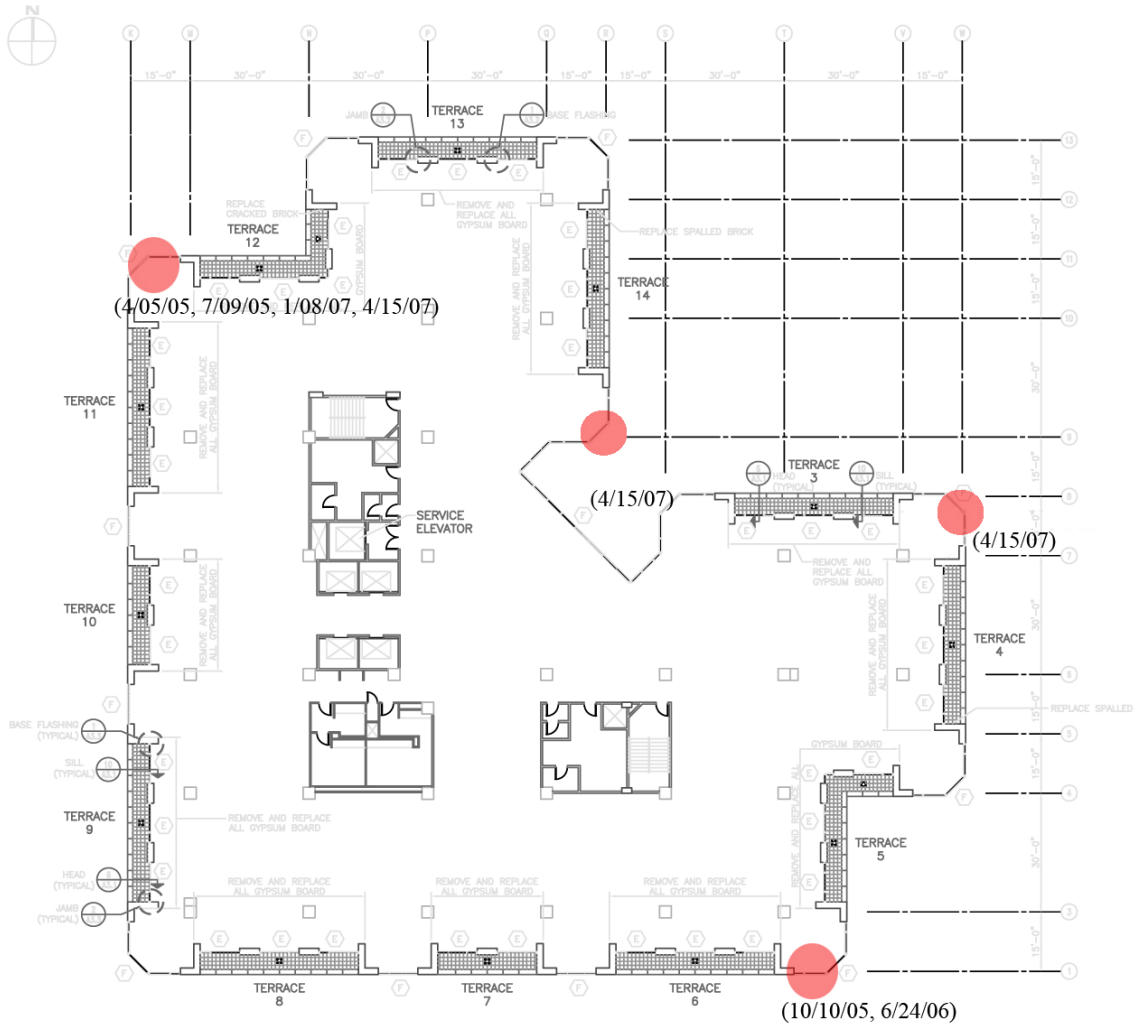
Observed Area of Failure above Window Assembly



