Memorandum

MIAMI-DADE COUNTY

Date: February 13, 2013

To: Honorable Chairwoman Rebeca Sosa
and Members, Board of County Commissioners

From: Carlos A. Gimenez
Mayor

Subject: February Status Update: Failure Analysis and Forensic Engineering Report of the Adrienne Arsht Center for the Performing Arts (Arsht Center) of Miami-Dade County

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On July 17, 2012, the Board authorized the expenditure of up to $5 million for the assessment, demolition, repair, and reconstruction of the Arsht Center to address the water damage to the facility that occurred on May 20, 2012. The Board also authorized the engagement of a forensic engineer to review and report on the cause of the damage.

The plan of action has been to fully restore the Arsht Center, identify what caused the failure of the roof rainwater drainage system, develop and implement a plan that would avoid a similar event in the future and pursue and secure restitution for the expenses incurred to accomplish this work.

To date, we have incurred approximately $4.3 million for the initial repairs. We have been able to secure a reimbursement commitment from the insurance provider for approximately $535,000. It is important to note that these initial repairs were made in time for the Arsht Center to open its 2012-2013 season on schedule.

Slider Engineering Group Inc. (the forensic engineer) has provided a detailed failure analysis and forensic engineering report identifying the cause of the failure of the roof rainwater drainage system. The assessment reviewed all aspects of this system. In this report, Slider also provided recommendations as to other necessary repairs throughout the facility. That report is attached for your review.

Our goal remains to secure the reimbursement of all costs incurred to date on these repairs, to perform the necessary remaining corrective actions to the entire facility, and to pursue all necessary avenues to recover these additional costs.

To this end, we have met and discussed the findings of the forensic engineer's report with Performing Arts Center Builders, J.V. (PAC Builders), a joint venture formed by Odebrecht Construction, Inc., The Haskell Company, and Ellis Don Construction, Inc., who were the builders of the Arsht Center. We also met with The Poole and Kent Company and Fred McGilvray, Inc., the subcontractors hired by PAC Builders to install the roof rainwater drainage system. While we have not achieved resolution of these issues yet, we will continue to take any necessary actions to protect our interests.

Should you need any additional information, please contact Lisa M. Martinez, Senior Advisor, at 305-375-2911.

Attachment

c: R.A. Cuevas, Jr., County Attorney
Edward Marquez, Deputy Mayor, Office of the Mayor
Lisa M. Martinez, Senior Advisor, Office of the Mayor
M. John Richard, President & CEO, Adrienne Arsht Center for the Performing Arts
Michael Spring, Director, Department of Cultural Affairs
Jennifer Moon, Director, Office of Management and Budget
Lester Sola, Director, Internal Services Department

SliderEngineeringgroup

Adrienne Arsht Center for the Performing Arts of Miami-Dade County

PN 112046

February 7, 2013

Storm Water System Failure Engineering Evaluation

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Adrienne Arsht Center for the Performing Arts of Miami-Dade County
Miami, Florida

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EVALUATION REPORT

Storm Water System Failure Engineering Evaluation
Adrienne Arsht Center for the Performing Arts of Miami-Dade County
1300 N. Biscayne Blvd.
Miami, Florida

February 7, 2013

SEG Project No. 112046

Prepared for:
Miami- Dade County
Miami, Florida 33128

1.0 EXECUTIVE SUMMARY

On May 20, 2012 a 12" primary roof drain pipe, hereafter referred to as a rain water leader (RWL), in the Ziff Ballet Opera House (ZBOH) failed during a rainfall event causing considerable damage to the facility. Slider Engineering Group, Inc. (SEG) was contracted by Miami-Dade County to investigate the cause of this failure. SEG's evaluation of the storm water drainage system at the ZBOH resulted in the opinion that multiple defects in the installation of the storm water drainage system caused the referenced failure. The installation deficiencies indentified were deviations from the requirements of the applicable building code, contract documents, industry standards, and manufacturer's installation instructions.

2.0 INTRODUCTION

2.1 Purpose

The evaluation was requested by Miami-Dade County. The purpose of the evaluation was to provide an opinion regarding the reported failure in the storm water system at the Adrienne Arsht Center for the Performing Arts of Miami-Dade County (PAC). The comments and conclusions presented are the professional opinion of Slider Engineering Group, Inc.

2.2 Evaluation Background

The evaluation and investigative effort were directed by Harold Sturm, P.E., an Architectural Engineer with SEG. The evaluation included interviews of PAC Management personnel; a review of project related documentation provided by PAC Management including: photographs, construction drawings and contract documents; a review of the applicable Building Code and relevant technical standards; and by visual observations and limited testing of the storm water system components. A list of the primary relevant documents reviewed to date for the purposes of this evaluation is included in Appendix "A". Observations were made of piping system components including areas where components were concealed by interior drywall, insulation and interior finishes, and piping insulation. A list of the primary SEG staff who participaed in the generation of this report is presented in Appendix "B".

The conclusions presented here are the professional opinions of Slider Engineering Group and are based on a reasonable degree of engineering certainty.

2.3 Construction Documents- to Date

Drawings obtained from the contract document records of PAC Management include record drawings titled, *Performing Arts Center of Greater Miami, Ballet/Opera House 1300 Biscayne Blvd. Miami Florida*. The record set was dated December 4, 2006.

Sheet B-LS 1.00 lists the design code for the project as the South Florida Building Code (SFBC) 1994 Dade County Ed. with Supplement No. 5 dated January 1998.
The Project Manual, containing applicable project specifications, was issued for construction on October 24, 2001 and lists Cesar Pelli & Associates Inc. as the Architect and Fraga Engineers as the Plumbing and Fire Protection Engineering Consultant; Cosenti Associates, MEP Engineering;

2.4 Applicable Building Code

The public records of the City of Miami Building Department reflect that building master permit #

015022470 for the PAC was applied for on March 15, 1999 and issued on November 2, 2001. Based on the application date of the construction permit, the South Florida Building Code (SFBC) 1994 Dade County Ed. with Supplement No. 5 dated January 1998 as referenced on sheet B-LS 1.00 was the applicable Building Code.

2.5 Contractor and Mechanical Subs

Pool & Kent Company of Florida, Mechanical Contractor
Fred McGilvery Inc, Mechanical Subcontractor.

2.6 Project Description

The PAC includes two buildings: The Ziff Ballet Opera House (ZBOH) and the Knight Concert Hall (KCH). The buildings are respectively located on the west and east side of Biscayne Blvd (see Figure 1- Site Aerial).

Figure 1: Site Aerial

Both buildings incorporate a primary rainwater drainage system that utilizes roof drains, RWL, and piping to conduct rain water from roof drainage areas to in-ground drainage wells surrounding the buildings at street level. No-hub (aka Hubless) cast iron soil pipe and fittings were used to construct the primary drainage systems. No-hub piping systems are assembled using a coupling comprised of an elastomeric sleeve secured by means of multiple metal bands to both connect and seal the pipe-to-pipe connections, and the pipe-to-fitting connections (see Photo 1). Each building is also equipped with a separate emergency overflow drainage piping system in the event that the primary system becomes overburdened or blocked. The emergency systems were constructed using PVC piping and fittings.

Photo 1: Typical Hubless Coupling with Stainless Steel Bands Securing an Elastomeric Sleeve

2.7 Storm Water Drainage System Point of Failure

On May 20, 2012, a 12" diameter RWL above the east restroom ceiling on the 4th Tier of the ZBOH failed during a rain event. The point of failure was a no-hub coupling used to connect a 90 degree elbow fitting at a transition from a vertical (down flow) pipe to a horizontal pipe. The fitting reportedly became disengaged from the coupling during the rain storm leading to separation of the piping assembly at the joint (see Photo 2) causing storm water to flood the facility. Photo 3 is the point of failure, post temporary repair.

