CITY OF MANHATTAN BEACH

City Hall HVAC Improvements

Final Report

July 2, 2019

KITCHELL

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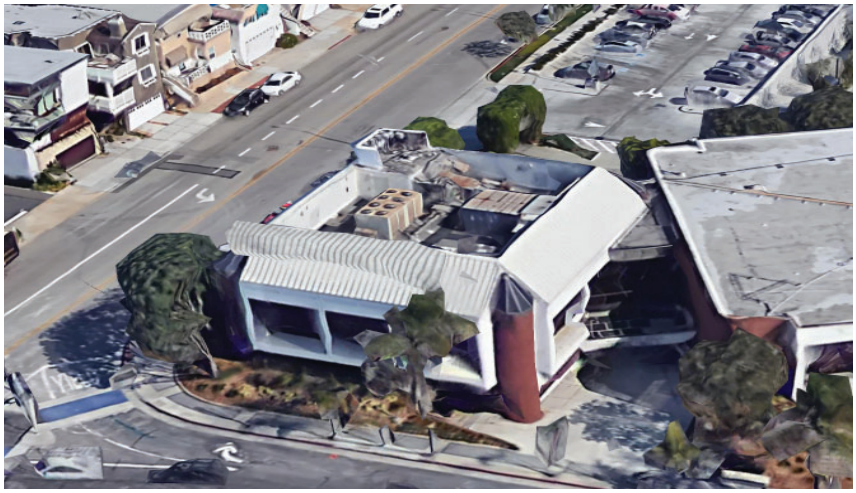
Executive Summary 1

Introduction

In 2019, the City of Manhattan Beach contracted with Kitchell to assess the existing Heating, Ventilation and Air Conditioning (HVAC) systems for the City Hall building located at 1400 Highland Avenue, Manhattan Beach, CA 90266 with the intent of providing recommendations for system upgrades. The building HVAC systems serve the City Council Chambers, the departments of Finance, Parks and Recreation, Community Development, Human Resources, Information Technology and Management Services.

Originally built in 1974, the building consists of two levels with approximately 27,500 square feet of office and administrative spaces. The configuration of the building has been modified multiple times through the years as follows: a partial HVAC retrofit in 1985, a partial renovation for public accessibility around 1995, and site improvements within the Civic Center parking garage to provide access on the east side of City Hall in 2007.

The HVAC systems serving the building consist of multiple air handling units, air cooled chillers, hydronic pumps, exhaust fans, and variable air volume systems (VAV). The HVAC systems have reached the end of their industry standard expected useful service life and are experiencing operational problems including regular system failures. The rusted internal components of the HVAC system have begun to fail, leading to an increased volume of maintenance calls related to thermal discomfort. The frequency of the thermal discomfort has negatively impacted the productivity and operations throughout the facility, to the extent that secure doors must remain open to allow for proper ventilation. The facility maintenance staff has also responded to multiple urgent interventions during off hours, to provide temporary solutions for failures. Continuous use of the existing systems in their current state will spread the corrosive air throughout the internal building systems, leading to further degradation and operational failures.



As part of the analysis, Kitchell developed recommendations to remediate the thermal comfort issues and improve the HVAC systems performance. Kitchell concluded that due to the current condition of the HVAC systems and existing deficiencies, a considerable upgrade to the existing system is required. A phased approach is recommended to prioritize the HVAC upgrades into budget packages. The phased approach will not remediate all issues related to the deterioration of the existing system. However, the phased approach will address the immediate needs required to resolve the failing equipment. By providing the system upgrades, the equipment energy efficiency could be improved by an estimated 30% based on listed SEER ratings by manufacturers.

An alternate recommendation to provide a complete HVAC system replacement with a variable refrigerant flow (VRF) system has been developed for consideration. The VRF system would allow for the greatest enhancement to the building system, energy performance and occupant thermal comfort. Additionally, because the fan coils are directly treating occupied spaces, this could improve energy usage beyond the 50% based on the improvements of SEER ratings as listed by manufacturer.

Summary of Project Goals and Recommendations

Kitchell's team of licensed architects and engineers collaborated with the City of Manhattan Beach to define the project goals:

I. Conduct an objective assessment of City Hall's current HVAC system equipment and performance

II. Prioritize critical system improvements into manageable budget packages

III. Develop alternative system improvement options

Kitchell's analysis recommends the replacement of all the air handlers, chillers, roof exhaust fans, variable air volume (VAV) boxes, rooftop ductwork and HVAC control system upgrades to resolve thermal comfort and performance issues.

Kitchell has prioritized the system improvements into manageable budget packages for like-for-like system improvements and repairs, in order of criticality. The budget packages and design improvement options are designed with the intent of keeping the building operational and minimize disruptions to the operation of the building.

The first budget package identifies the critical system improvements that will have the greatest impact to thermal comfort, HVAC performance and efficiency. Each subsequent package is formatted to provide solutions that improve building performance over time and includes architectural and electrical elements that would potentially be affected.

1. Critical Replacement Items (Package 1) | [$1,358,937] *with Add Alternates*

Package 1 identifies critical replacement items for a Like-for-Like HVAC system replacement with external ductwork replacement. These critical items include equipment replacement required to keep the building HVAC operational and have the greatest impact on the improvement of user thermal comfort, overall mechanical performance, and energy usage.

The additive alternates identifies necessary replacement items for a Like-for-Like HVAC system replacement with external ductwork replacement. These necessary items include equipment replacement phased to continue the improvement of energy usage by detaching the basement server room from the main system, improve thermal comfort for the basement occupants, and improve mechanical performance for the exhaust fans that are at the end of their expected useful service life due to salt-air corrosion.

It was observed that all exposed outdoor mechanical air handlers and chilling equipment, ductwork, and piping are in extremely poor condition. This is in great part due to the salt-air corrosion and the age of the HVAC equipment, ductwork, piping and controls. The majority of the equipment is past its useful life and it was noted that several ductwork systems were not connected.

- **New external ductwork and connection of all capped or improperly mounted ductwork.** A new external air distribution will significantly enhance airflow performance and minimize monthly utility costs due to system losses.
- **Replacement of roof mounted air-cooled chiller.** Providing a new air cooled chilling plant with current technology and enhanced unit operating efficiencies will minimize maintenance and high operating costs.
- **Replacement of air handler (AH-1).** A new AH-1 air handler will provide improved heating, cooling and ventilation air to all areas of the first floor level to ensure occupant comfort levels are achieved.
- **Replacement of heating hot water and chilled water pumps.** New hydronic water pumps will ensure flow of heating and chilled water is provided to air handler coils for optimum heating and cooling system performance.

- **Replacement of rooftop chilled/heating hot water piping.** Providing a new hydronic piping system including valves and gauges will eliminate the existing water leaks and improve air handler heating and cooling coil performance and overall system control. A new piping system will minimize monthly operating costs and allow proper monitoring of HVAC equipment operation.
- **Building energy management control system upgrades.** A new energy management system will provide optimum room temperature control for individual thermal zones and allow HVAC components to be quick responding in order to satisfy thermal zone comfort requirements.
- **HVAC system test and balance.** An HVAC system test and balance will ensure all airflows and hydronic flows have been recorded and adjusted to meet the specific engineering heating and cooling requirements. This will provide optimum system performance and eliminate wasted system energy.
- **General building work.** Provide new equipment curbs and patch existing roof where affected by the mechanical work.
- **Electrical work.** Provide new disconnect switches and feeders to new HVAC equipment. Provide new overcurrent protection (starters or circuit breakers).
- **Additive Alternate 1: Replacement of air handler (AH-2).** A new AH-2 air handler for the Assembly Room area will provide improved heating and cooling performance and provide the code required ventilation air needed for this high occupancy area.
- **Additive Alternate 2: Replacement of basement air handler (AH-3) and associated internal ductwork**. A new AH-3 air handler will provide improved heating, cooling and ventilation air to all areas of the basement floor level to ensure occupant comfort levels are achieved.
- **Additive Alternate 3: Replacement of roof exhaust fans.** New roof exhaust fans will provide improved ventilation air to all areas throughout all floors.
- **AdditiveAlternate 4: New redundant dedicated split system serving data server room.** A new redundant dedicated split system serving the data server room will eliminate wasted system energy from the main HVAC by dedicating and isolating the consistent energy load to a smaller single zone.
- **Additive Alternate 5: HVAC system test and balance for equipment approved in additive bid alternate.** An HVAC system test and balance will ensure all airflows and hydronic flows have been recorded and adjusted to meet the specific engineering heating and cooling requirements. This will provide optimum system performance and eliminate wasted system energy.
- **Additive Alternate 6: Electrical work for equipment approved in additive bid alternate.** Provide new disconnect switches and feeders to new HVAC equipment. Provide new overcurrent protection (starters or circuit breakers).
- **Additive Alternate 7: General building work for equipment approved in additive bid alternate.** Provide new equipment curbs and patch existing roof where affected by the mechanical work.

2. Impending Replacement Items (Package 2) | [$332,639]

Package 2 identifies impending replacement items for a Like-for-Like HVAC system replacement with external ductwork replacement. These impending items will improve the user thermal comfort and mechanical performance by replacing all existing variable air volume (VAV) terminals, with and without reheat capabilities, at both basement and first floor levels, replacing supply and return air diffusers and grilles at the basement and first floor levels. The VAV terminals have been updated since the original construction; however, the dampers, actuators and valves are slow responding due to age of the components and the outdated pneumatic controls. The existing diffusers are performing poorly due to age. Additional electrical circuits will be provided as necessary.

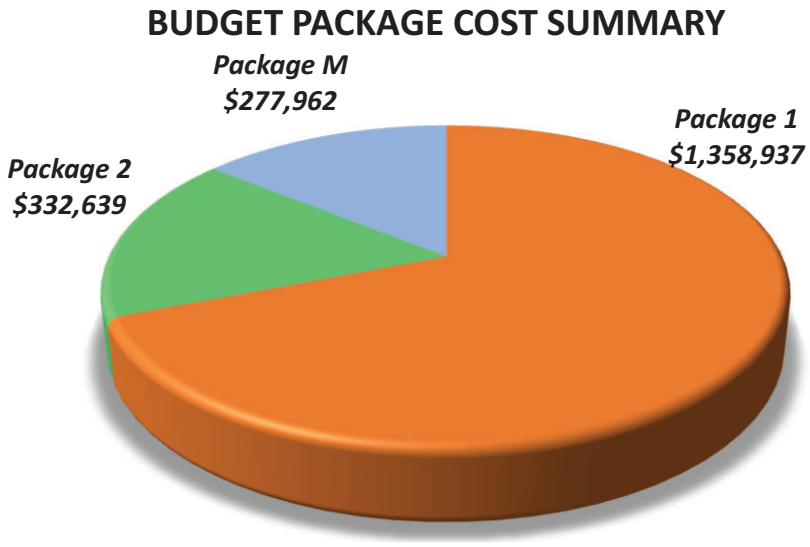
- **Replacement of VAV boxes and associated ductwork.** New VAV boxes will provide improved ventilation air and air distribution controllability to all areas throughout all floors.
- **Replacement of air distribution devices.** New air distribution boxes will provide improved air distribution to all areas throughout all floors improving thermal comfort to the occupant.
- **Electrical work.** Provide new feeders to new VAV boxes. Provide new overcurrent protection (circuit breakers).

3. Maintenance Items (Package M) | [$277,962]

Package M identifies all work that can be accomplished by the City's in-house staff. This work is supplemental to all previous package improvements and is required based on specific work conducted. Removal and replacement of bird screens and the removal and reinstallation of existing ceiling and light fixtures will be required to accommodate the replacement of existing HVAC systems. Removal and reinstallation of existing light fixtures will require replacement of existing lighting controls in order to meet Title 24.