SIXTEENTH FLOOR PLAN



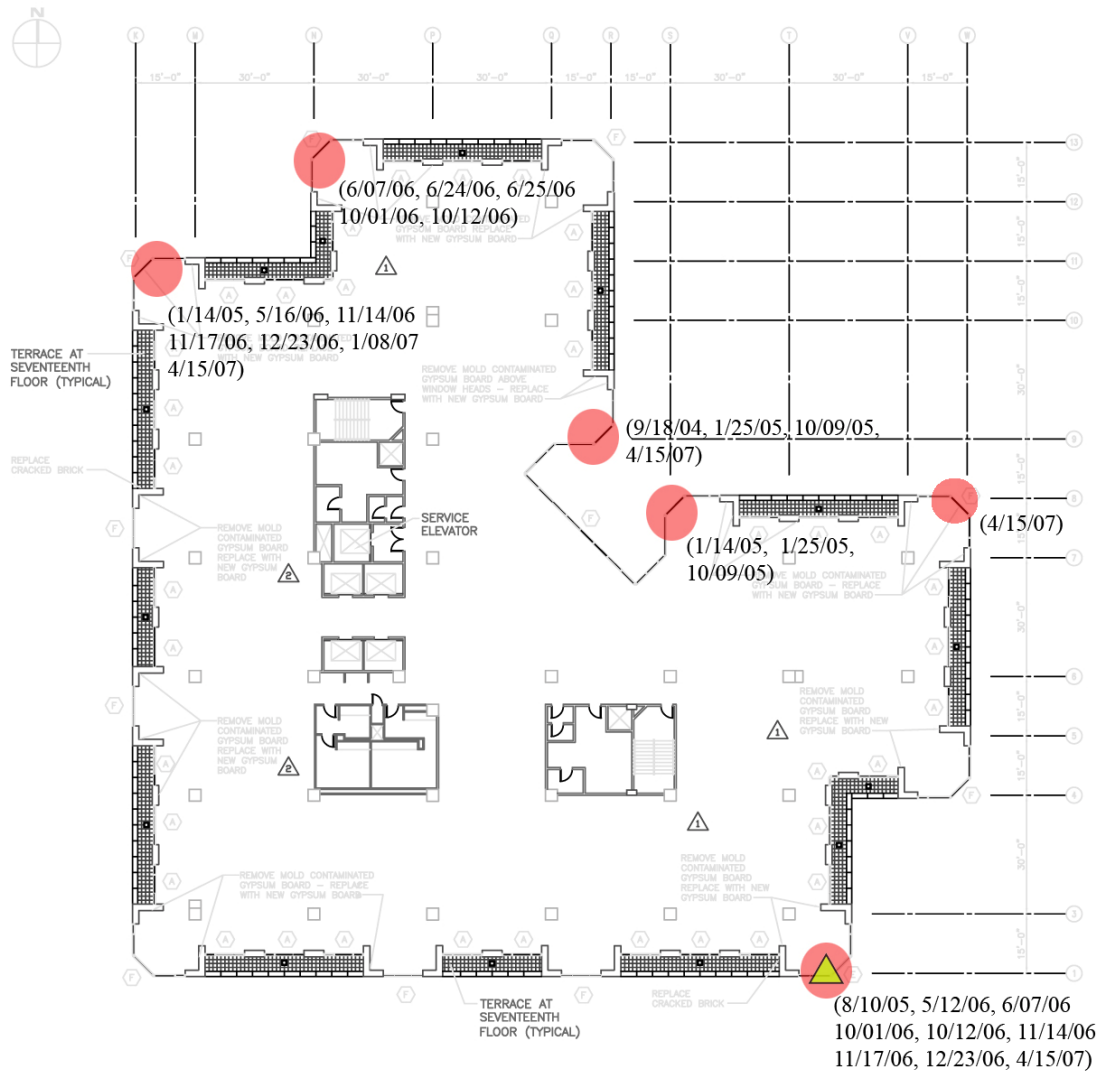
- = Area of repeated leaks since 2004
(Dates leaks were observed)
- ▲ - Flood Tested July 2007
(areas without triangle were not tested due to inaccessibility at time of testing)