This failure of the storm water drainage system resulted in considerable damage to the interior finishes of the ZBOH building (See Appendix "C" for damage summary). Because the point of failure was located above the 4th tier of the ZBOH, the areas of water damage extended to the 4th tier, 3rd Tier, 2nd tier, Ballet Box Tier, Intermediate Level and Orchestra Level (see Photos 4 thru 7).

Photo 2: Point of Failure Showing Elbow Detached from Vertical Rainwater Leader

Photo 3: Post Failure Temporary Repairs at Point of Failure Illustrating New Code Compliant Joint Restraints and Couplings (Noted by Arrows

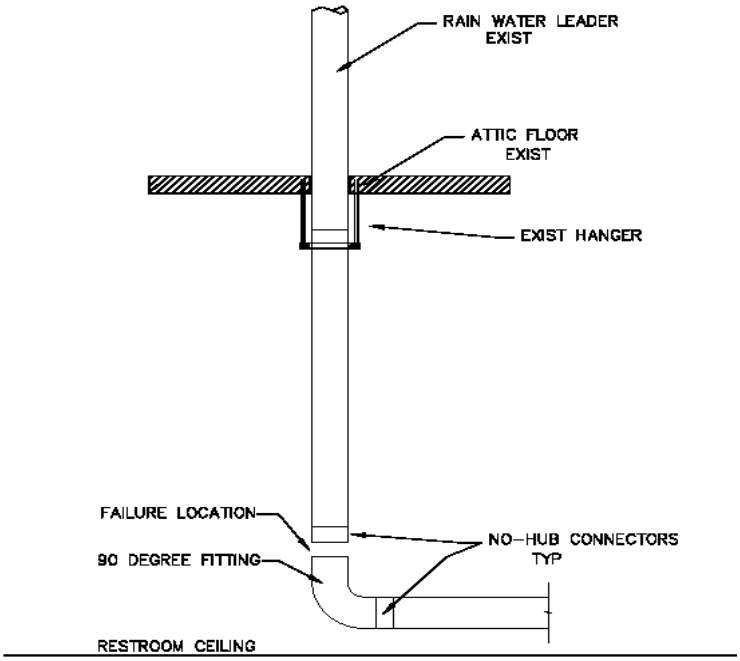

Figure 2: Failure location

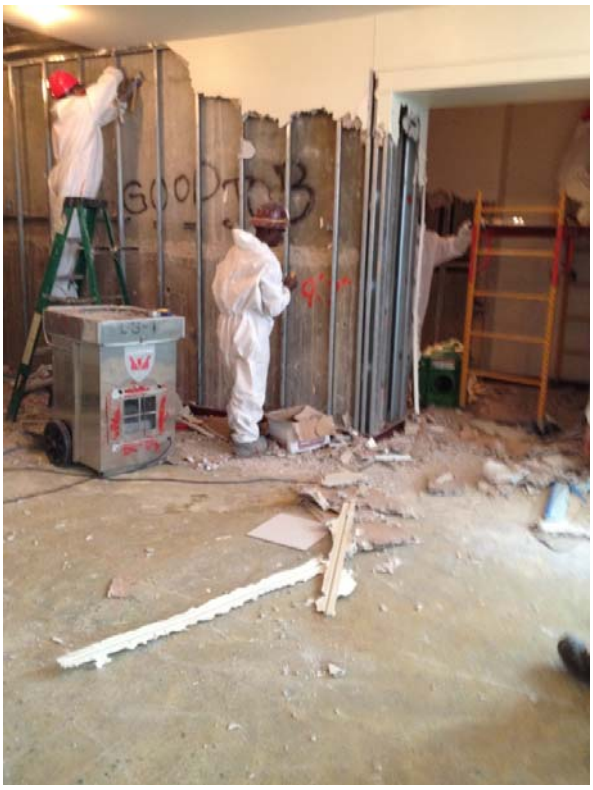

Photo 4: Damage to Interior Finishes

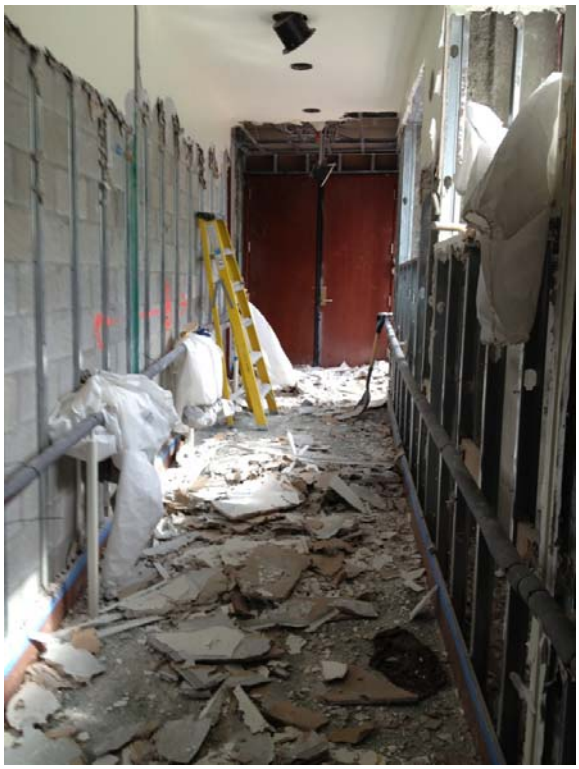

Photo 5: Damage to Interior Finishes

Photo 6: Damage to Interior Finishes

Photo 7: Damage to Interior Finishes

2.8 Temporary Repairs at Point of Failure

It was reported that PAC Management directed the temporary repairs of the area on the night of the incident. These repairs included re-assembling the failed pipe joint with a new no-hub coupling, the installation of temporary joint reinforcement at both ends of the elbow fitting, and the installation of a new pipe support hanger (see Photo 3).

3.0 FINDINGS

3.1 Joint Reinforcement not Installed

When water is flowing down the pipe and changes direction due to a fitting or branch opening, the water imposes a force on the fitting in the direction of the water flow. This force acts to separate the fitting from the connection. Joint reinforcement acts to prevent this force from separating the joint (as occurred in the ZBOH failure). Additionally, the manufacturer of the no-hub fitting, ANACO, specifies in their installation instructions to follow the joint bracing requirements of CISPI.

Section 1.04 of Project Specification 15011: Plumbing General Provisions specifies that,

> *"All work shall comply with guidelines set in the latest edition of following applicable standards and codes: …Cast Iron Soil Pipe Institute…"*

The Cast Iron Soil Pipe Institute (CISPI) was organized in 1949 by the leading American manufacturers of cast iron soil pipe and fittings. The Institute is dedicated to aiding and improving the plumbing industry, establishing minimum manufacturing standards and installation guidelines and procedures. CISPI industry specification 301 governs the design and manufacture of cast iron pipe systems. CISPI 310 sets forth installation guidelines and procedures applicable to installation of pipe. For large diameter pipe, CISPI 310 states that:

> *"Horizontal pipe and fittings five inches and larger must be suitably braced….at every branch opening or change of direction…..to prevent movement or joint separation."*

Similarly, this requirement for joint restraint is mandated by the SFBC and the AANACO no-hub coupling installation instructions. (Appendix "D")

Suitable bracing at joint locations, as required by CISPI, is achieved through the installation of a bolted-on joint reinforcement bracket. Figure 3 illustrates typical joint reinforcement as recommended by CISPI.

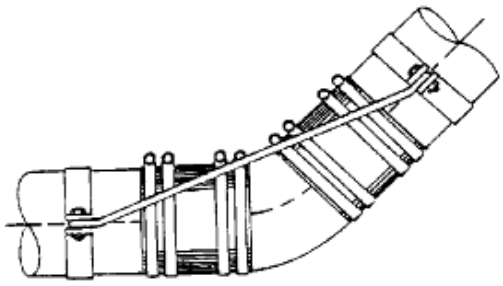

Figure 3: Typical Joint Reinforcement for Large Diameter Pipe (CISPI)

Photo 8: 90 degree Fitting missing Joint Reinforcement

During our review it was observed that no joint reinforcement was installed throughout the storm water drainage system. Photo 8 is a typical example of a 90 degree pipe fitting connected with no-hub couplings, but is lacking the joint reinforcement specified in the contract documents.