- **Remove and reinstall light fixtures to accommodate HVAC work.** Accommodates HVAC upgrades and improvements impacted by work above the ceiling.
- **Remove and reinstall suspended ceiling to accommodate impacted HVAC work.** Accommodates HVAC upgrades and improvements impacted by work above the ceiling.
- **Remove and replace bird screen.** Removal will allow construction material access for the roof level HVAC upgrades and improvements. Providing a new replacement bird screen mesh will prevent wildlife interference once the work is complete.

City of Manhattan Beach			
Budget Packages Cost Summary			
Package 1	**Package 2**	**Package M**	**Total**
Critical Replacement Items	**Impending Replacement Items**	**Maintenance Items**	
$1,358,937	$332,639	$277,962	**$1,969,538**



PACKAGE NO.	COST ESTIMATE	THERMAL COMFORT IMPROVEMENTS	ENERGY IMPROVEMENTS	LONGEVITY IMPROVEMENTS
1	$1,358,937	HIGH	HIGH	HIGH
2	$332,639	MODERATE	MODERATE	HIGH
M	$277,962	LOW	LOW	LOW
VRF Design Alternate	$3,282,687	HIGH	HIGH	HIGH

Conclusion

A phased approach is recommended to prioritize and address the key needs of replacing the main failing systems over the span of manageable budget packages. The phased approach will address the immediate needs required to resolve the failing equipment. It will not solve all issues experienced by the deterioration of the existing system as a like-for-like equipment replacement will not improve user controllability, individual system energy efficiencies (SEER/EER) and system performance to anticipate system longevity.

The design alternate recommendation to provide a variable refrigerant flow (VRF) system redesign will allow for the largest flexibility of individual office thermal comfort control, but will also provide the greatest enhancement to the building's system and energy performance.

Existing Conditions 2

A. Summary

On March 12th, 2019 Kitchell conducted a kick-off meeting as well as a mechanical and electrical site evaluation with City staff. During this visit to the site present conditions of interior spaces were observed, and indoor and roof top HVAC equipment and associated electrical equipment were evaluated.

The rooftop HVAC equipment and control systems have exceeded the industry standard useful life. Extensive salt-air corrosion due to marine air has impacted all air handling units, exhaust fans, air cooled chillers, air distribution, hydronic piping and pneumatic control systems indicating the source of the operational deficiencies and user discomfort. The server room in the basement does not have a dedicated unit and is supplied from the main hydronic system serving the offices causing a large consumption of energy to keep the server room operational.

On April 2nd, 2019 American Air Balance Co., Inc. conducted a test and balance report to verify and evaluate the impact of the HVAC equipment age and marine-air corrosion to the air distribution systems throughout the building. Their evaluation confirms that several internal critical HVAC equipment components were in either poor or inoperable condition. They also identified inefficient energy usage due to the inadequate airflows of several air distribution diffusers. These diffusers were either not connected properly or capped preventing adequate airflow into the space. There were also several variable air volume (VAV) boxes receiving no air flow due to inoperable controls.

B. Site

Located at the southeast corner of Highland Avenue and 15th Street in the City of Manhattan Beach, the City Hall building was constructed in 1974. It is located on a large city block along with Fire Department Station 1, Police Department, a branch of the Los Angeles County Library, Civic Center parking garage and a mixed-use development on the southwest corner. Public entry to the building is provided on the basement level accessed from Highland Avenue and from the first floor level of the Civic Center parking garage.

C. Mechanical

The building's space conditioning is provided by three (3) separate air-handling units (AH-1, AH-2 & AH-3). Air handlers AH-1 and AH-2 are exterior units and are located in an equipment roof well. The main air handler, AH-1, provides conditioned air to the entire first floor level while AH-2 serves the Council Chambers at the basement level. These units are original from 1974. The components of these two (2) air handlers include chilled and hot water coils, supply and relief fans, filter sections and ducted outside air hoods with motorized dampers and controls **(see Photos 1 and 2).**

The indoor air handler unit, AH-3 installed in 1994, is located in the basement and serving the Administration, Storage, Training and Public Works areas. This air handling unit includes a direct expansion (DX) cooling and hot water coil, supply fan, filter section, room plenum relief and outside air intake louvers with motorized dampers and controls **(see Photo 3).** The hot water coil at AH-3 unit has been disconnected and electric heaters serving all areas except the server room have been installed in the duct mains **(see Photo 4).**

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

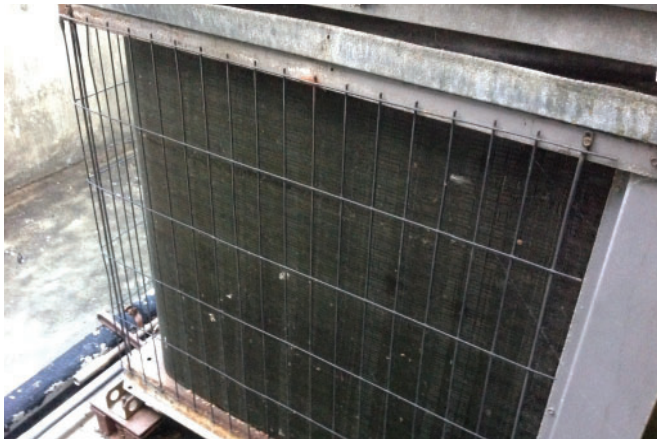


Photo 8

The exposed supply and return ductwork, in the equipment well from units AH-1 and AH-2, extends through the roof deck and into the ceiling space at both the first floor and basement levels **(see Photo 5).** A supply air distribution system with variable air volume (VAV) terminals is routed in the ceiling space at both floor levels and is connected to the respective air handling unit and cooling/heating zone which it serves **(see Photo 6).** The ceiling space above the first floor and basement serve as a return air plenum for all three (3) air handling systems and contains minimal ductwork.

A roof mounted air cooled chiller (ACCH-1) installed in 1992, provides chilled water for both AH-1 and AH-2 **(see Photo 7).** The insulated and jacketed chilled water piping routed on the roof from the chiller to the two (2) air handlers includes pumps, valves and temperature gauges. The basement air handler, AH-3, has a dedicated air cooled condensing unit (CU-1) located in a ventilated sub-vault with an open grate at grade level **(see Photo 8).**

All three (3) air handlers are served by a roof mounted hydronic hot water boiler plant (B-1), located within a mechanical room located on the roof level. The insulated and jacketed hot water piping system from B-1 is routed exposed on the roof and serves AH-1 and AH-2. Hydronic piping from B-1 extends through the roof deck and serves the abandoned hot water coil at AH-3 and several active duct mounted hydronic hot water coils located at first floor and basement levels.

The building is equipped with several split heat pump systems dedicated to serve electrical and audio visual rooms **(see Photo 9).** A portable cooling unit is dedicated to serve the Data Server Room at the basement level **(see Photo 10).** The Data Server Room is also served by AH-3.

An existing Inergen fire suppression system including tanks, piping, nozzles and controls is located in the Data Server Room and is dedicated to this space. This fire suppression system is to remain with no changes.

A partial controls system upgrade was completed the 1994 basement remodel. A new main Novar control system was installed in 2014. The existing control system is still a primarily pneumatic type with the controls system air compressor located in the basement mechanical room **(see Photos 11 and 12).** Control wiring and tubing extends to the various HVAC thermostats and components serving the building.

Photo 9

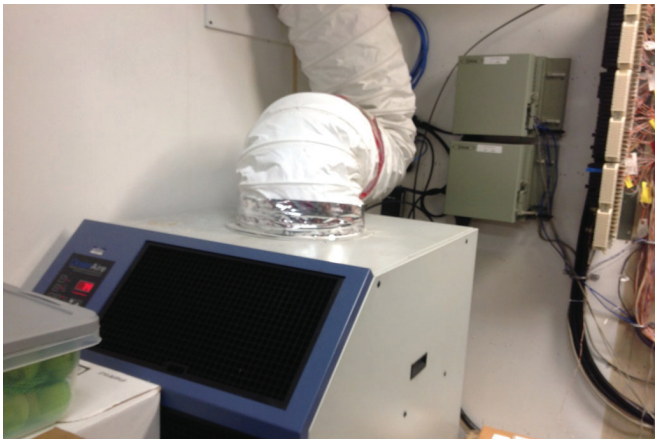


Photo 10

Photo 11

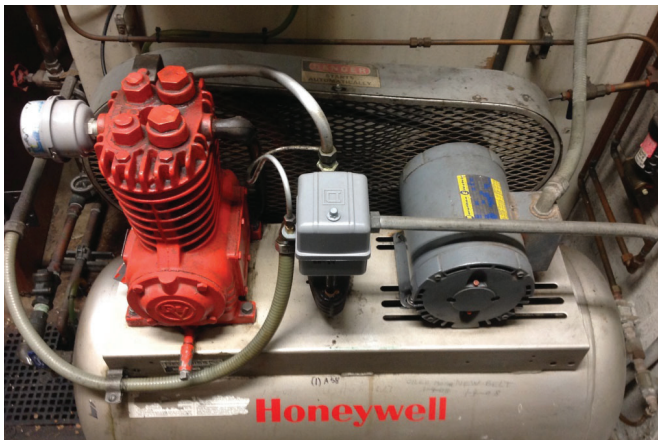


Photo 12

D. Architectural

Consisting of two levels, the City Hall building is divided into two wings with connecting lobbies on both levels. The northern wing houses the Council Chambers and City executive offices. The building has sloped screen on all exterior walls, creating a roof well that houses most of the HVAC equipment. The equipment consists of air cooled chillers, air handlers and boiler plants. The southern wing houses Community Development and Parks and Recreation departments.

The mechanical equipment in the roof well serves both wings, with the exception of the equipment located in a light well which serves part of the basement level in the south wing.

Both wings are covered with modified bitumen roofing membrane of indeterminate age. The roofing is in fair condition with the exception of rock grandules loss in high traffic areas. It is recommended that more rock grandules be added as they are essential for protection of the membrane assembly **(see Photo 13).** The screen walls around the north wing roof well are prefinished metal panels, which appear to be in fair condition. Any improvements to the rooftop HVAC systems will require the removal and replacement of the equipment, which will affect the roofing.

In areas where the roof will be impacted by the required equipment replacement, it is recommended to tear out local patching and the elastomeric coating on the roofing membrane. However, this short term solution will require the replacement of the entire roofing system within five to ten years. A long term and more cost effective solution would be to replace the entire roofing membrane in conjunction with the HVAC equipment installation.

Some of the mechanical design options consist of roof mounted HVAC equipment on the south wing. A pre-engineered, five (5) foot tall, rooftop screen around the center of the roof will be required to minimize public sightline of the equipment. The wall can be anchored as needed to the structural steel beam members below the roof assembly. Prefinished with light colored paint coating on galvanized metal panels, the screen walls can be as unobtrusive as possible on viewing the building from any side.

Photo 13

Photo 14

Photo 15

The roof well is covered with bird netting supported by tensioned wires at the perimeter and spanning across the well. The netting is draping and touching the top of some mechanical equipment, and it has openings that permits birds to roost inside the well **(see Photo 14).** For replacement of any mechanical equipment on the roof, the netting will need be removed for equipment access by crane. After the work is done on the roof, the existing wires should be re-tensioned and new netting installed to keep the well and equipment free of birds.