SEVENTEENTH FLOOR PLAN



- = Area of repeated leaks since 2004
(Dates leaks were observed)
- ▲ - Flood Tested July 2007
(areas without triangle were not tested due to inaccessibility at time of testing)

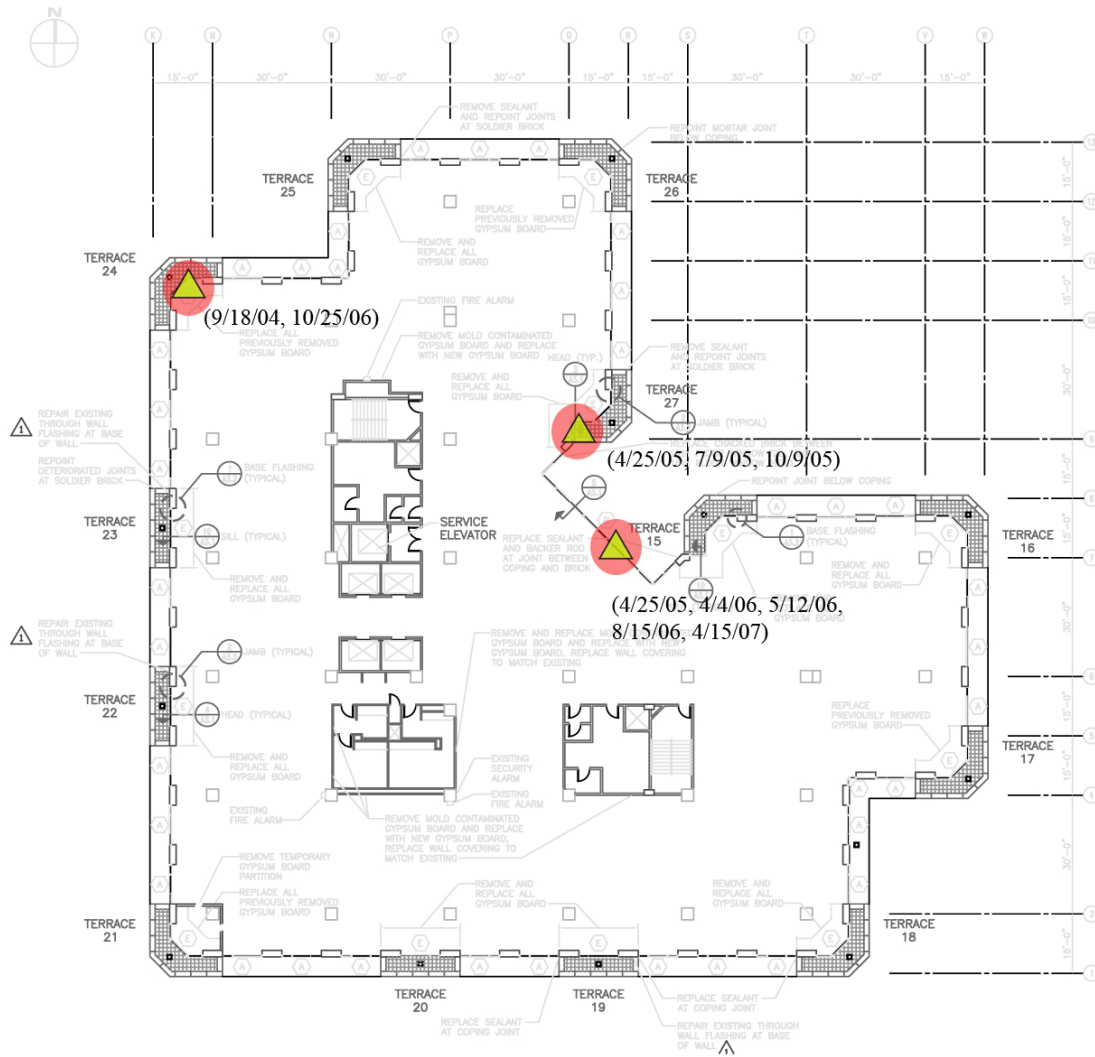


EIGHTEENTH FLOOR PLAN



● = Area of repeated leaks since 2004
(Dates leaks were observed)