It is my professional opinion that the original pipe installer's failure to install joint reinforcement on both ends of the subject elbow was the primary cause of the failure.

3.2 Sway Bracing not Installed

When water moves through a storm water pipe system, it exerts forces on the pipe that cause movement (sway) which results in misalignment between pipe sections and fittings. This misalignment imposes stress on the couplings leading to failure. Sway braces restrict this movement, thereby protecting the connections. If these anticipated forces are not adequately restrained, coupling failure (separation) can result, as it did in the subject failure.

Section 4609.3 (b) of the SFBC 1994 states that:

> *"Suspended lines shall be suitably braced to prevent horizontal movement."*

Also, the installation procedures outlined in the CISPI 310 further explains,

> *"Where components are suspended in excess of 18 inches by means of non-rigid hangers they should be suitably braced against horizontal movement, often called sway bracing."*

Additionally, the ANACO coupling installation instructions (Appendix "D") state that,

> *"Horizontal pipe and fittings five inches and larger must be suitably braced to prevent horizontal movement."*

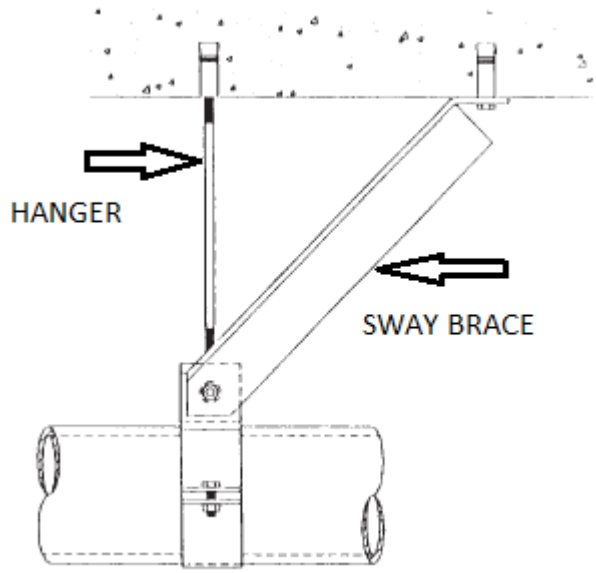

Figure 4: Example of Typical Sway Bracing (CISPI)

Photo 9: Pipe Installation with no Sway Bracing

During the survey of the pipe installation SEG observed that the piping is primarily suspended from single, threaded rod hangers with no "sway bracing" installed (see Photo 9). Single point rod hangers, incorporating rubber sound isolators, are considered "non rigid" hangers and were observed installed with an un-braced length of up to 20 feet. The installed configuration provides no restraint of horizontal sway motion. Figure 3 above shows an example of typical sway brace as detailed by CISPI.

It is my professional opinion that the original pipe installer's failure to include sway bracing on the storm water drainage system pipe was a significant contributor to the failure.

3.3 Installer's failure to comply w/ Hanger Spacing

Improper support of piping causes the weight of the pipe or fitting, and the water, to be imposed on the elastomeric rubber sleeve of the no-hub coupling. Additionally, the placement of the support too far away from the joint allows the weight of the pipe and water to be placed on the rubber coupling joint. The coupling is not intended to support these loads.

Photo 10: Pipe Installation missing Hangers

Photo 11: Piping Installation missing Hangers

Section 3.02(C) of Project Specification 15420: Piping Specialties, states:

> *"Hubless Joints: Provide support at every other joint…"*

Also, Section 3.03(C) of Project Specification 15425: Supports/Anchors – Plumbing/Fire Protection, instructs:

"Place a hanger within one foot of a horizontal elbow."

SFBC 4609.3(b) states that supports shall be placed immediately adjacent to the coupling, and that the pipe be suitably braced to prevent horizontal movement.

CISPI General Installation Instructions B.1 state, for 12" pipe, a support should be installed on both sides of a coupling when installing full length (10 FT) pipe sections.

At various points throughout the system, pipe components were observed that were not supported at every joint as required per Contract Documents. Photos 10 thru 12 illustrate examples of these deviations from specifications.

Photo 12: Piping Installation missing Hangers

It is my professional opinion that the original pipe installer's failure to include sway bracing on the storm water drainage system pipe was a significant contributor to the failure.

3.4 Vertical Piping Support Improperly Installed

Vertical runs of piping, which are termed a riser, are supported by a bracket (riser clamp) which is clamped around the pipe and rests on the concrete floor. This configuration prevents the weight of the pipe from being put on the no-hub couplings.

Section 4609.2(b) of the SFBC 1994 requires that,

> *"Cast-iron soil pipe shall be supported at not less than at every story height and its base."*

Also, CISPI 310 general installation instructions further address these requirements by instructing,

> *"Support stacks* [risers, SEG] *at their bases and at sufficient floor intervals to meet the requirements of local codes."*

SFBC 1994 and CISPI 310 specify that risers be supported by riser clamps at each floor level. Vertical piping supports are intended to transfer the weight of the piping assembly to the surrounding floor system. A lack of these supports will impose additional loads on pipe couplings along the river, leading to separation of the joint.

Photo 13: Vertical Piping missing Riser Clamps

Photo 14: Improperly installed Riser Clamp

Photo 15: Evidence of Pipe Slippage above Point of Failure

Riser clamps were observed to be missing on several of the vertical risers (see Photo 13). In other locations the riser clamps were improperly installed. Photo 14 shows a riser clamp that is not in contact with the floor and is therefore not supporting the weight of the pipe riser.

Improper vertical support was further evidenced at the piping section directly above the point of failure. Photo 15 shows that the pipe had slipped downwards in the pipe clamp at this location. These observed configurations impose weight on the elastomeric rubber connections of the pipe system. As an additional note, the riser clamps should incorporate sound isolation pads.

This riser section, just above the attic floor, is directly above the failure point of the 90 degree elbow in the 4th tier restroom. The slippage of the pipe is indicative of the downwards force imposed by the storm water pulsing through the inadequately restrained and/or braced piping system impacting on the elbow below. The force of the falling storm water caused a downward load to impact on the fitting, which disengaged the fitting from the coupling. Additionally, the force of the water changing direction in the fitting will generate sway movement of the inadequately restrained piping system.

It is my professional opinion that the original pipe installer's failure to properly install riser clamps on the storm water drainage system pipe was a significant contributor to the failure.

3.5 Improper Installation of No-Hub Couplings

The no-hub fittings incorporate either 4 or 6 hose clamp bands which secure the elastomeric rubber sleeve to the pipes (see Photo 16).

Photo 16: No-Hub Coupling with 6 Hose Clamps

The manufacturer (ANACO) of the couplings specifies that these bands be tightened using a torque wrench to a torque value of 80

inch-pounds for 12 inch diameter pipe and 60 inch-pounds for other sizes. The fitting that failed was 12 inch diameter. (Appendix "D")

A calibrated torque wrench ensures that these values are achieved and not exceeded. An inadequately torqued band will provide a lower clamping/attachment force and a reduced sealing capacity, which makes the connection more likely to separate.

A limited survey of the bands was made to evaluate the torque of the band screws. The survey examined 404 individual bands using a calibrated torque wrench. A majority of these bands were found to be inadequately tightened. (98.5%) Such field testing revealed that the average torque value for 12 inch bands was 51 inch-pounds (80 required). The bands adjacent to the point of failure were evaluated. One of 30 bands exhibited the correct torque. The average value for other sizes was 44 inch pounds (60 required). The values ranged from 6 to 80 inch pounds. 45 bands (13%) were found to be stripped indicating that they were over-torqued or torqued in the improper sequence, and lacking adequate capacity.

Several of the couplings reviewed exhibited a deformation of the metal shield as shown in Photo 17. Deformation of the shield metal indicates that the coupling has been displaced from its original installation configuration. This deformation is indicative of excessive movement of the piping system due to inadequate sway bracing.