On the interior, approximately a quarter of the existing rooms have a hard lid ceiling, with the remainder consisting of acoustic ceiling tile in a suspended ceiling grid. Most of the existing spaces have plenum air returns, meaning that the supplied heated or cooled air provided to the spaces will return to the mechanical units by an open space between the ceiling and the deck located above. On the first floor, the deck above is that of the roof, and roof insulation consisting of unfaced fiberglass insulation is exposed on the underside of the deck **(see Photo 15).** It is recommended that the supply air be tested to ensure that transference has not occurred in the supply ductwork and affected the indoor air quality. Routine maintenance of AHU filtration system should prevent any transference. Ducted returns on all systems are recommended to prevent transfer and improve occupant air quality. Where mechanical design options require replacement or installation of ducts, the hard ceiling finish and framing will be removed as required for mechanical work and then replaced in kind. Where suspended acoustic ceiling tiles are present, the tiles will be removed as required and reinstalled when mechanical work is complete. The first floor of the south wing ceiling tiles appear to be original to the building and cannot be adapted for new mechanical diffusers and returns. Therefore, new ceiling tiles which will utilize some of the existing suspended grid will be required after mechanical work is completed. In the Council Chambers, the mechanical work in the ceiling can be done within the plenum without any ceiling demolition. During the entire removal/replacement process, all the existing wall and floor finishes will need to be protected; any damage done will need to be restored to its original condition. Hazardous material was not part of our scope of work for this project. No survey for hazardous materials was provided or noted during the site investigation.

Americans with Disabilities Act (ADA) improvement review was not in the scope of work for this evaluation. A 2% ADA contingency has been provided in the estimates should there be any upgrades required by Authority Having Jurisdiction (AHJ).

E. Structural

The building's primary gravity structural system consists of a reinforced concrete joist, beam and slab at the first floor supported by concrete foundation walls and columns in the basement bearing on reinforced concrete continuous footings and spread footings respectively. Above the first floor slab, the building system is reinforced clay masonry block exterior walls and interior steel columns supporting the steel roof beams. Both wings of the first floor east and west sides have concrete cantilevered beams and piers forming the sunshades for the window openings. Sloping roofs on all sides of the north wing consist of reinforced spray-on concrete (Gunite) on metal deck with steel beam and column supports. Where roof mounted mechanical units occur, concrete housekeeping slabs of 6" thickness are used to support the heavier mechanical units. The basement concrete slab on grade is 4 inches thick and reinforced with welded wire fabric.

The building's primary lateral-force-resisting-system consists of metal roof deck and first floor concrete diaphragm, and reinforced clay masonry walls and concrete moment frames on reinforced concrete foundation walls with continuous concrete footings. Where new mechanical equipment is installed on the north wing roof, it can be placed on the existing concrete housekeeping slabs. The new equipment will need to be supported by W8 x 10 steel hanger beams on all sides and bolted to the existing roof beams. Mechanical screens can be supported by bolting onto new support hanger beams attached to roof beams.

F. Electrical

Main switchboard MSB, which provides power to the building, is located in the basement electrical roof and is rated 1200 amps at 480/277V, 3 phase, 4 wire. The equipment appeared to be in fair condition with no issues reported by maintenance personnel **(see Photo 16).**

Main Switchboard MSB feeds Motor Control Center MCA which is located on the roof. MCA provides power to the roof mounted HVAC equipment. MCA appeared to be in fair condition with no issues reported by maintenance personnel **(see Photo 17).**

Emergency power is provided to some building loads by a 250 KW emergency generator located on the basement level in an outdoor enclosure. The generator feeds Switchboard SBA via an automatic transfer switch. Both Switchboard SBA and the automatic transfer switch are located in the basement electrical room. Motor Control Center MCA is not fed by emergency generator power.

Utility bills from Southern California Edison show that the peak load at the main switchboard over the last year has been 266 KW (between August 6, 2018 and September 5, 2018). This translates to 288 amps at 480V. Thus, the 1200A main switchboard has adequate capacity for any load increase that may result from this project.

Photo 16

Photo 17

Budget Packages 3

Package 1 Summary of Package

General

Package 1 identifies critical replacement items for a Like-for-Like HVAC system replacement with external ductwork replacement. These critical items include equipment replacement required to keep the building HVAC operational and have the greatest impact on the improvement of user thermal comfort, overall mechanical performance, and energy usage. The total cost to address the items in Package 1 with Alternates included is **$1,358,937.** The critical items are as follows:

- New external ductwork and connection of all capped or improperly mounted ductwork
- Replacement of roof mounted air-cooled chiller
- Replacement of air handler (AH-1)
- Replacement of heating hot water and chilled water pumps
- Replacement of rooftop chilled/heating hot water piping
- Building energy management control system upgrades
- HVAC system test and balance
- General building work
- Electrical work

Analysis

It was observed that all exposed outdoor mechanical air handlers and chilling equipment, ductwork, and piping are in extremely poor condition. This is in great part due to the salt-air corrosion and the age of the HVAC equipment, ductwork, piping and controls.

Extensive corrosion on air handler equipment AH-1 and chiller unit ACCH-1 shows numerous penetrations through the equipment casing which has impacted the structural integrity of the units and caused the internal insulation to separate from the casing wall **(see Photos 18, 19 and 20).** The deterioration has degraded the equipment allowing moisture to enter the unit and further compromising the internal components and their operation.

Photo 18

Air handler AH-2 also shows significant rust on the unit **(see Photo 21).** The survey and report developed by American Air

Replacement of the equipment with new units incorporating high efficiency motors, and compressors, and double insulated wall unit casing, will reduce maintenance and utility costs and provide

Photo 19

Photo 20

improved heating, cooling and airflow to individual thermal zones. Continued operation of the existing equipment will result in further deterioration of the HVAC components to the point where equipment and unit components will no longer function and provide the needed building space comfort.

The ductwork and hydronic hot and chilled water piping similar to the HVAC equipment also showed extensive corrosion and leaks. Due to deterioration and rusted shut dampers and shafts, the air distribution system does not provide the code necessary ventilation air required for space comfort **(see Photo 21).** All exposed hydronic chilled and hot water piping have evidence of pipe joint leaks, sections of missing pipe insulation and jacketing, broken temperature gauges, in-operative valves and rusted pump motors **(see Photos 22, 23 and 24).** Installation of new insulated ductwork, insulated piping and system components on the roof will eliminate the thermal losses and significantly reduce utility costs.

Improved airflow and hydronic hot and chilled water performance will improve space comfort and allow code ventilation air to enter the supply air distribution system. Without replacement of these components, a continued escalation of utility costs

Photo 21

Photo 22

Photo 23

Photo 24

due to system energy loss in ducts and piping will occur. Inefficient and leaking air distribution with no ventilation air will result in complaints from building occupants.

The controls systems are an outdated pneumatic system that have exceeded their effectiveness in managing the variable air volume (VAV) terminal unit damper actuators and other interfacing HVAC components **(see Photos 25 and 26).** The age of the system air tubing and control wiring will have air and signal losses that will minimize the effectiveness of system operation. Older pneumatic systems can experience an energy penalty ranging between 5% and 15% due to out of calibration system components. Continued use of the existing controls will result in poor system performance and high monthly operating costs. A new controls system utilizing a Building Management System (BMS), and new VAV actuators will significantly improve overall HVAC operating performance, provide better throttling ranges, quicker response for discharge air temperature reset from space, improved signaling for system start and stop schedules and reduction in utility costs.

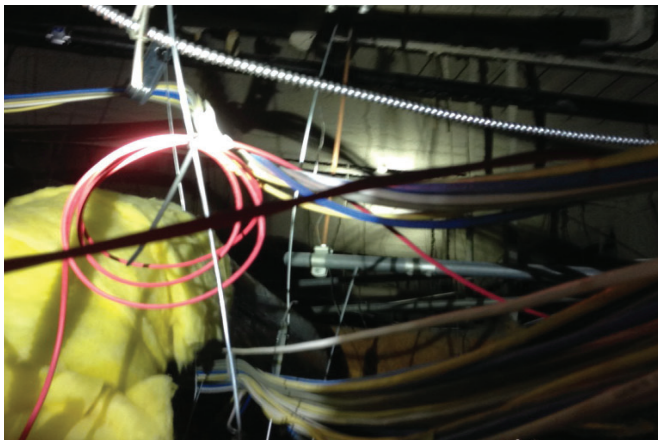


Photo 25

Photo 26

Package 1 Summary of Package

The survey report from American Air Balance indicates a number of diffusers serving the Assembly Room are not properly connected to the air distribution resulting in conditioned air leaking into the ceiling space. To eliminate wasted energy, improve system performance and maintain zone temperatures, it is recommended the diffusers be reconnected.

The HVAC equipment and associated ductwork, piping and controls described in Package 1 have reached their maximum useful operating life and have been identified as high priority for replacement. To ensure continued HVAC operation and optimum space comfort, improved system performance and reduction in operating costs, it is strongly recommended all of the components described in this package be replaced in the near future.

Patchwork on the existing roof will be required to accommodate the demolition of existing equipment and the installation of all new HVAC equipment on the roof.

All existing electrical disconnects associated with demolished HVAC equipment will be demolished. Existing electrical feeders associated with HVAC equipment being demolished will be demolished back to their source panelboard, switchboard, or motor control center.

New electrical disconnects, conduit, and conductors will be provided to all new HVAC units.

New circuit breakers in panelboards/switchboards or new motor starters in motor control centers will be provided to feed new HVAC units.

Package 1A Summary of Package 1 Alternates

General

Package 1A additive alternates identifies necessary replacement items for a Like-for-Like HVAC system replacement with external ductwork replacement. These necessary items include equipment replacement phased to continue the improvement of energy usage by detaching the basement server room from the main system, improve thermal comfort for the basement occupants, and improve mechanical performance for the exhaust fans that are at the end of their expected useful service life due to salt-air corrosion. The necessary items are as follows:

- Replacement of air handler (AH-2) with associated ductwork and test and balance
- Replacement of basement air handler (AH-3) and associated internal ductwork
- Replacement of roof exhaust fans
- New redundant dedicated split system serving data server room
- HVAC system test and balance for equipment approved in additive bid alternates
- Electrical work for equipment approved in additive bid alternates
- General building work for equipment approved in additive bid alternates

Analysis

Air handler AH-2 also shows significant rust on the unit **(see Photo 27)**. The survey and report developed by American Air Balance describes the poor condition of the equipment, the level of corrosion at the equipment, ductwork, piping and the measured airflow performance. The survey results reflect an HVAC system that lacks significantly in performance which is contributing to uncomfortable space conditions.

Photo 27

Package 1A Summary of Package 1 Alternates

American Air Balance describes the poor condition of the equipment, the level of corrosion at the equipment, ductwork, piping and the measured airflow performance. The survey results reflect an HVAC system that lacks significantly in performance which is contributing to uncomfortable space conditions. The indoor AH-3 unit located in the basement mechanical room and serving this area has been field revised from its original configuration. The unit mounted hot water coil has been disconnected and multiple electric duct mounted heaters serving various thermal zones have been installed **(see Photo 28).** This arrangement allows cooling air from AH-3 to serve the Server Room. The use of electrical resistance heating has a tremendous impact to monthly utility costs. Any upgrades relating to the system will result in the need to bring equipment configuartion to current Title 24 standards. The AH-3 unit located inside the building did not experience the corrosion as the outdoor roof mounted air handlers, however the relief air fan, dampers and motors are rusted to the point of being non-operable **(see Photo 29).** The interconnected outdoor cooling condensing unit also showed evidence of salt-air corrosion and was operating with audible excessive noise at the time of the site visit **(see Photo 30).**

Photo 28

Photo 29

Photo 30

Package 1A Summary of Package 1 Alternates

Considering the boiler plant and hydronic piping serving AH-3 unit are already in place and to remain in use, a new AH-3 unit with heating hot water coil and direct expansion refrigerant coil should be provided. A new cooling condensing unit engineered to provide the necessary cooling capacity for the basement level, excluding the Server Room, should be included. This arrangement would allow separate Server Room cooling units to be considered allowing improved overall system operation, lower utility costs, improved zonal temperature control, and reduced maintenance costs.