▲ = Flood Tested July 2007
(areas without triangle were not tested due to inaccessibility at time of testing)



NINETEENTH FLOOR PLAN



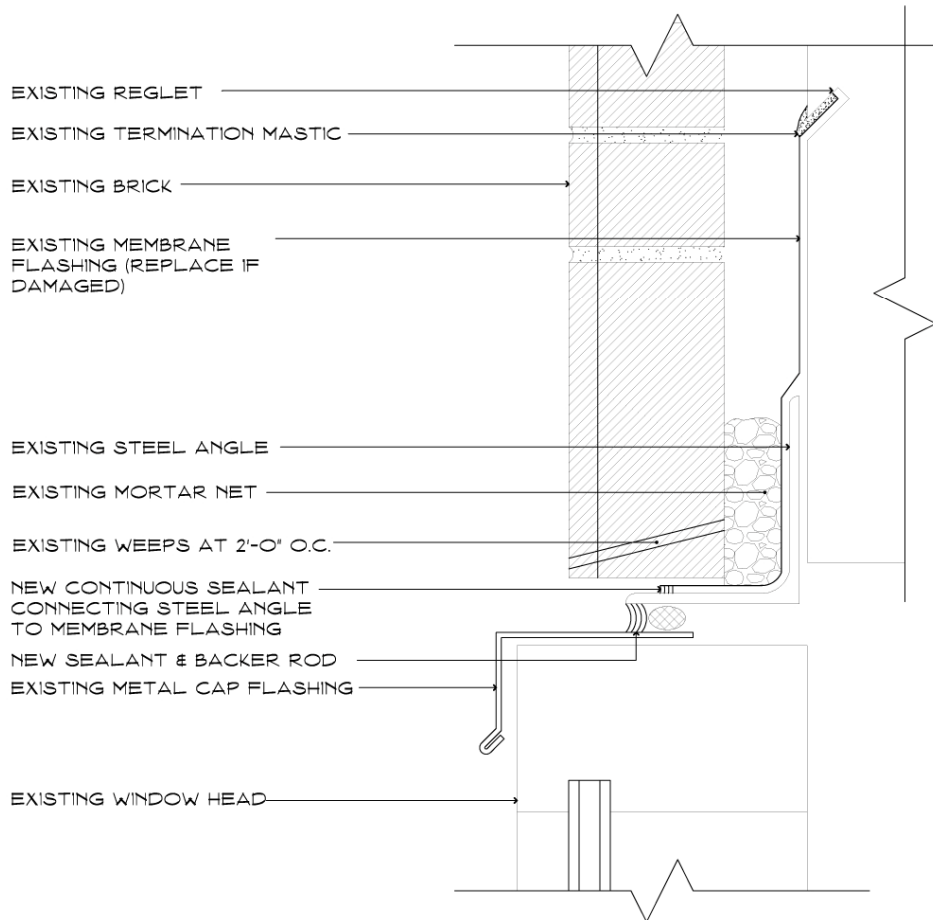
- = Area of repeated leaks since 2004
(Dates leaks were observed)
- ▲ - Flood Tested July 2007
(areas without triangle were not tested due to inaccessibility at time of testing)

RECOMMENDATIONS

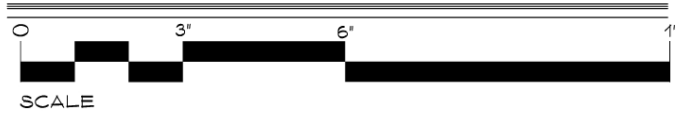
We recommend a simple, multi step process to determine the most effective solution to remedying the leaks while minimizing costs. By determining their effectiveness during the next design phase, they should be proven effective in preventing future water infiltration issues. The First more cost effective step is to place a thin bead of sealant between the bottom of the thru wall paper membrane flashing inside the wall cavity to the top of the steel angle to close the thin gap that is allowing water to infiltrate the building skin. (See flashing detail on page 14 for area to place sealant) After the sealant has had sufficient enough time to cure the windows should then be flood tested to see if the problem has been solved.