Photo 17: Example of a Coupling with a Deformed Shield

It is my professional opinion that, more likely than not, the original pipe installer's failure to properly install the bands of the no-hub coupling on the storm water drainage system pipe was a significant contributor to the subject failure.

4.0 CONCLUSION

It is my professional opinion that the ZBOH storm water drainage system failure of May 20, 2012, was caused by the original installer's multiple failures to install the storm water drainage system in accordance with the requirements of SFBC, CISPI, the piping and coupling manufacturer's instructions, and the Contract Documents. These installation failures include, but are not limited to, lack of reinforcement installed at either end (joint) of the 90 degree elbow fitting (failure location), lack of sway bracing to prevent horizontal movement of the piping, inadequate vertical pipe supports, and inadequate installation of the ANACO no-hub coupling bands. It is my further opinion that the installation deficiencies referenced above fell below the reasonable standard of care for experienced mechanical/plumbing contractors in the Florida construction industry, and that this substandard installation work was the direct cause of the May 20, 2012 storm water drainage system failure at the ZBOH, resulting in significant water intrusion and the subsequent damage to the facility.

The latent defects and deficiencies noted above also present a continuing risk of similar future failure to the entirety of the storm water drainage system at both the ZBOH and the KCH. Bracing and shoring has been installed as a temporary measure at the ZBOH.

5.0 DAMAGE

To date, the County has spent $4,268,031(numbers provided by Miami-Dade County) repairing the damages to the ZBOH arising from the May 20, 2012 storm water drainage system failure. The damage amount is preliminary amount may increase.
In addition, SEG has inspected both the ZBOH and the KCH to identify areas where the original storm water drainage system was not installed in accordance with the requirements of the SFBC,

CISPI, Contract Documents, and manufacturer's installation instructions. The estimated cost to bring these deficient systems into compliance is presented in Appendix "F".

6.0 CLOSURE

Slider Engineering Group, Inc. is the author of the report. Slider Engineering Group, Inc. and Harold Sturm, P.E. reserve the right to amend and supplement this report as additional information is available.

APPENDIX "A"

Documents Review List

Storm Water System Failure
Adrienne Arsht Center for the Performing Arts of Miami-Dade County
Miami, Florida

Documents:

1. Video provided by the PAC Management taken at the point of failure on 05/20/2012.

2. Photographs taken by the PAC Management dated 05/23/2012 pages 1 thru 42.

3. Adrienne Arsht Center Report by Steven Feller, P.E., PL dated 07/03/2012.

4. Record Drawings for the *Performing Arts Center of Greater Miami, Ballet/Opera House*, prepared by Caesar Pelli & Associates, Inc. dated 12/04/2006

5. As-Built Project Manual for the *Performing Arts Center of Greater Miami,* prepared by Caesar Pelli & Associates, Inc. dated 10/24/2001 (inclusive of revisions up to 06/2006).

6. Repair Project photos from Fachinna Construction of Florida.

Codes and Technical Standards:

1. The South Florida Building Code (SFBC) 1994 Dade County Ed. with Supplement No. 5 dated January 1998

2. *"Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications"* prepared by the Cast Iron Soil Pipe Institute (CISPI 301-04).

3. Manufacturer cut-sheet and instruction submittal *"No-Hub Couplings"* prepared by Anaco.

APPENDIX "B"

List of SEG Contributors

Harold Sturm, PE	Sarasota, FL
Scott Harvey-Lewis, PE	West Palm Beach, FL
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APPENDIX "C"

Damage Classification Summary

(Provided by Miami- Dade Architecture and Engineering Services)

Access, Temporary Protection, Scaffolding

Supervision, Labor, Tools, Rentals

Demolition, Disposal, Air Quality

Drywall, Paint, Acoustic Fabric, , Tile, Woodwork

HVAC, Eelectrical, Fire Protection, Plumbing

Insurance, Cleaning, Storage, Safety

On-site project totals to date- $4,268,031(numbers provided by Miami-Dade County)

APPENDIX D

Submittal
No-Hub Couplings

Anaco No-Hub couplings meet CISPI 310 and ASTM C 1277. Couplings consist of a stainless steel shield, clamp assembly and a gasket manufactured from a properly vulcanized virgin compound in which the primary elastomer is polychloroprene (neoprene) conforming to ASTM C 564.

Compliant to BAA, TAA, ARRA, NAFTA & NSF.

NSF
CISPI 310

The coupling is used to join hubless cast iron pipe and fittings made to CISPI 301 and/or ASTM A 888. Coupling sizes range from 1½" through 15" diameters. The stainless steel shield and clamp assemblies are corrosion resistant.

Material Specifications

Clamp: Type 301 AISI stainless steel
Screw: Type 305 AISI stainless steel 5/16 hex head for 1 ½"-10", 3/8 for 12" &15"
Shield: Type 301 AISI stainless steel corrugated. Shield thickness 0.0075
Housing: Type 301 AISI stainless steel

Gasket Test

Test	Physical Tests Min. or Max Requirements	ASTM Method
Tensile Strength	1500 psi min.	D412
Elongation	250 min.	D412
Durometer [Shore A]	70 ± 5 @ 76° F ± 5°F	D2240
Accelerated Aging	15% maximum tensile and 20% maximum elongation deterioration, 10 points maximum increase in hardness, all determinations after oven aging for 96 hours at 158°F	D573
Compression Set	25% maximum after 22 hours at 158°F	D395 Method B
Oil Immersion	80% maximum volume change after immersion in IRM 903 for 70 hours at 212°F	D471
Ozone Cracking	No visible cracking at 2 times magnification of the gasket after 100 hours exposure in 1.5ppm ozone concentration at 100°F. Testing and inspection to be on gasket which is loop mounted to give approximately 20% elongation of outer surface.	D1149
Tear Resistance	150 lbs. minimum per inch of thickness	D624
Water Absorption	20% maximum by weight after 7 days at 158°F	D471

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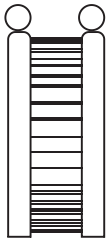
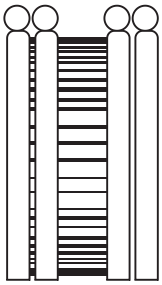
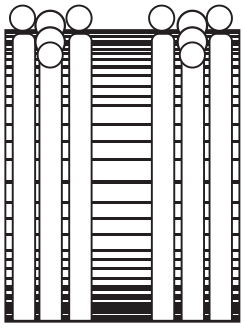
No Hub Couplings			
Size	**Width**	**No. of Straps**	**Torque**
1 ½" – 4"	**2.125**	**2**	**60**
5 & 6	**3.0**	**4**	**60**
8 & 10	**4.0**	**4**	**60**
12 & 15	**5.50**	**6**	**80**



Size 1-1/2"
thru 4"
TWO BANDS
Figure 1



Size 5", 6"
8" thru 10"
FOUR BANDS
Figure 2



Size 12"
AND 15"
SIX BANDS
Figure 3

Installation Instructions

1. After making the field cuts square and placing the ends of the pipes against the center-stop of the gasket, slide the clamp assembly into position centered over the gasket.
2. Using a torque wrench, tighten stainless steel screws alternately to 60-inch pounds torque for 1½" to 10" and 80-inch pounds torque for 12" & 15".
3. For 5" to 10" couplings, tighten inner bands first, then tighten outer bands.
4. For 12" & 15" couplings, tighten inner bands, center bands and outer bands. When min-max conditions exist, tighten each band starting on the smaller side: 3,2,1 and 3,2,1 again. Then torque the maximum side: 4, 5, 6 and 4, 5, 6 again. Finally, torque 2,1 on the minimum side and 4, 5, 6 on the maximum side. (See Figure 3 above)

Bracing

Horizontal pipe and fittings five inches and larger must be suitably braced to prevent horizontal movement. This must be done at every branch opening or change of direction by the use of braces, blocks, rodding or other suitable method, to prevent movement or joint separation. *(Chapter IV, Handbook Cast Iron Soil Pipe Institute)*

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APPENDIX E

SECTION 15011

PLUMBING/FIRE PROTECTION GENERAL PROVISIONS

PART 1.GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division I - Specifications sections, apply to work specified in this Section.