Similar to Package 1, the American Air Balance survey and report describes the poor condition of the equipment, the level of corrosion, and the measured airflow performance reflecting an HVAC system that lacks significantly in performance. This is a contributing factor to the uncomfortable space conditions being experienced.

The exposed roof mounted exhaust fans serving various toilet room areas in this building are showing evidence of corrosion and poor system performance. Replacement of this equipment with new fans of equal performance and configuration will significantly improve proper air distribution and system performance **(see Photo 31).**

Photo 31

The HVAC equipment and improper zoning and use of electric resistance heating described in Package 2 have not only reached their maximum useful operating life but should considered for replacement to ensure improved HVAC system operation and reduction in operating costs. This package is not considered as critical for system upgrade as compared to Package 1, however mechanical component replacement and dedicated new cooling equipment for the Server Room is recommended.

Patchwork on the existing roof will be required to accommodate the demolition of existing equipment and the installation of all new HVAC equipment on the roof.

All existing electrical disconnects associated with demolished HVAC equipment will be demolished. Existing electrical feeders associated with HVAC equipment being demolished will be demolished back to their source panelboard or switchboard.

New electrical disconnects, conduit, and conductors will be provided to all new HVAC units.

New circuit breakers in panelboards/switchboards will be provided to feed new HVAC units.

Package 1 & 1A Summary of Package 1 and Alternates

ESTIMATE WORKSHEET

MANHATTAN BEACH CITY HALL

PROJECT: **HVAC UPGRADE**
PHASE: **CONCEPTUAL**
ESTIMATE DATE: **JUNE 19, 2019**
BID DATE: **OCTOBER 1, 2019**
PREPARED BY: M. CHAPPELL

BUILDING: **PACKAGE 1**
BUILDING GSF: 27,500

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	PACKAGE 1 BASE				
	MECHANICAL DEMOLITION				
	DEMO ROOF MOUNTED AIR COOLED CHILLER CH-1	1	EA	$6,280.50	$6,281
	DEMO ROOF MOUNTED AIR HANDLING UNITS AH-1	1	EA	$1,884.15	$1,884
	DEMO AIR HANDLING UNIT AH-3 IN BASEMENT	1	EA	$1,884.15	$1,884
	DEMO HEATING HOT WATER PUMP	1	EA	$188.42	$188
	DEMO CHILLED WATER PUMP	1	EA	$188.42	$188
	DEMO OUTSIDE AIR HOOD	1	EA	$125.61	$126
	DEMO RAINHOOD	1	EA	$125.61	$126
	DEMO PNEUMATIC DAMPER	45	EA	$62.81	$2,826
	DEMO PNEUMATIC CONTROLS	1	LS	$6,280.50	$6,281
	DEMO DUCTWORK	1	LS	$1,884.15	$1,884
	DEMO CHILLED/HEATING HOT WATER PIPING	225	LF	$5.02	$1,130
	NEW MECHANICAL WORK				
	NEW AIR COOLED CHILLER CH-1 ON ROOF (AH-1 & AH-2)	80	TONS	$1,130.49	$90,439
	NEW ROOF MOUNTED AIR HANDLING UNIT AH-1	17,000	CFM	$5.02	$85,415
	NEW ROOF MOUNTED AIR HANDLING UNIT AH-2	10,300	CFM	$5.02	$51,751
	NEW HOT WATER CIRCULATING PUMP	1	EA	$1,884.15	$1,884
	NEW CHILLED WATER PUMP	1	EA	$4,396.35	$4,396
	NEW OUTSIDE AIR HOOD	2	EA	$628.05	$1,256
	NEW RAINHOOD	2	EA	$628.05	$1,256
	NEW CHILLED WATER PIPING	130	LF	$94.21	$12,247
	NEW SA, RA & EA DUCT IN EXTERIOR EQUIPMENT WELL	2,000	LBS	$18.84	$37,683
	NEW ENERGY MANAGEMENT CONTROL SYSTEM	27,500	SF	$5.65	$155,442
	NEW TEST AND BALANCE	27,500	SF	$1.57	$43,178
	ELECTRICAL WORK				
	DEMO CONNECTIONS TO MECHANICAL EQUIPMENT	5	EA	$567.18	$2,836
	NEW CONNECTION TO CHILLER	1	EA	$2,126.93	$2,127
	NEW CONNECTION TO AIR HANDLING UNIT (AH-1)	1	EA	$1,701.54	$1,702
	NEW CONNECTION TO AIR HANDLING UNIT (AH-2)	1	EA	$1,701.54	$1,702
	NEW CONNECTION TO PUMPS	2	EA	$1,417.95	$2,836
	NEW CIRCUITS IN EXISTING PANEL	5	EA	$708.98	$3,545
	GENERAL BUILDING WORK				
	PATCH EXISTING ROOF	1	LS	$12,500.00	$12,500
	PACKAGE 1 BASE SUBTOTAL				**$534,994**

Package 1 & 1A Summary of Package 1 and Alternates

ESTIMATE WORKSHEET

MANHATTAN BEACH CITY HALL

PROJECT: **HVAC UPGRADE**
PHASE: **CONCEPTUAL**
ESTIMATE DATE: **JUNE 19, 2019**
BID DATE: **OCTOBER 1, 2019**
PREPARED BY: M. CHAPPELL

BUILDING: **PACKAGE 1**
BUILDING GSF: 27,500

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	PACKAGE 1 ALTERNATE				
	MECHANICAL DEMOLITION				
	DEMO ROOF MOUNTED AIR HANDLING UNIT AH-2	1	EA	$1,884.15	$1,884
	DEMO AIR HANDLING UNIT AH-3 IN BASEMENT	1	EA	$1,884.15	$1,884
	DEMO AIR COOLED CONDENSING UNIT ACC-1	1	EA	$1,256.10	$1,256
	DEMO ROOF EXHAUST FANS	4	EA	$314.03	$1,256
	DEMO ELECTRIC DUCT REHEAT COIL	2	EA	$157.01	$314
	DEMO PORTABLE AC UNIT	1	EA	$125.61	$126
	DEMO REFRIGERANT PIPING	20	LF	$7.54	$151
	NEW MECHANICAL WORK				
	NEW ROOF MOUNTED AIR HANDLING UNIT AH-2	10,300	CFM	$5.02	$51,751
	NEW AIR HANDLING UNIT AH-3 IN BASEMENT	1	EA	$25,122.01	$25,122
	NEW ROOF EXHAUST FANS	4	EA	$2,260.98	$9,044
	NEW CONDENSING UNIT (AH-3)	1	EA	$15,073.21	$15,073
	NEW 3 TON SPLIT SYSTEM COOLING UNITS FOR THE SERVER ROOM	2	EA	$9,420.75	$18,842
	NEW CONNECTIONS TO BMS AND AH-3 AND EXHAUST FANS	9,200	SF	$5.65	$52,003
	NEW TEST AND BALANCE	9,200	SF	$1.57	$14,445
	ELECTRICAL WORK				
	DEMO CONNECTIONS TO MECHANICAL EQUIPMENT	9	EA	$567.18	$5,105
	NEW CONNECTION TO AIR HANDLING UNITS	2	EA	$1,701.54	$3,403
	NEW CONNECTION TO EXHAUST FANS	4	EA	$1,417.95	$5,672
	NEW CONNECTIONS TO SPLIT SYSTEMS	2	EA	$1,063.46	$2,127
	NEW CIRCUITS IN EXISTING PANEL	8	EA	$708.98	$5,672
	GENERAL BUILDING WORK				
	PATCH EXISTING ROOF	1	LS	$7,500.00	$7,500
	PACKAGE 1 ALTERNATE SUBTOTAL				**$222,629**
	SUBTOTAL HARD COSTS				**$757,623**
	CONTINGENCY				
	ESTIMATING CONTINGENCY 15.00%				**$113,643**
	SUBTOTAL CONSTRUCTION COSTS				**$871,266**
	MARK-UPS				
	GENERAL CONDITIONS 14.00%				$121,977
	OVERHEAD & PROFIT 12.00%				$119,189
	INSURANCE & BONDS 3.00%				$33,373
	SUBTOTAL MARK-UPS				**$274,539**
	SUBTOTAL CONSTRUCTION COSTS & MARK-UPS				**$1,145,806**

Package 1 & 1A Summary of Package 1 and Alternates

ESTIMATE WORKSHEET

MANHATTAN BEACH CITY HALL

PROJECT: **HVAC UPGRADE**
PHASE: **CONCEPTUAL**
ESTIMATE DATE: **JUNE 19, 2019**
BID DATE: **OCTOBER 1, 2019**
PREPARED BY: M. CHAPPELL

BUILDING: **PACKAGE 1**
BUILDING GSF: 27,500

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	ESCALATION				
	ESCALATION	4.17%			**$47,780**
	FEES				
	DESIGN FEE				**$165,351**
	TOTAL FOR PACKAGE 1:				**$1,358,937**

Package 2 Summary of Package

General

Package 2 identifies impending replacement items for a Like-for-Like HVAC system replacement with external ductwork replacement. These impending items will improve the user thermal comfort and mechanical performance by replacing all existing variable air volume (VAV) terminals with and without reheat capabilities at both basement and first floor levels, replacing supply and return air diffusers and grilles at the basement and first floor levels. The total cost to address these items is **$332,639.** The impending items are as follows:

- Replacement of VAV boxes and associated ductwork
- Replacement of air distribution devices
- Electrical work

Analysis

The VAV terminals have been updated since the original construction however the dampers, actuators and valves are slow responding due to age of the components **(see Photo 32).** The slow responding components interfacing with an outdated pneumatic controls system should be replaced. The replacement of the VAV terminals with new reheat coils, actuators and valves will improve the responsiveness to satisfy room thermostat settings, reduce maintenance and utility costs and provide enhanced zone comfort for room occupants.

The existing diffusers at the basement and first floor levels are mostly original to the building construction. These outlets include perforated face and linear slot diffusers which are poor performing diffusers. To enhance space comfort and provide improved air distribution, the diffusers in these areas should be replaced **(see Photo 33).**

Photo 32

Photo 33

The existing electrical circuits providing power to the existing VAV terminals can be re-used. Additional electrical circuits will be provided as necessary. Multiple VAV terminals can be connected to a single circuit so the cost of additional electrical circuits will be minimal.

Removal and reinstallation of existing light fixtures will require the replacement of existing lighting controls in order to meet Title 24 requirements. Rooms where existing fixtures are being temporarily removed will require occupancy sensors and daylight harvesting controls (where rooms have windows).

ESTIMATE WORKSHEET

MANHATTAN BEACH CITY HALL

BUILDING: **PACKAGE 2**

PROJECT: **HVAC UPGRADE**

BUILDING GSF: 27,500

PHASE: **CONCEPTUAL**

ESTIMATE DATE: **JUNE 19, 2019**

BID DATE: **OCTOBER 1, 2019**

PREPARED BY: M. CHAPPELL

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	MECHANICAL DEMOLITION				
	DEMO VAV BOXES	48	EA	$94.21	$4,522
	NEW MECHANICAL WORK				
	NEW VAV BOXES WITH HW REHEAT	32	EA	$1,507.32	$48,234
	NEW COOLING ONLY VAV BOXES	16	EA	$942.08	$15,073
	NEW AIR DISTRIBUTION DEVICES	130	EA	$376.83	$48,988
	NEW HEATING HOT WATER PIPING MODIFICATIONS TO VAV BOXES	800	LF	$56.52	$45,220
	MODIFY DUCTWORK AT VAV BOXES	1	LS	$15,073.21	$15,073
	ELECTRICAL WORK				
	NEW CONNECTION TO VAV UNITS	48	EA	$708.98	$34,031
	SUBTOTAL HARD COSTS				**$211,141**
	CONTINGENCY				
	ESTIMATING CONTINGENCY	15.00%			**$31,671**
	SUBTOTAL CONSTRUCTION COSTS				**$242,812**
	MARK-UPS				
	GENERAL CONDITIONS	14.00%			$33,994
	OVERHEAD & PROFIT	12.00%			$33,217
	INSURANCE & BONDS	3.00%			$9,301
	SUBTOTAL MARK-UPS				**$76,511**
	SUBTOTAL CONSTRUCTION COSTS & MARK-UPS				**$319,323**
	ESCALATION				
	ESCALATION	4.17%			**$13,316**
	TOTAL FOR PACKAGE 2:				**$332,639**

Package M Summary of Package

General

Package M identifies all work that can be accomplished by the City's in-house staff. This work is supplemental to all previous package improvements and is required based on specific work conducted. The total cost to address these items is **$277,962.** These maintenance items are as follows:

- Remove and reinstall light fixtures to accommodate HVAC work
- Remove and reinstall suspended ceiling to accommodate HVAC work
- Remove and replace bird screens

Analysis

Removal and replacement of the bird screens impacts the replacement of the rooftop mechanical units identified in Package 1. This work will prevent any further damage from outside wild-life after completion of new work.