If the testing proves that the window heads are still leaking then the second step is to remove all metal flashing above windows where leaks have been reported and replace with new metal cap flashing making sure to crimp the interior side of the flashing upward to prevent water overflowing the back of the flashing. (See flashing detail on page 15 for new flashing recommendation) All laps in the flashing should be completely sealed with sealant. New sealant and backer rod should be added connecting the steel angle to the new cap flashing. Most importantly, step one should be repeated and sealant should be applied on the exterior of the building between the bottom of the thru wall paper membrane flashing inside the wall cavity to the top of the steel angle. If there are any visible leaks or tears in the membrane they should be repaired or replaced at the same time. Any sealant added to the building should be done externally to keep water on the exterior face of the building as originally designed to mitigate future leaks caused by breakdown of exterior water barriers.

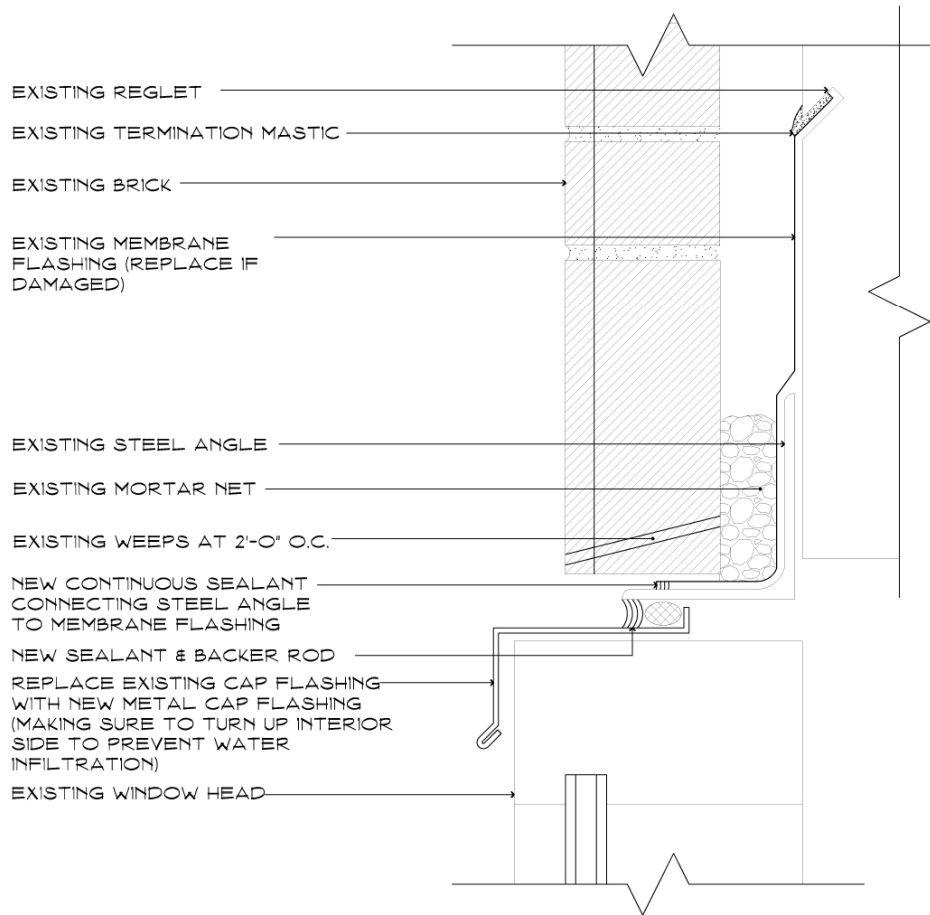
After these modifications have been made to the building at one or two locations, the repairs should be flood tested again to determine if the modifications are successful in keeping the water from infiltrating the building. Only after these tests have been conducted can it be assumed that the proposed solutions are proven and that the rest of the known leak locations can be sent to contractors and eventually repaired. At this time it is important to determine if it is feasible to fix only the windows that have had reported leaks or if all windows with deficient detailing should be repaired.