1.02 RELATED WORK IN OTHER DIVISIONS

Division 2 - Site Utilities
Division 9 - Field painting of mechanical equipment
Division 16 - All electrical work for this Division 15 as noted in this Division's sections.
Section 15240 – Vibration Isolation
Section 15245 – Vibration Isolation

1.03 DESCRIPTION OF WORK

A. It is the intent of these plans and specifications to provide complete and operating mechanical systems as hereinafter outlined. The work contained within the scope of this contract shall include furnishing and installing heating, ventilating, air conditioning, mechanical and plumbing systems, as specified, indicated on contract drawings, and as required to constitute complete operating systems.

B. This section applies to each section in Division 15 - Mechanical.

C. Drawings are diagrammatic and indicate general arrangement of systems and work included in contract. Contractor shall follow drawings in laying out work; check drawings of all trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, Architect-Engineer shall be notified before proceeding with installation. If directed by Architect-Engineer, contractor shall, without extra charge, make reasonable modifications in layout as needed to prevent conflict with work of various trades or for proper execution of the work. Where variances occur between drawings and specifications, or within either document itself, the item or arrangement of better quality, greater quantity, or higher cost shall be included in contract price. Architect-Engineer shall decide on item and manner in which the work shall be installed.

1.04 QUALITY ASSURANCE

Standards and Codes: All work shall comply with guidelines set in latest edition of following applicable standards and codes:

ADC	- Air Diffusion Council
AMCA	- Air Moving and Conditioning Association
ANSI	- American National Standards Institute
API	- American Pipe Institute
ARI	- Air Conditioning and Refrigeration Institute
ASHRAE	- American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	- American Society of Mechanical Engineers
ASTM	- American Society of Testing and Materials

CISPI	- Cast Iron Soil Pipe Institute
FM	- Factory Mutual
NBS	- National Bureau of Standards
NEC	- National Electrical Code
NEMA	- National Electrical Manufacturers Association
NFPA	- National Fire Protection Association - National Fire Codes including Life Safety Code
OSHA	- U.S. Dept. of Labor - Occupational Safety and Health Acts Standards
PDI	- Plumbing Drainage Institute
UL	- Underwriters' Laboratories, Inc.
USAS	- USA Standard
	- Regulation of Florida Industrial Commission Regarding Safety
	- Sanitary Code of the State Board of Health
	- Model Energy Efficiency Code for Building
	- Construction (State of Florida Energy Code)

1.05 FIELD MEASUREMENTS AND COORDINATION

A. Verify all field dimensions and location of equipment, to insure close, neat fit, with work of other trades.

B. Coordinate and install work under this Division in proper sequence with and cooperation with all other trades, to insure that total work is completed within contract time schedule.

C. Carefully examine any existing conditions, piping, and premises, and compare drawings with existing conditions. Notify Architect of any observed discrepancies, who will issue equitable written instructions resolving these discrepancies.

1.06 SINGULAR REFERENCES

Singular references in these specifications are not to be constructed as requiring only one device if multiple devices are shown on drawings or required to complete the work.

1.07 ACCEPTANCE

Prior to requesting final inspection, contractor shall:

A. Complete all work required under this Division. After final installation of all equipment, a complete test and balance shall be performed on all air distribution, refrigerant system or circuits. Four certified copies of final test data shall be submitted to the Architect. Furnish a letter from an authorized representative of the control manufacturer that all controls have been checked for operation and calibration and that system is operating as intended.

B. Furnish the required operating instructions, wiring diagrams, and control diagrams and mount one copy of each in the electrical equipment room framed under glass.

1.08 CLEANUP

A. Thoroughly clean all exposed parts of all apparatus and equipment of cement, plaster, and other materials, and remove all oil and grease spots. Repaint or touch up as required to look like new. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and touched up with primer.

B. During the progress of work, each Sub-contractor shall carefully clean up after this men and leave premises and all portions of building free from debris and in a clean and safe condition.

1.09 SERVICE

Provide recorded and reported maintenance and service for one (1) year after Owner's substantial completion of all portions of the work. Such service includes the following:

~~A. Necessary adjustments and/or replacement of all defective equipment and materials furnished.~~

~~B. Replacement of any loss of oil.~~

~~C. Replacement of all air handling unit filters in accordance with filter loading and manufacturer's recommended replacement time.~~

~~D. Re-calibration and re-setting of automatic controls as required.~~

~~E. Tightening of belts of all belt driven equipment.~~

~~F. Oiling all bearings, drives, etc., as required by the equipment service recommendations.~~

~~G. Cleaning cooling coils and drain pans of all air handlers every six months.~~

~~H. Adjusting and operation of all variable volume box actuators.~~

A. Perform any other maintenance and service on equipment as recommended in the respective equipment manufacturer's maintenance recommendations.

B. Offer the Owner a full service and maintenance agreement for a period of one year following the previous one year service period. The Owner will have the option to accept or not to accept the service and maintenance agreement.

~~1.10 WARRANTY/GUARANTEE~~

~~The condensing unit compressor shall have a complete 5 year labor and materials warranty. Except for this 5 year compressor warranty, the Contractor shall guarantee all labor and materials for a period of two (2) years after Owner's substantial completion of all portions of the work. In addition, Contractor shall provide included in his bid, manufacturer's warranty for labor and materials on all equipment furnished under this Division.~~

1.10 SUBMITTALS

A. Provide layouts of all piping, ductwork, equipment, etc., fully coordinated with the layout of the other trades, at a suitable scale but not smaller in size than 1/4" = 1'-0" scale.

PART 2.PRODUCTS

2.01 OPERATING AND MAINTENANCE MANUAL

A. Operating and maintenance instructions shall be provided for all mechanical equipment and systems as hereinafter specified.

B. Operating and maintenance manuals will be used for training of and use by the Owner's operating personnel in the operation and maintenance of the mechanical system. The manuals must therefore address themselves not only to equipment but also to the operation of the systems.

C. Format of the manuals shall be based on a separate manual or chapter for each class of system as follows:

1. Air conditioning, heating and ventilating systems

2. Plumbing systems

3. Emergency systems

4. Control systems

D. Content of each manual or chapter shall include but not be limited to the following:

1. Description of system

2. Operating sequence and procedures

a. Step-by-step procedure for system start-up, including a pre-start checklist.
b. Detailed instruction in proper sequence, for each mode of operation.

D. Maintenance instructions and requirements shall be divided into two primary categories: Preventive maintenance and corrective maintenance:

1. Preventive Maintenance:

a. A schedule for preventive maintenance
b. Cleaning
c. Inspection
d. Instruction for minor repairs or adjustments

2. Corrective Maintenance:

a. Corrective maintenance instructions shall be predicted upon a logical effect to cause troubleshooting philosophy and a rapid replacement procedure to minimize equipment downtime
b. Troubleshooting
c. Repair and replacement
d. Safety precautions

F. Manufacturer's Brochures:

This subsection shall include manufacturer's descriptive literature covering devices and equipment used in the system, together with illustrations, exploded views and renewal parts lists. Manufacturer' standard brochures shall be corrected so that the information applying to the actual installed equipment is clearly defined.

G. Submittal of four draft copies of the complete operating and maintenance manual shall be made for review by the Architect-Engineer within 60 calendar days after approval of mechanical equipment shop drawings. One copy will be returned to the Contractor within 30 days after receipt by the Architect-Engineer. Submit final operating and maintenance

manuals bound in three ring binders with tabs and index at least five (5) days prior to the final acceptance inspection.

2.02 TRAINING

A. The Contractor shall train the Owner's representative(s) in the operation and maintenance of all mechanical equipment and systems.