Removal and reinstallation of existing ceiling and light fixtures will affect work within the ceiling. This work is impacted by control upgrades in Package 1, removal of electric duct reheat coils in Package 1A Add Alternates and the variable air volume (VAV) upgrades in Package 2.

Removal and reinstallation of existing light fixtures will require the replacement of existing lighting controls in order to meet Title 24 requirements. Rooms where existing fixtures are being temporarily removed will require occupancy sensors and daylight harvesting controls (where rooms have windows).

ESTIMATE WORKSHEET

MANHATTAN BEACH CITY HALL

BUILDING: **PACKAGE MAINTENANCE**

PROJECT: **HVAC UPGRADE**

BUILDING GSF: 27,500

PHASE: **CONCEPTUAL**

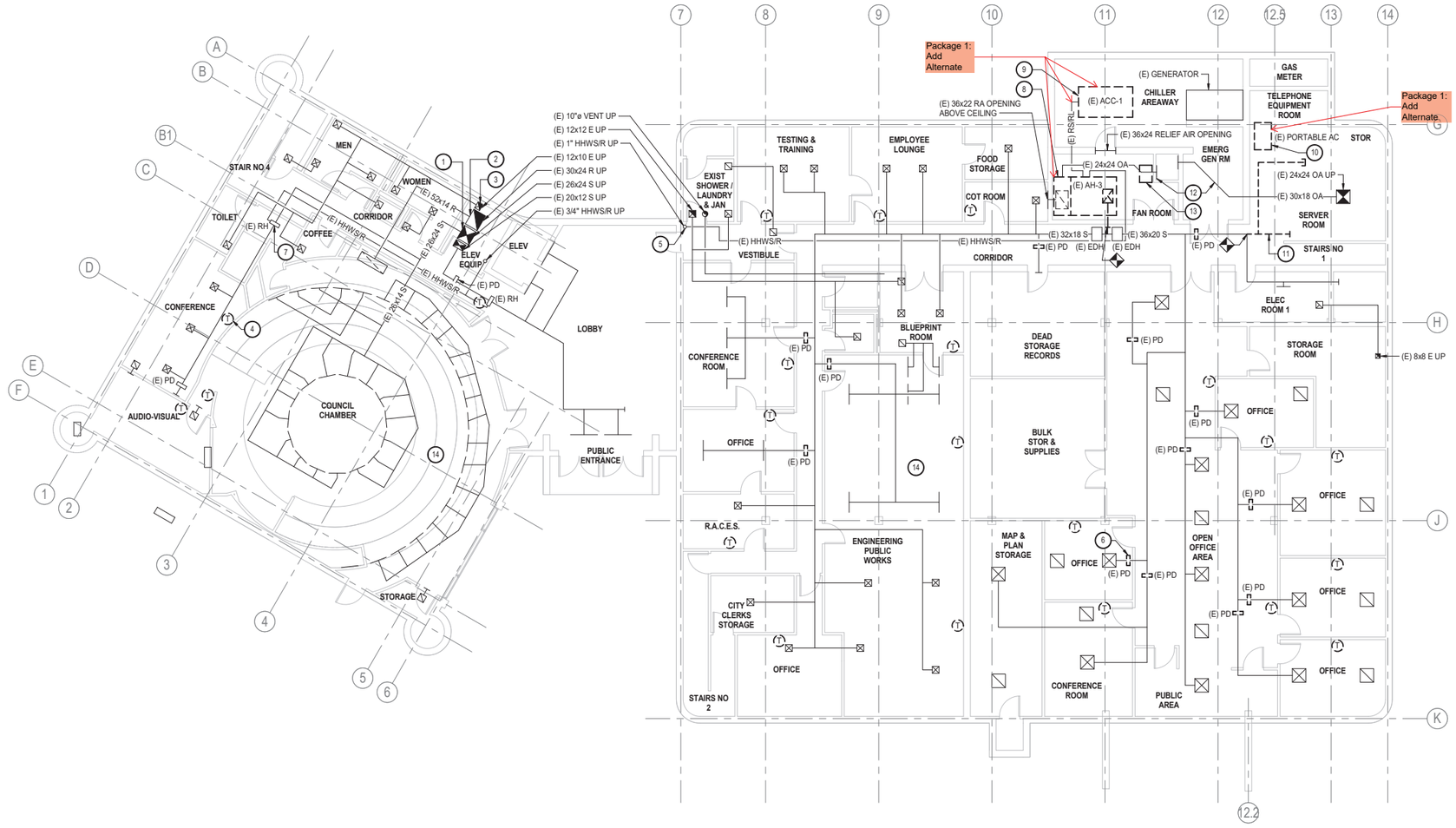
ESTIMATE DATE: **JUNE 19, 2019**

BID DATE: **OCTOBER 1, 2019**

PREPARED BY: M. CHAPPELL

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	ELECTRICAL WORK				
	REMOVE AND REINSTALL LIGHT FIXTURES TO ACCOMMODATE HVAC WORK	16,600	SF	$7.09	$117,690
	GENERAL BUILDING WORK				
	REMOVE & REINSTALL SUSPENDED CEILING	13,280	SF	$4.00	$53,120
	REMOVE & REPLACE BIRD SCREEN	2,250	SF	$2.50	$5,625
	SUBTOTAL HARD COSTS				**$176,435**
	CONTINGENCY				
	ESTIMATING CONTINGENCY	15.00%			**$26,465**
	SUBTOTAL CONSTRUCTION COSTS				**$202,900**
	MARK-UPS				
	GENERAL CONDITIONS	14.00%			$28,406
	OVERHEAD & PROFIT	12.00%			$27,757
	INSURANCE & BONDS	3.00%			$7,772
	SUBTOTAL MARK-UPS				**$63,935**
	SUBTOTAL CONSTRUCTION COSTS & MARK-UPS				**$266,835**
	ESCALATION				
	ESCALATION	4.17%			**$11,127**
	TOTAL FOR PACKAGE MAINTENANCE:				**$277,962**

Budget Package Schematic Design Drawings



1 DEMO MECHANICAL BASEMENT LEVEL
1/8" = 1'-0"

SYMBOL	DESCRIPTION
AC	AIR CONDITIONER
ACC	AIR COOLED CHILLER
AH	AIR HANDLING UNIT
CH	CHILLER
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
DOAS	DEDICATED OUTDOOR AIR SYSTEM
(E)	EXISTING
E	EXHAUST
EF	EXHAUST FAN
HHWR	HEATING HOT WATER RETURN
HHWS	HEATING HOT WATER SUPPLY
HP	HEAT PUMP
HWP	HOT WATER PUMP
(N)	NEW
OA	OUTSIDE AIR
P	PUMP
R	RETURN
RH	REHEAT COIL
RL	REFRIGERANT LIQUID LINE
RS	REFRIGERANT SUCTION LINE
S	SUPPLY
WH	WATER HEATER
VAV	VARIABLE AIR VOLUME

LEGEND

- SUPPLY AIR DIFFUSER
- RETURN AIR GRILLE
- EXHAUST AIR GRILLE
- SUPPLY AIR DUCT RISER
- RETURN AIR DUCT RISER
- EXHAUST AIR DUCT RISER
- POINT OF CONNECTION
- POINT OF DISCONNECT
- THERMOSTAT
- LINEAR DIFFUSER
- PD — PNEUMATIC DAMPER
- RH — REHEAT COIL

KEY NOTES:

1. EXISTING SUPPLY DUCT DROP DOWN FROM FLOOR ABOVE TO REMAIN. ALL EXISTING SUPPLY AIR DUCT DISTRIBUTION AND ASSOCIATED SUPPORTS ABOVE CEILING AND WITHIN BUILDING TO REMAIN. TYPICAL FOR AH-2 AND AH-3.
2. EXISTING RETURN DUCT DROP DOWN FROM FLOOR ABOVE TO REMAIN. ALL EXISTING RETURN AIR DUCT DISTRIBUTION AND ASSOCIATED SUPPORTS ABOVE CEILING AND WITHIN BUILDING TO REMAIN. TYPICAL FOR AH-2 AND AH-3.
3. EXISTING EXHAUST DUCT DROP DOWN FROM FLOOR ABOVE TO REMAIN. ALL EXISTING EXHAUST AIR DUCT DISTRIBUTION AND ASSOCIATED SUPPORTS ABOVE CEILING AND WITHIN BUILDING TO REMAIN. TYPICAL FOR EF-1.
4. DEMOLISH ALL (E) THERMOSTAT AND ALL ASSOCIATED WIRING AND PNEUMATIC TUBING. PREPARE FOR NEW THERMOSTAT/SENSOR CONTROL AT THIS LOCATION.
5. EXISTING HYDRONIC HOT WATER PIPING SUPPLY AND RETURN DOWN FROM FLOOR ABOVE. ALL EXISTING HYDRONIC PIPING AND SUPPORTS ABOVE CEILING AND WITHIN BUILDING TO REMAIN.
6. DEMOLISH ALL (E) PNEUMATIC DAMPER (PD) AND PREPARE FOR NEW VAV BOX AT SAME LOCATION. REMOVE ALL WIRING AND PNEUMATIC TUBING.
7. EXISTING DUCT MOUNTED REHEAT COIL SERVING AH-2 UNIT SHALL REMAIN. PREPARE FOR NEW CONTROLS AND VALVES.
8. DEMOLISH (E) AIR HANDLING UNIT AH-3 AND ASSOCIATED CURB, SUPPORTS, CONTROL SYSTEMS, ACCESSORIES AND DUCT WORK AS SHOWN. REMOVE DUCT MOUNTED ELECTRIC RESISTANCE HEATERS AND RECONNECT SUPPLY AIR DUCT SYSTEMS.
9. DEMOLISH (E) AIR-COOLED CONDENSING UNIT ACC-1 AND ASSOCIATED CURB, SUPPORTS, REFRIGERANT PIPING, CONTROL SYSTEMS AND ACCESSORIES AS SHOWN.
10. DEMOLISH (E) PORTABLE AIR-CONDITIONING UNIT AND ASSOCIATED CURB, SUPPORTS, DUCTWORK, CONTROL SYSTEMS AND ACCESSORIES AS SHOWN.
11. DEMOLISH (E) SUPPLY AIR DUCTWORK FROM AH-3 SERVING DATA SERVER ROOM AS SHOWN. CAP SUPPLY AIR DUCT.
12. EXISTING OUTSIDE AIR DUCT SERVING AH-3 TO REMAIN.
13. DEMOLISH (E) CONTROLS AIR COMPRESSOR AND ALL ASSOCIATED MAIN CONTROL PANELS LOCATED IN FAN ROOM.
14. ALL EXISTING SUPPLY AND RETURN AIR DUCTWORK TO REMAIN AS SHOWN. TYPICAL FOR AH-2 AND AH-3.