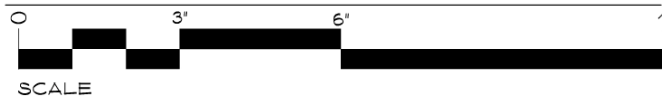
FLASHING DETAIL



Flashing Detail for First Step Recommendations



FLASHING DETAIL



Flashing Detail for Second Step Recommendations

ESTIMATES OF PROBABLE COST

Step One:

Projected Time of Construction: Two Days

WATER INFILTRATION REMEDIATION ESTIMATE

20-Sep-07

25 Sigourney Street
 Hartford, CT 06106
 DPW Project Number B1-2B-033L

STUDY PHASE OPINION OF PROBABLE CONSTRUCTION COST

PAGE 1

SECTION NUMBER	WORK CATEGORIES	UNIT	UNIT COST	UNIT QTY.	ALLOWANCE	TOTAL \$
DIVISION ONE						
	Bonds, Insurance	LS			\$525	\$525
	Safety Protection	LS			\$500	\$500
	Construction Supervision	HR	\$100.28	16		\$1,604
	Cleaning of site	HR	\$78.62	4		\$314
			DIV 1		\$2,944	
DIVISION TWO						
	Building Protection	LS			\$100	\$100
	Staging Rental (Suspended)	DAY	\$1,575.00	2.0		\$3,150
	Dumpsters	EA				\$0
	Setup / Break Down Staging	HR	\$78.62	48		\$3,774
			DIV 2		\$7,024	
DIVISION SEVEN						
	Sealant at Window Heads	LF	\$9.50	350		\$3,325
	Interior Sealant @ Shims	HR	\$78.62	4		\$314
	Aluminum Window Flashing Replacement	LF	\$12.00	50		\$600
			DIV 7		\$4,239	
DIVISION NINE						
	Ceiling Replacements	SF	\$3.50	60		\$210
			DIV 9		\$210	

Construction Cost	\$14,417.20
Includes O & P	
Contingency 10%	\$1,441.72
Total Construction Cost	15,858.92

GENERAL NOTES:

CONSTRUCTION COSTS ARE BASED ON 2007 CONSTRUCTION COSTS.
 ESCALATE 5% PER YEAR THEREAFTER.
 COST ESTIMATES BASED ON HISTORICAL DATA FOR COMPARABLE PROJECTS.
 THESE ESTIMATES ARE SCHEMATIC AND DO NOT REFLECT CONSTRUCTION DOCUMENT DETAIL.



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Step One:

Projected Time of Construction: Two Weeks

WATER INFILTRATION REMEDIATION ESTIMATE

20-Sep-07

25 Sigourney Street
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	Cleaning of site	HR	\$78.62	4		\$314
	Construction Supervision	HR	\$100.28	96		\$9,627
			DIV 1		\$10,966	
DIVISION TWO						
	Building Protection	LS			\$100	\$100
	Staging Rental (Suspended)	DAY	\$1,575.00	4.0		\$6,300
	Dumpsters	EA				\$0
	Setup / Break Down Staging	HR	\$78.62	96		\$7,548
	Remove Aluminum Flashing	HR	\$78.62	72		\$5,661
			DIV 2		\$19,608	
DIVISION SEVEN						
	Sealant at Window Heads	LF	\$9.50	350		\$3,325
	Coping Joints - remove & replace	LF	\$8.50	30		\$255
	Aluminum Window Flashing Replacement	LF	\$12.00	350		\$4,200
	Interior Sealant @ Shims	HR	\$78.62	4		\$314
			DIV 7		\$8,094	
DIVISION NINE						
	Paint Fascia or Soffits	HR	\$60.00	24	\$150	\$1,590
	Ceiling Replacements	SF	\$3.50	60		\$210
			DIV 9		\$1,800	

Construction Cost	\$40,469.00
Includes O & P	
Contingency 10%	\$4,046.90
Total Construction Cost	44,515.90

GENERAL NOTES:

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