B. Thirty days prior to completion of the building, submit for acceptance the proposed training schedule and scope of materials and techniques.

C. Training shall not commence until the draft copy of the operating and maintenance manual has been approved and returned to the Contractor.

D. The Contractor shall provide training by qualified installation and maintenance personnel for a period of not less than one day. Training shall occur after the project final inspection and shall be performed according to the Operation and Maintenance Manuals and the Design Basis Document for the system.

E. The Contractor shall videotape all training sessions.

F. Furnish three (3) copies of a signed acknowledgement that the Owner's representative(s) have received the specified training.

2.03 MATERIALS

The equipment to be furnished shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these shall be the product of a single manufacturer.

2.04 FLOOR AND CEILING PLATES

Shall be steel, 1-inch split ring type. Finish as noted.
Provide deep dish type over extended floor sleeves.

2.05 ACCESS PANELS

A. Furnish required number of access panels needed to reach and service all service and maintenance points of this Division's work concealed behind finished construction.

B. Indicate the required location of panels to those performing their installation.

C. Panels to be minimum 12"x12" size, and larger where required. Access panels to be (Milcor) Inland-Ryerson Construction Products Co., or (Boico) Birmingham Ornamental Iron Company. Finish steel panels and frames with prime coat or rust inhibitor enamel. Access panel styles to suit location and finish of surface where installed.

D. Furnish panels with the required fire rating where panels are to be installed in a fire treated partition, shaft, etc.

2.06 ANCHOR MATERIALS

Conform materials to Division 5, Metals, for both ferrous and non-ferrous metals. Metal anchors to be same materials as piping, except where Architect-Engineer gives written approval otherwise. Inserts shall be steel, slotted type with end caps. Sleeves shall be 18 gauge mil galvanized sheet metal.

2.07 ELECTRIC MOTORS AND EQUIPMENT

A. U.S. Electric, Westinghouse, General Electric, Allis Chalmers, or accepted equal as required to drive all apparatus specified in other sections of this Division. Motors - sleeve bearing or ball bearing especially selected for quiet operation. Select motors of adequate size to prevent overloading under normal operating conditions. Replace noisy motors with quiet operating motors, where directed by Architect-Engineer.

B. Motors inside building - drip proof, service factor of 1.15.

C. Internal thermal or external low voltage and over current protective device required for each motor.

D. Conform to all other electrical equipment to Division 16 specifications.

E. Starters: Furnish starters under the Mechanical Sections for installation under Division 16. Motor starters as manufactured by Cutler Hammer, Allen Bradley, General Electric or accepted equal, shall meet following requirements:

1. Overload protection on each phase and external to motor overloads with snap-on type connections.

2. Each magnetic starter with red indicating light in the cover.

3. H-O-A switches in cover.

4. Provide necessary auxiliary contacts.

5. Control circuit shall be 24 or 120 volt derived from a suitable sized transformer in each individual starter, one leg grounded and one leg fused or from a separate building circuit.

6. Enclosures: Starters not exposed to weather with NEMA Type 1 enclosures.

7. Each starter shall have an engraved plastic nameplate on the outside cover and an overload heater schedule on the inside cover.

8. Each starter shall be clearly labeled with name of equipment for which is intended as designated on drawings.

2.08 HOISTING, RIGGING, TRANSPORTATION AND SCAFFOLDING

Provide under this Section all necessary hoisting, rigging, transportation and scaffolding to move, position and to install all mechanical equipment and materials.

2.09 EQUIPMENT SUPPORT MATERIALS

Concrete to Division 3 - Concrete. Conform steel to Division 5 -Metals.

2.10 ESCUTCHEONS

Provide chrome plated cast brass spring clamp escutcheons (for 1/4 or 1 inch projecting sleeves as required) at each point where an uninsulated pipe passes through a finished surface.

2.11 INSERTS

Where inserts must be set in poured concrete, use self-drilling screw anchors sized as producer's recommendation for weight and device to be supported. Approved producers are Fee and Mason, J.D. Polis Mf. Co., Phillips Drill Co. or approved equal.

2.11 SLEEVES

Use steel pipe sleeves. Size sleeve lengths to extend through full thickness of sleeved construction and 4 inches above finished concrete floors. Size sleeve diameters to permit clearance for pipe movement and proper grading of pipe. Sleeves for insulated pipe to be of adequate size to clear insulation.

2.13 VEE BELT DRIVES AND GUARDS

A. Cast iron sheave vee belt drives with guard. Motor sheave to be variable pitch type capable of plus or minus 10% speed variation from rated driven RPM. Maximum ratio of driver to driven speed is 6. Size vee belt drives to transmit at least 150% of motor HP.

B. Provide guards for all shaft couplings, rotating and reciprocating machinery.

2.14 NAMEPLATES

Black laminated plastic with white lettering, attached to equipment with screws or rivets.

2.15 FIRE RETARDANT CAULKING COMPOUND

To seal around ducts and pipe sleeves; butyl rubber base single or double components, non-staining type.

2.16 CORROSION COATING

Nokorode Seal-Coat (standard) manufactured by the Lion Oil Company, El Dorado, Arkansas, or approved equal.

2.17 ACCEPTABLE MANUFACTURERS

The design is based on the specified manufacturer only. The Contractor is fully responsible for verifying that any equipment submitted fits the space allotted, and shall bear any costs involved in equipment submitted requires changes in other trades that the submitted equipment affects, ie., electrical, structural, architectural, etc. Equipment shown is as scheduled on the drawings.

PART 3.EXECUTION

3.01 GENERAL

A. Install all materials and equipment in a neat and workmanlike manner, by competent specialists for each subtrade. Installation of materials and equipment not meeting these standards may be condemned by Architect-Engineer and shall be removed and reinstalled by Sub-contractors at no additional cost to Owner. Each Sub-contractor is responsible for safety and good condition of his materials and equipment installed, until Owner's Substantial completion.

B. Make all minor location changes from indications on drawings as necessary to make work conform with building as constructed, to fit work of other trades, or rules of authorities having jurisdiction, at each Sub-contractor's expense.

C. Locate all apparatus symmetrical with architectural elements. Install to exact height and location, where shown dimensioned on drawings. Install work as required to fit structure, avoid obstructions and retain clearance, headroom, openings, and passageways. Do not cut structural members without Architect's prior written approval.

D. Do not deface or endanger any work by cutting, excavating or otherwise altering work previously installed except with written consent of Architects. Each Sub-contractor is to cut all openings and do all excavation and backfill required for installation of his work.

E. Provide pipe sleeves for all piping passing through walls, partitions, slabs on grade or above grade, roof, etc.

F. All welding shall be performed by certified welders. Electric arc welding shall be performed using electrodes conforming with AWS A5.1-69, Classification E6010. Each layer shall be cleaned. Chip out trapped slag and unfused areas before applying next bead. Finished weld shall be visually inspected for cracks, porosity or imperfections. If the weld contains any defects, it shall be repaired to the satisfaction of the Architect-Engineer.

3.02 EQUIPMENT SUPPORTS

A. Provide concrete bases and structural steel to support equipment and piping even where not specifically shown on Structural or Architectural drawings.

B. Provide a raised reinforced concrete base for all floor supported equipment such as air handling units. Provide one common base to support each motor and its driven apparatus.

3.03 ELECTRICAL WORK

Mechanical Sub-contractor will furnish and set all controls necessary for proper operation of this Divisions' systems as identified on Mechanical and Electrical drawings. Furnish starters for all motors. For all equipment provided under this Section, Electrical Sub-contractor will furnish all disconnect switches, manual switches, wiring and conduit.

3.04 PIPING COATING

Coat all ferrous piping with corrosion coating compound. Herein before specified, hand or glove applied, before applying any insulation to the pipes.

3.05 MECHANICAL EQUIPMENT PAINTING

A. Refer to Division 9 - Painting specification section for requirements. Touch-up of damaged equipment painting or finishes is included under this Division.