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KITCHELL
Capital Expenditure Managers
2450 Venture Oaks Way
Suite 500
Sacramento, CA. 95833
(916) 648-9700

MANHATTAN BEACH CITY HALL
HVAC IMPROVEMENTS
1400 HIGHLANDS AVE, MANHATTAN BEACH, CA 90266

NOT FOR BID
NOT FOR CONSTRUCTION

PROJECT STATUS:
SCHEMATIC DESIGN
BUILDINGS:

SHEET TITLE:
DEMO MECHANICAL BASEMENT PLAN

SCALE: 0 1/2 1 — BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

REVISIONS

No.	Description	Date

JOB NO. 6501A3
DATE 04/15/19
SHEET MD100

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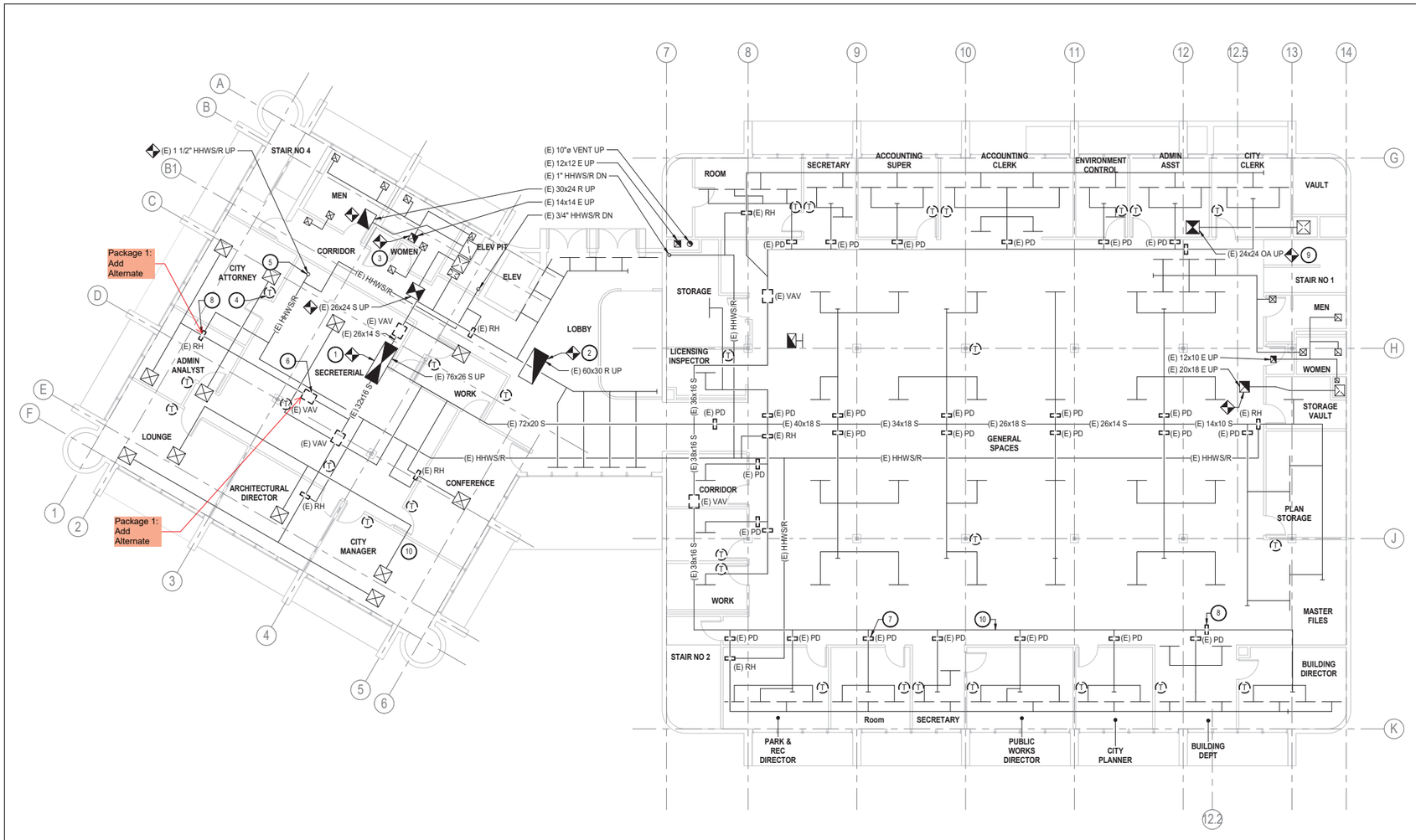

1 DEMO MECHANICAL 1ST FLOOR PLAN
1/8" = 1'-0"

SYMBOL	DESCRIPTION
AC	AIR CONDITIONER
ACC	AIR COOLED CHILLER
AH	AIR HANDLING UNIT
CH	CHILLER
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
DOAS	DEDICATED OUTDOOR AIR SYSTEM
(E)	EXISTING
E	EXHAUST
EF	EXHAUST FAN
HHWR	HEATING HOT WATER RETURN
HHWS	HEATING HOT WATER SUPPLY
HP	HEAT PUMP
HWP	HOT WATER PUMP
(N)	NEW
OA	OUTSIDE AIR
P	PUMP
R	RETURN
RH	REHEAT COIL
RL	REFRIGERANT LIQUID LINE
RS	REFRIGERANT SUCTION LINE
S	SUPPLY
WH	WATER HEATER
VAV	VARIABLE AIR VOLUME

LEGEND

- SUPPLY AIR DIFFUSER
- RETURN AIR GRILLE
- EXHAUST AIR GRILLE
- SUPPLY AIR DUCT RISER
- RETURN AIR DUCT RISER
- EXHAUST AIR DUCT RISER
- POINT OF CONNECTION
- POINT OF DISCONNECT
- (T) THERMOSTAT
- LINEAR DIFFUSER
- PD PNEUMATIC DAMPER
- RH REHEAT COIL

KEY NOTES:

1. EXISTING SUPPLY DUCT DROP DOWN THROUGH ROOF FROM AIR HANDLER ON ROOF. PREPARE FOR NEW DUCT CONNECTION ON ROOF AT THIS LOCATION. ALL EXISTING SUPPLY AIR DUCT DISTRIBUTION AND ASSOCIATED SUPPORTS ABOVE CEILING AND WITHIN BUILDING TO REMAIN. TYPICAL FOR AH-1, AH-2 AND AH-3.
2. EXISTING RETURN DUCT DROP DOWN THROUGH ROOF FROM AIR HANDLER ROOF. PREPARE FOR NEW DUCT CONNECTION ON ROOF AT THIS LOCATION. ALL EXISTING RETURN AIR DUCT DISTRIBUTION AND ASSOCIATED SUPPORTS ABOVE CEILING AND WITHIN BUILDING TO REMAIN. TYPICAL FOR AH-1, AH-2 AND AH-3.
3. EXISTING EXHAUST DUCT DROP DOWN THROUGH ROOF FROM EXHAUST FAN ON ROOF. PREPARE FOR NEW DUCT CONNECTION ON ROOF AT THIS LOCATION. ALL EXISTING EXHAUST AIR DUCT DISTRIBUTION AND ASSOCIATED SUPPORTS ABOVE CEILING AND WITHIN BUILDING TO REMAIN.
4. DEMOLISH ALL (E) THERMOSTAT AND ALL ASSOCIATED WIRING AND PNEUMATIC TUBING. PREPARE FOR NEW THERMOSTAT/SENSOR CONTROL AT THIS LOCATION.
5. EXISTING HYDRONIC HOT WATER PIPING SUPPLY AND RETURN DOWN THROUGH ROOF FROM BOILER ON ROOF. PREPARE FOR NEW HOT WATER PIPING CONNECTION ON ROOF AT THIS LOCATION. ALL EXISTING HYDRONIC PIPING AND SUPPORTS ABOVE CEILING AND WITHIN BUILDING TO REMAIN.
6. DEMOLISH ALL EXISTING VAV BOX AND RECONNECT SUPPLY DUCT SYSTEM. PREPARE HYDRONIC PIPING TO ACCOMMODATE EXTENDING TO NEW HOT WATER COIL. TYPICAL.
7. DEMOLISH ALL (E) PNEUMATIC DAMPER (PD) AND PREPARE FOR NEW VAV BOX AT SAME LOCATION. REMOVE ALL WIRING AND PNEUMATIC TUBING.
8. DEMOLISH ALL (E) DUCT MOUNTED REHEAT COIL. RECONNECT SUPPLY DUCT WORK. PREPARE HYDRONIC PIPING TO ACCOMMODATE EXTENDING TO NEW HOT WATER COIL.
9. EXISTING OUTSIDE AIR DUCT UP TO ROOF TO REMAIN. PREPARE FOR NEW INTAKE HOOD ON ROOF AT THIS LOCATION.
10. ALL EXISTING SUPPLY AND RETURN AIR DUCTWORK TO REMAIN AS SHOWN. TYPICAL FOR AH-1, AH-2 AND AH-3.

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24x36

KITCHELL
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Sacramento, CA. 95833
(916) 648-9700

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1400 HIGHLANDS AVE, MANHATTAN BEACH, CA 90266

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PROJECT STATUS:
SCHEMATIC DESIGN
BUILDINGS:

SHEET TITLE:
DEMO MECHANICAL 1ST FLOOR PLAN

SCALE: 0 1/2 1 BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

REVISIONS

No.	Description	Date

JOB NO. 6501A3
DATE 04/15/19
SHEET MD101

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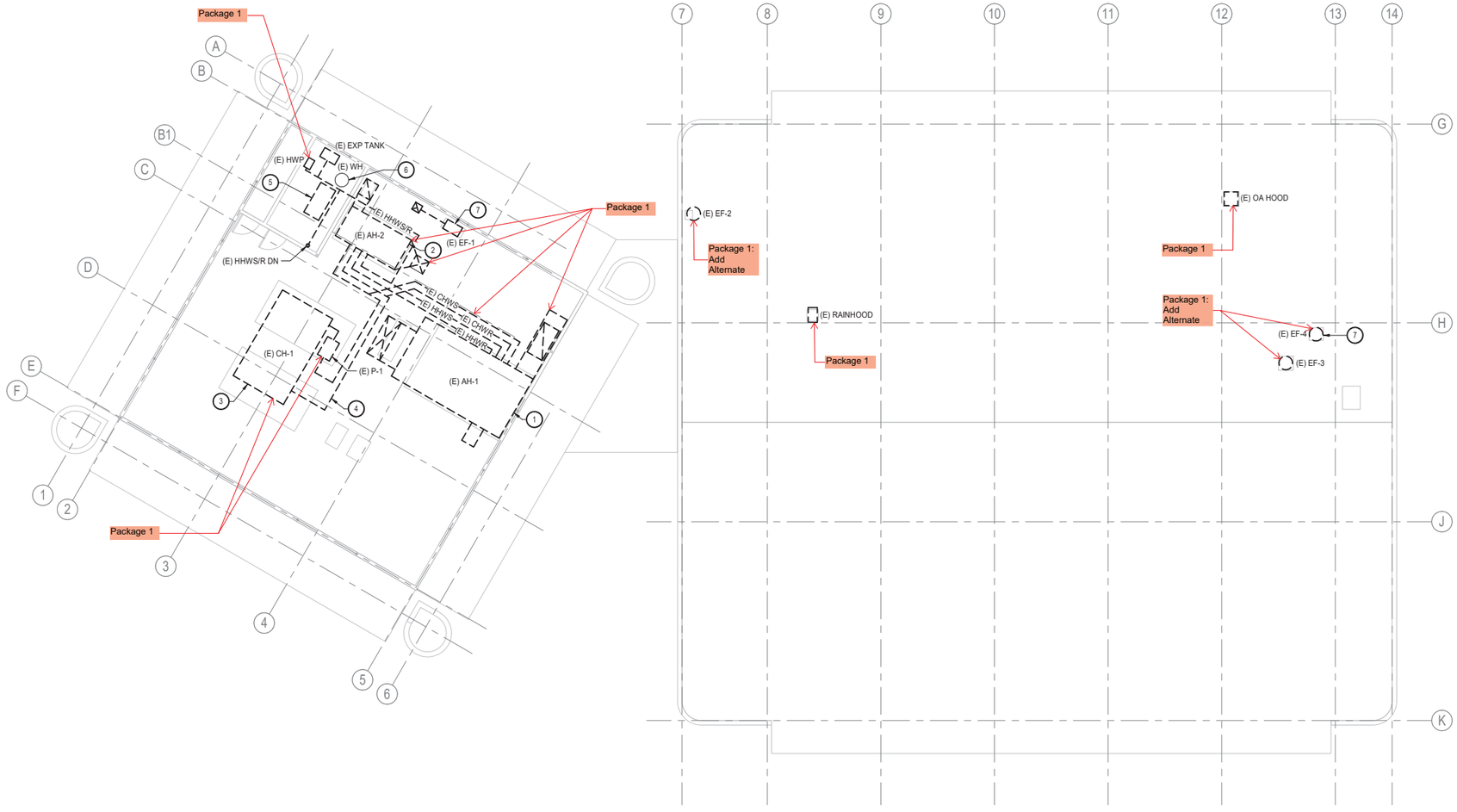