B. Do not paint nameplates.

C. Stencil piping with designation of function at 10 foot intervals in equipment rooms and at 50 foot intervals throughout building including roof. Abbreviations acceptable: CWS - Condensing Water Supply.

D. Permanently tag valves with coded brass discs or engraved plastic tags attached with brass chain. Coordinate code with operating instructions. Rivet engraved plastic identification nameplates to electric switches and controls.

3.06 IDENTIFICATION CHART AND DIAGRAM

A. Charts and diagrams shall be photographic or equal non-fading reproductions. Provide framed, wall mounted charts and diagrams covered with 1/8 inch thick clear glass or acrylic plastic giving complete list of applicable piping identification system at mechanical room.

B. Provide a valve chart and insert same in the operation and maintenance manual. Valve chart shall include valve location, valve service and valve number. Format shall be accepted by Architect-Engineer.

3.07 NAMEPLATES FOR MECHANICAL EQUIPMENT

A. Shall identify equipment and its function.

B. Nomenclature and equipment numbers shall correspond to those used in preparation of posted operating instructions.

C. Following items shall receive nameplate minimum 1" x 2 1/2":

1. Pilot lights
2. Panel mounted gauges, instruments and meters
3. Starters
4. Switches and push buttons
5. Air handlers

3.08 CLEANING

A. Refrigerant piping: Pull through a clean, dry lintless cloth.

B. Clean ducts and air terminals inside and out before placing in operation.

C. Before testing and balancing is started, do the following:

1. Clean all strainers in piping system.
2. Replace temporary filters in all air handling units.

END OF SECTION

APPENDIX F

SECTION 15420

PIPING SPECIALTIES (PLUMBING)

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide piping specialties (plumbing) including necessary accessories indicated on drawings and specified in this section.

1.02 SUBMITTALS

A. Submit properly identified Manufacturer's literature to the form defined in Section 01340 before commencing work.

1. Shock Absorbers: Catalog cuts.
2. Unions and Flanges: Catalog cuts.
3. Hangers and Inserts: Catalog cuts.
4. Trap Resealers: Catalog cuts.
5. Vacuum Breakers: Catalog cuts.

1.03 RELATED WORK IN OTHER DIVISIONS

Section 15240 – Vibration Isolation
Section 15245 – Vibration Isolation

PART 2 PRODUCTS

2.01 TRAP RESEALERS

A. Water Closet Valve: Sloan Valve Co. F-72-A1 chrome plated with tubing to wall and wall flange.

B. Lavatory or Sink:

1. Josam 88250 cast brass chrome plated with 1/2 inch female union connection and 1/2 inch female outlets, integral vacuum breaker.
2. Chicago Faucet Co., No. 447, Zurn Industries, Inc., Model Z-1022 or accepted equivalent.

C. Remote Location: Precision Plumbing Products Model P.1 or P.2 as applicable, machined brass valve with integral vacuum breaker, pressure adjustment and distribution unit(s) with visual operations inspection cover where required for multiple connections.

2.02 SHOCK ABSORBERS

A. Josam 75000 stainless steel shell, elastomeric bellows, pressurized argon charge, sized per PDI-WH 201 at each branch of cold and hot water or as shown on drawings and/or required.

B. Zurn Industries, Inc., Model Z-1700 or accepted equivalent.

2.03 VACUUM BREAKERS

A. Hose Bibb Vacuum Breaker: Watts Regulator Co., Model No. 8A non-removable type.

B. Atmospheric Type: Watts Regulator Co., Model No. 288A.

C. For Plumbing Fixtures: As specified under Section 15450.

2.04 UNIONS AND FLANGES

A. Steel Pipe 2-1/2 Inches and Smaller:
1. Malleable iron unions with brass seat.
a. Galvanized pipe requires galvanized unions.

B. Steel Pipe 3 Inches and Larger:
1. Bronze flanged connections 150 pound Class.
a. Galvanized pipe requires galvanized unions.

C. Copper Pipe 2-1/2 Inches and Smaller: Bronze unions.

D. Copper Pipe 3 Inches and Larger: Bronze flanged connections 150 pound Class.

E. Dielectric Unions or Flanges:
1. Meet dimensional requirements and tensile strength of pipe unions or flanges in accordance with Fed. Spec. WW-U-531D.
2. Suitable for required operating pressures and temperature conditions.
3. Provide metal connections on both ends.
a. Ends shall be threaded or soldered to match adjacent piping.
4. Separate metal parts of union to prevent current flow between dissimilar metals.

2.05 ESCUTCHEONS

A. Provide escutcheons securely in place on exposed pipes where they pass thru walls, partitions, floors and ceiling of finished areas unless otherwise noted on drawings.

1. Interior Walls, Partitions and Ceilings:
a. Solid or stamped chrome plated brass or stainless steel, one piece or split pattern.

2. Floors and Exterior:
a. Solid cast brass, rough chrome plated or cast nickel bronze alloy, one piece or split pattern.

2.06 FLEXIBLE CONNECTORS

A. Rubber flexible pipe, 125 psi minimum working pressure rating, 6 inch maximum length.

1. Install in strict accordance with manufacturer's recommendations.
2. Accepted Manufacturers: Metraflex Style 100 or accepted equivalent.

2.07 PIPE HANGERS AND SUPPORTS

A. Provide hangers, supports and supplementary steel as hereinafter specified for different applications.

B. Insert, Hangers, Rods and Clamps:

1. Figure numbers used refer to Grinnell; Elcen or Michigan Hanger Co. are accepted equivalents.

a. Inserts:
1) Universal Concrete Insert: Fig. 282.

2) CB Junior Concrete Insert: Fig. 279.
3) Wedge Type Concrete Insert: Fig. 281.
4) Expansion Case: Fig. 117.
5) Hangers: Adjustable clevis type.
6) Cast Iron Pipe: Fig. 590.

b. Copper Tubing: Fig. CT-65.
c. Insulated Steel Pipe: Fig. 300.
d. Uninsulated Steel Pipe: Fig. 146.
e. Tube Straps: Fig. 9120.
f. Tin Straps: Fig. 231

2. Rods: Continuous Thread, Fig. 146.

C. Horizontal Steel Piping:

Clamp or Hanger Pipe Size	Rod Diameter	Maximum Spacing
Up to 1-1/4 inches	3/8 inch	8 feet
1-1/2 and 2 inches	3/8 inch	10 feet
2-1/2 and 3 inches	1/2 inch	12 feet
4 and 5 inches	5/8 inch	12 feet
6 inches	3/4 inch	15 feet

D. Horizontal Copper Piping:

Clamp or Hanger Pipe Size	Rod Diameter	Maximum Spacing
Up to 1 inch	3/8 inch	6 feet
1-1/4 and 1-1/2 inches	3/8 inch	6 feet
2 inches	3/8 inch	8 feet
2-1/2 inches	1/2 inch	8 feet
3 and 4 inches	1/2 inch	8 feet

E. Horizontal Cast Iron Piping:

Pipe Size	Rod Diameter	Maximum Spacing
Up to 4 inches	1/2 inch	5 feet
4 inches	5/8 inch	5 feet
6 inches and larger	3/4 inch	5 feet

F. Insulation Protection Shield: Fig. 167.

G. Wall Access: As specified under General Provisions.

2.08 BACKFLOW PREVENTOR: Backflow preventer shall be of the reduced pressure principle furnished with shut-off valves, ball type test cocks and air gap connection in drain line. Watts Series 900 and 909, BEEco by Hersey Products, Inc. or equal.

PART 3 EXECUTION

3.01 INSPECTION

A. Do not proceed with the work of this section until conditions detrimental to the proper and timely completion of the work have been corrected in an acceptable manner.

3.02 PIPE HANGERS AND SUPPORTS

A. Provide adjustable hangers, inserts, brackets, rolls, clamps and supplementary steel as required for proper support of pipe lines.

1. Design hangers to allow for expansion and contractions of pipe lines adequately sized to permit pipe covering to run continuously through hangers.
2. Support piping at equipment independently so that weight is not supported by equipment.
3. Coordinate location of hangers with light fixtures.
4. Wire brush steel or iron supports and prepare surfaces ready for painting specified under Section 09900.

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PES. SEE END OF PROCEDURES SEC.

B. Horizontal Cast Iron Pipe: Place hangers within 18 inches of hub or joint.

C. Hubless Joints: Provide support at every other joint except that when length between supports exceeds four feet, support each joint.

D. Trapeze Clamp or Hangers: Secure pipes supported by trapeze clamp or hangers and not mounted on pipe rolls to trapeze with pipe clamps or "U" bolts.

1. Change of Direction: Place clamp or hangers at each change of direction.
2. Valves and Other Appurtenances in Horizontal Piping: Place clamp or hangers within one foot.
3. Branch Runouts: Place clamp or hangers maximum three feet from end of each branch runout.

E. Insulated Pipes:

1. Provide hangers with a diameter large enough to include insulation.
2. Install a protection shield with each hanger.

F. Special Supports: Clamps, hangers and supports required by equipment manufacturers shall be installed in accordance with equipment manufacturer's recommendations.

G. Plumbers tape, straps, chain, wire hangers or perforated bar WILL NOT be allowed as a means for hanging pipe.

3.03 UNIONS AND FLANGES

A. Provide at connections to piece of equipment and at strainers and control valves.

3.04 ESCUTCHEONS

A. Fit and firmly secure escutcheons to pipes passing through finished floors, ceilings and walls.

1. Size: Provide escutcheons with sufficient outside diameter to adequately cover sleeved openings.

END OF SECTION

APPENDIX G

SECTION 15425

SUPPORTS/ANCHORS – PLUMBING/FIRE PROTECTION

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide supports, anchors and seals including necessary accessories indicated on drawings and specified in this section.

1.02 SUBMITTALS

A. Submit properly identified manufacturer's literature to the form defined in Section 01340 before commencing work.

1.03 REFERENCES

A. Pipe supports: ANSI B31.1, Power Piping.

1.04 RELATED WORK IN OTHER DIVISIONS

Section 15240 – Vibration Isolation
Section 15245 – Vibration Isolation

PART 2 PRODUCTS

2.01 INSERTS

A. Malleable iron case of galvanized steel shell expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

B. Size insert to suit threaded hanger rods.

2.02 PIPE HANGERS AND SUPPORTS

A. Hangers:
1. Pipe sized 1/2 Inch to 1-1/2 Inch: Adjustable wrought steel ring.
2. Pipe sizes Two Inches and Cold Pipe Six Inches and Over: Adjustable wrought steel clevis.

B. Hangers:
1. Hot Pipe Size Six inches and Over: Adjustable steel yoke and cast iron roll.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods, cast iron roll and stand for hot pipe six 6 inches and over.

D. Wall Support:
1. Pipe Sizes to Three Inches: Cast iron hook.
2. Pipe Sizes Four Inches and Over: Welded steel bracket and wrought steel clamps.

E. Vertical Support: Steel riser clamp.

F. Floor Support:
1. Pipe Sizes to Four Inches and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier to steel support.

2. Hot Pipe Sizes Six Inches and Over: Adjustable cast iron roll and stand, steel screws and concrete pier or steel support.

G. Design hangers to impede disengagement by movement of supported pipe.

H. Provide copper plated hangers and supports for copper piping or provide sheet lead packing between hanger or support and piping.

2.03 HANGER RODS

A. Provide steel hanger rods, threaded both ends, threaded one end or continuous threaded.

2.04 FLASHING

A. Steel flashing: 26 gage stainless steel.

B. Safes:
1. 5 lbs./sq. ft. sheet lead or 8 mill thick neopreme.

C. Caps:
1. Stainless Steel, 22 gage minimum except 16 gage at fire resistant structures.

2.05 SLEEVES

A. Pipe Through Floors:
1. Form from 18 gage galvanized sheet metal.

B. Pipes Through Beams, Walls, Fireproofing, Footings, Potentially Wet Floor:
1. Form from steel plate or 18 gage galvanized sheet metal.

C. Size large enough to allow for movement due to expansion.

PART 3 EXECUTION

3.01 INSPECTION

A. Do not proceed with the work of this section until conditions detrimental to the proper and timely completion of the work have been corrected in an acceptable manner.

3.02 INSERTS

A. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

3.03 PIPE HANGERS AND SUPPORTS

A. Support Horizontal Steel and Copper Piping as Follows:

Nominal Size (in)	Pipe Distance Between Support (ft.)	Hanger Rod Diameter (in.)
1/3	6	3/8
3/4 to 1-1/2	6	3/8

Nominal	Pipe Distance Between	Hanger Rod

Size (in)	Support (ft.)	Diameter (in.)
2 & 2-1/2	10	3/8
3 & 4	12	5/8
6 to 12	14	7/8
14 to 18	20	1

B. Install hangers to allow minimum 1/2 inch clear space between finished covering and adjacent work.

C. Place a hanger within one foot of each horizontal elbow.

D. Use hangers which are vertically adjustable 1-1/2 inch minimum after piping is erected.

E. Provide multiple or trapeze hangers where several pipes can be installed in parallel and at same elevation,

F. Support riser piping independently of connected horizontal piping where practical,

3.04 PRIMING

A. Prime coat exposed steel (not galvanized) hangers and supports.

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3.05 FLASHING

A. Flash and counterflash where mechanical equipment passes through weather or waterproofed walls, floors and roofs.

3.06 SLEEVES

A. Where piping passes through floor, ceiling or wall, close off space between pipe or duct and construction with noncombustible insulation.
   1. Provide tight fitting metal caps on both sides and calk.

END OF SECTION

Pelli Clarke Pelli Architects AA0002494

CHANGE PROPOSAL REQUEST

C.P.R. NO.: 541

DISTRIBUTION:

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PACB	X	CA	X
PCPA (New Haven)	X	YAS	X
PCPA (Miami)	X	IG	X
ARTEC	X	GBBN-Miami	X

MAR 07 2006
Performing Art Center Builders
RECEIVED

PROJECT: PERFORMING ARTS CENTER OF GREATER MIAMI C.P.R. NO.: 541

OWNER: PERFORMING ARTS CENTER MANAGEMENT OFFICE DATE: 03/02/06

TO: PERFORMING ARTS CENTER BUILDERS
4770 BISCAYNE BOULEVARD
SUITE 500
MIAMI, FLORIDA 33128

FROM: PELLI CLARKE PELLI ARCHITECTS
1056 CHAPEL STREET
NEW HAVEN, CT. 06510

SUBJECT: Amendment of Contract Requirement: Paint and Preparation of Supports for HVAC, Plumb, and Fire Protection

PROJECT NO: 9501

Provide an itemized quotation for labor, materials, equipment and services to make the following changes to the Contract work in accordance with Document 00510 - Article 11 - Changes in the Work:

Attach complete breakdown for price quote and justification for any Contract time extensions requested.

Item No. Description

Due to the density of the installation in Mechanical Rooms, the A/E team has accepted the partial completion of the following requirements of the contract specifications:

15420-3.02-A.4
Wire brush steel or iron supports of piping and prepare surfaces ready for painting

15425-3.04-A
Prime coat of exposed steel (not galvanized) hangers and supports for plumbing and fire protection

15890-3.~~09~~ 03-A.10
All angles (used for support) shall be galvanized or shop painted with two coats of rust-resistant paint.

These three items were discussed with CM on site on 11/11/05. Refer to Meeting Minutes. Provide credit to the owner for the portion of this work not completed.

Provide credit to the owner for the deletion of this Portion of the Work. Refer to
005100-7.4..3.2
005100-11.1.4
00700-8.3-A
01028-1.04-B-5

ATTACHMENTS: None

By: Celia Toche	By:
Architect's Representative: Celia Toche Pelli Clarke Pelli Architects	Authorized Representative: Performing Arts Center Management Office