DEMO MECHANICAL ROOF PLAN

1/8" = 1'-0"

SYMBOL	DESCRIPTION
AC	AIR CONDITIONER
ACC	AIR COOLED CHILLER
AH	AIR HANDLING UNIT
CH	CHILLER
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
DOAS	DEDICATED OUTDOOR AIR SYSTEM
(E)	EXISTING
E	EXHAUST
EF	EXHAUST FAN
HHWR	HEATING HOT WATER RETURN
HHWS	HEATING HOT WATER SUPPLY
HP	HEAT PUMP
HWP	HOT WATER PUMP
(N)	NEW
OA	OUTSIDE AIR
P	PUMP
R	RETURN
RH	REHEAT COIL
RL	REFRIGERANT LIQUID LINE
RS	REFRIGERANT SUCTION LINE
S	SUPPLY
WH	WATER HEATER
VAV	VARIABLE AIR VOLUME

LEGEND

- SUPPLY AIR DIFFUSER
- RETURN AIR GRILLE
- EXHAUST AIR GRILLE
- SUPPLY AIR DUCT RISER
- RETURN AIR DUCT RISER
- EXHAUST AIR DUCT RISER
- POINT OF CONNECTION
- POINT OF DISCONNECT
- (T) THERMOSTAT
- LINEAR DIFFUSER
- PD PNEUMATIC DAMPER
- RH REHEAT COIL

KEY NOTES:

1. DEMOLISH (E) AIR HANDLING UNIT AH-1 AND ASSOCIATED CURB, SUPPORTS, CONTROL SYSTEMS AND ACCESSORIES AS SHOWN. REMOVE EXISTING SUPPLY/RETURN/OUTSIDE DUCTWORK AS SHOWN.
2. DEMOLISH (E) AIR HANDLING UNIT AH-2 AND ASSOCIATED CURB, SUPPORTS, CONTROL SYSTEMS AND ACCESSORIES AS SHOWN. REMOVE EXISTING SUPPLY/RETURN/OUTSIDE DUCTWORK AS SHOWN.
3. DEMOLISH (E) AIR-COOLED CHILLER AND ASSOCIATED CURB, SUPPORTS, CONTROL SYSTEMS AND ACCESSORIES AS SHOWN.
4. DEMOLISH (E) CHILLED SUPPLY AND RETURN PIPING, PUMPS, SUPPORTS AND ALL OTHER ASSOCIATED SYSTEM COMPONENTS ON ROOF PLAN AS SHOWN.
5. DEMOLISH (E) BOILER IN MECHANICAL ROOM AND ALL ASSOCIATED SUPPORTS, FLUES, PUMPS, HEATING HOT WATER SUPPLY AND RETURN PIPING ON ROOF PLAN AS SHOWN.
6. EXISTING DOMESTIC HOT WATER TANK AND ASSOCIATED PIPING, PUMPS AND FLUE TO REMAIN.
7. DEMOLISH (E) EXHAUST FAN AND ASSOCIATED SUPPORTS AND DUCTWORK ON ROOF PLAN AS SHOWN.

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24x36

KITCHELL
Capital Expenditure Managers
2450 Venture Oaks Way
Suite 500
Sacramento, CA. 95833
(916) 648-9700

MANHATTAN BEACH CITY HALL
HVAC IMPROVEMENTS
1400 HIGHLANDS AVE, MANHATTAN BEACH, CA 90266

NOT FOR BID
NOT FOR CONSTRUCTION

PROJECT STATUS:
SCHEMATIC DESIGN
BUILDINGS:

SHEET TITLE:
DEMO MECHANICAL ROOF PLAN

SCALE: 0 1/2 1 BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY.

REVISIONS

No.	Description	Date

JOB NO. 6501A3
DATE 04/15/19
SHEET MD102

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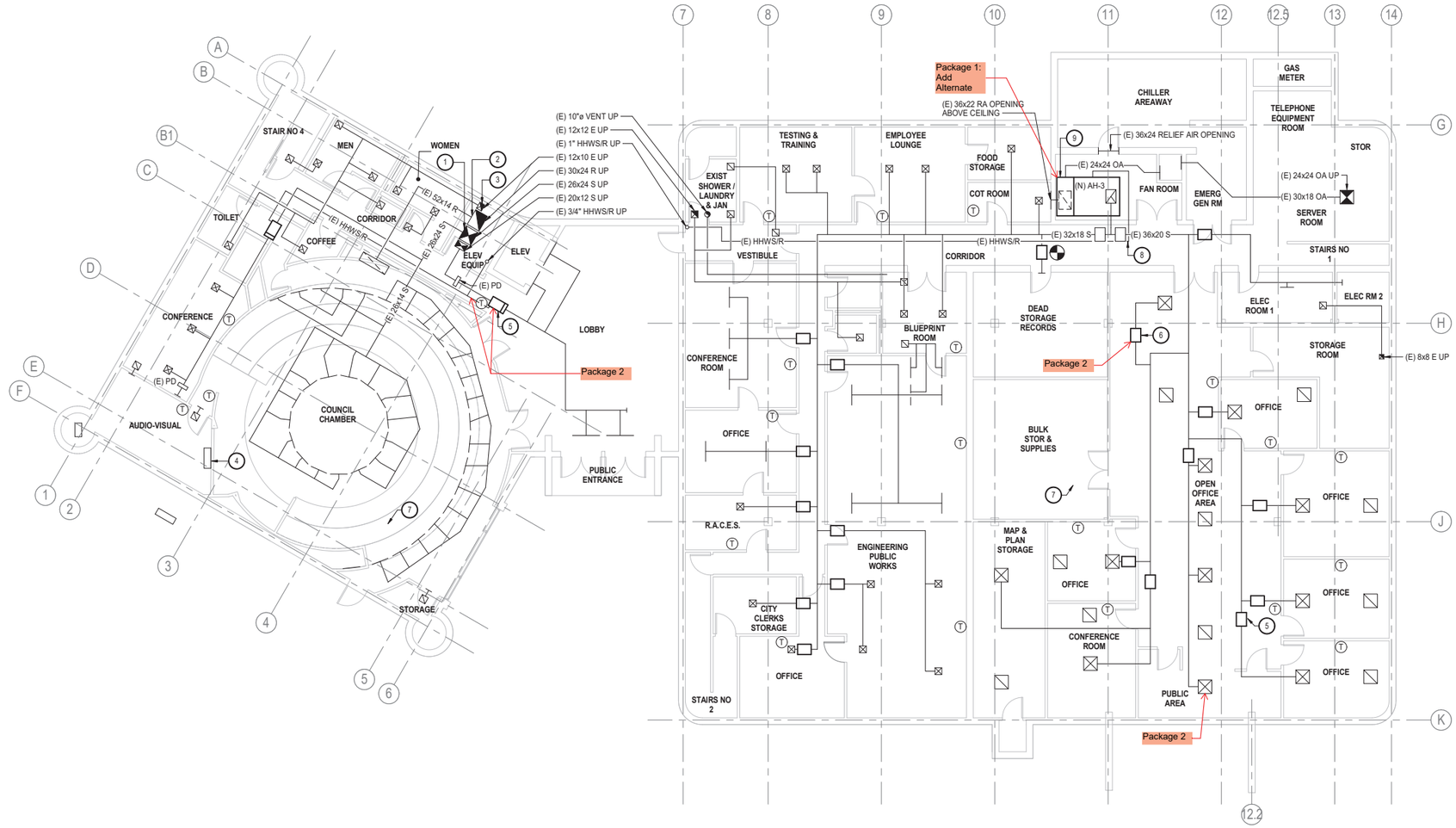

1 MECHANICAL BASEMENT LEVEL
1/8" = 1'-0"

SYMBOL	DESCRIPTION
AC	AIR CONDITIONER
ACC	AIR COOLED CHILLER
AH	AIR HANDLING UNIT
CH	CHILLER
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
DOAS	DEDICATED OUTDOOR AIR SYSTEM
(E)	EXISTING
E	EXHAUST
EF	EXHAUST FAN
HHWR	HEATING HOT WATER RETURN
HHWS	HEATING HOT WATER SUPPLY
HP	HEAT PUMP
HWP	HOT WATER PUMP
(N)	NEW
OA	OUTSIDE AIR
P	PUMP
R	RETURN
RH	REHEAT COIL
RL	REFRIGERANT LIQUID LINE
RS	REFRIGERANT SUCTION LINE
S	SUPPLY
WH	WATER HEATER
VAV	VARIABLE AIR VOLUME

LEGEND

- SUPPLY AIR DIFFUSER
- RETURN AIR GRILLE
- EXHAUST AIR GRILLE
- SUPPLY AIR DUCT RISER
- RETURN AIR DUCT RISER
- EXHAUST AIR DUCT RISER
- POINT OF CONNECTION
- POINT OF DISCONNECT
- (T) THERMOSTAT
- LINEAR DIFFUSER
- PD PNEUMATIC DAMPER
- RH REHEAT COIL

KEY NOTES:

1. EXISTING SUPPLY DUCT DROP DOWN FROM FLOOR ABOVE. ALL EXISTING SUPPLY AIR DUCT DISTRIBUTION AND ASSOCIATED SUPPORTS ABOVE CEILING AND WITHIN BUILDING TO REMAIN IN OPERATION.
2. EXISTING RETURN DUCT DROP DOWN FROM FLOOR ABOVE. ALL EXISTING RETURN AIR DUCT DISTRIBUTION AND ASSOCIATED SUPPORTS ABOVE CEILING AND WITHIN BUILDING TO REMAIN IN OPERATION.
3. EXISTING EXHAUST DUCT DROP DOWN FROM ABOVE. ALL EXISTING EXHAUST AIR DUCT DISTRIBUTION AND ASSOCIATED SUPPORTS ABOVE CEILING AND WITHIN BUILDING TO REMAIN IN OPERATION.
4. PROVIDE NEW THERMOSTAT/SENSORS AND ALL ASSOCIATED WIRING AND CONTROL PANELS FOR A COMPLETE AND CODE COMPLIANT BUILDING MANAGEMENT SYSTEM (BMS). INSTALL NEW THERMOSTAT/SENSOR CONTROL AT THE SAME LOCATION. TYPICAL FOR AH-2 AND AH-3 UNITS ON BASEMENT LEVEL.
5. PROVIDE NEW VARIABLE AIR VOLUME UNIT (VAV) WITH REHEAT COIL PIPING AND CONTROLS FOR ALL PERIMETER ROOMS. TYPICAL FOR AH-2 AND AH-3 UNITS ON BASEMENT LEVEL. MODIFY EXISTING DUCTWORK TO ACCOMMODATE NEW VAV INSTALLATION.
6. PROVIDE NEW VARIABLE AIR VOLUME UNIT (VAV) AND CONTROLS FOR ALL INTERIOR ROOMS. TYPICAL FOR AH-3 UNIT. MODIFY EXISTING DUCTWORK TO ACCOMMODATE NEW VAV INSTALLATION
7. EXISTING CEILING SPACE SHALL CONTINUE TO BE USED AS A RETURN AIR PLENUM. TYPICAL FOR AH-1 AND AH-3 UNITS.
8. EXISTING HYDRONIC HOT WATER PIPING MAINS ABOVE CEILING SHALL REMAIN TO SERVE AIR HANDLER AND VAV UNITS WITH REHEAT COILS. EXTEND PIPING TO SERVE ALL NEW VAV WITH REHEAT BOXES. NEW PIPING SHALL BE SUPPORTED AND ROUTED ABOVE CEILING. BRANCH PIPE SIZES SHALL BE SIZED TO ACCOMMODATE INDIVIDUAL VAV BOX SIZE AND HEATING DEMAND.
9. PROVIDE (N) VARIABLE VOLUME AIR HANDLING UNIT AH-3 OF EQUAL CAPACITY, PERFORMANCE AND DIMENSIONS AS EXISTING AIR HANDLER. INCLUDE NEW EQUIPMENT CURB, INTERNAL SPRING ISOLATION, HEATING AND DIRECT EXPANSION COOLING COILS, FILTER BANKS AND CONTROL SYSTEMS. UNIT SHALL BE RATED FOR INTERIOR INSTALLATION. OUTDOOR COOLING UNIT SHALL BE LOCATED ON ROOF OF PARKS AND RECREATION BUILDING. THIS OUTDOOR UNIT SHALL BE RATED FOR EXTERIOR INSTALLATION WITH COMPLETE SALT-AIR CORROSION RESISTANCE TO CASING AND COMPONENTS.

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24x36

KITCHELL
Capital Expenditure Managers
2450 Venture Oaks Way
Suite 500
Sacramento, CA. 95833
(916) 648-9700

MANHATTAN BEACH CITY HALL
HVAC IMPROVEMENTS
1400 HIGHLANDS AVE, MANHATTAN BEACH, CA 90266

NOT FOR BID
NOT FOR CONSTRUCTION

PROJECT STATUS:
SCHEMATIC DESIGN
BUILDINGS:

SHEET TITLE:
MECHANICAL BASEMENT PLAN

SCALE: 0 1/2 1 BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

REVISIONS

No.	Description	Date

JOB NO. 6501A3
DATE 04/15/19
SHEET M100

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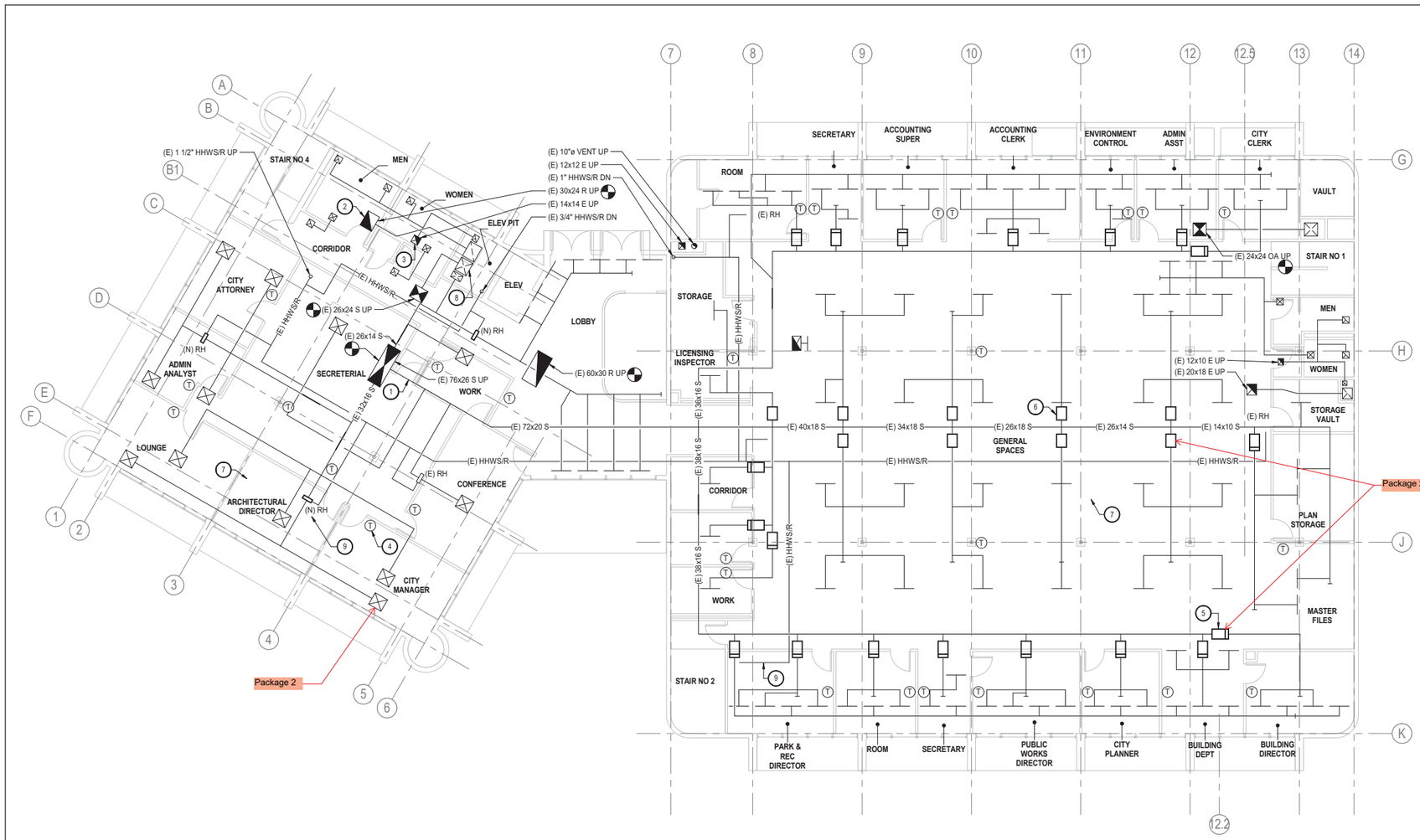

1 MECHANICAL 1ST FLOOR PLAN
1/8" = 1'-0"

SYMBOL	DESCRIPTION
AC	AIR CONDITIONER
ACC	AIR COOLED CHILLER
AH	AIR HANDLING UNIT
CH	CHILLER
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
DOAS	DEDICATED OUTDOOR AIR SYSTEM
(E)	EXISTING
E	EXHAUST
EF	EXHAUST FAN
HHWR	HEATING HOT WATER RETURN
HHWS	HEATING HOT WATER SUPPLY
HP	HEAT PUMP
HWP	HOT WATER PUMP
(N)	NEW
OA	OUTSIDE AIR
P	PUMP
R	RETURN
RH	REHEAT COIL
RL	REFRIGERANT LIQUID LINE
RS	REFRIGERANT SUCTION LINE
S	SUPPLY
WH	WATER HEATER
VAV	VARIABLE AIR VOLUME

LEGEND

- SUPPLY AIR DIFFUSER
- RETURN AIR GRILLE
- EXHAUST AIR GRILLE
- SUPPLY AIR DUCT RISER
- RETURN AIR DUCT RISER
- EXHAUST AIR DUCT RISER
- POINT OF CONNECTION
- POINT OF DISCONNECT
- (T) THERMOSTAT
- LINEAR DIFFUSER
- PD PNEUMATIC DAMPER
- RH REHEAT COIL

KEY NOTES:

1. EXISTING SUPPLY DUCT DROP DOWN THROUGH ROOF FROM AIR HANDLER ON ROOF. PREPARE FOR NEW DUCT CONNECTION ON ROOF AT THIS LOCATION. ALL EXISTING SUPPLY AIR DUCT DISTRIBUTION AND ASSOCIATED SUPPORTS ABOVE CEILING AND WITHIN BUILDING TO REMAIN IN OPERATION.
2. EXISTING RETURN DUCT DROP DOWN THROUGH ROOF FROM AIR HANDLER ROOF. PREPARE FOR NEW DUCT CONNECTION ON ROOF AT THIS LOCATION. ALL EXISTING RETURN AIR DUCT DISTRIBUTION AND ASSOCIATED SUPPORTS ABOVE CEILING AND WITHIN BUILDING TO REMAIN IN OPERATION.
3. EXISTING EXHAUST DUCT DROP DOWN THROUGH ROOF FROM EXHAUST FAN ON ROOF. PREPARE FOR NEW DUCT CONNECTION ON ROOF AT THIS LOCATION. ALL EXISTING EXHAUST AIR DUCT DISTRIBUTION AND ASSOCIATED SUPPORTS ABOVE CEILING AND WITHIN BUILDING TO REMAIN IN OPERATION.
4. PROVIDE NEW THERMOSTAT/SENSORS AND ALL ASSOCIATED WIRING AND CONTROL PANELS FOR A COMPLETE AND CODE COMPLIANT BUILDING MANAGEMENT SYSTEM (BMS). INSTALL NEW THERMOSTAT/SENSOR CONTROL AT THE SAME LOCATION. TYPICAL FOR AH-1 UNIT.
5. PROVIDE NEW VARIABLE AIR VOLUME UNIT (VAV) WITH REHEAT COIL PIPING AND CONTROLS FOR ALL PERIMETER ROOMS. MODIFY EXISTING DUCTWORK TO ACCOMMODATE NEW VAV INSTALLATION. YPICAL FOR AH-1 UNIT.
6. PROVIDE NEW VARIABLE AIR VOLUME UNIT (VAV) AND CONTROLS FOR ALL INTERIOR ROOMS. MODIFY EXISTING DUCTWORK TO ACCOMMODATE NEW VAV INSTALLATION. TYPICAL FOR AH-1 UNIT.
7. EXISTING CEILING SPACE SHALL CONTINUE TO BE USED AS A RETURN AIR PLENUM. TYPICAL FOR AH-1 AND AH-3 UNITS.
8. EXISTING SUPPLY, RETURN AND EXHAUST DUCT SYSTEM ROUTED IN CHASE BEHIND FINISHED SURFACES AND SERVING BASEMENT LEVEL SHALL REMAIN. TYPICAL FOR AH-2 AND EF-1.
9. EXISTING HYDRONIC HOT WATER PIPING MAINS ABOVE CEILING SHALL REMAIN. EXTEND PIPING TO SERVE ALL NEW VAV WITH REHEAT BOXES. NEW PIPING SHALL BE SUPPORTED AND ROUTED ABOVE CEILING. BRANCH PIPE SIZES SHALL BE SIZED TO ACCOMMODATE INDIVIDUAL VAV BOX SIZE AND HEATING DEMAND.

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PROJECT STATUS:
SCHEMATIC DESIGN
BUILDINGS:

SHEET TITLE:
MECHANICAL 1ST FLOOR PLAN
SCALE: 0 1/2 1 BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

REVISIONS

No.	Description	Date

JOB NO. 6501A3
DATE 04/15/19
SHEET M101

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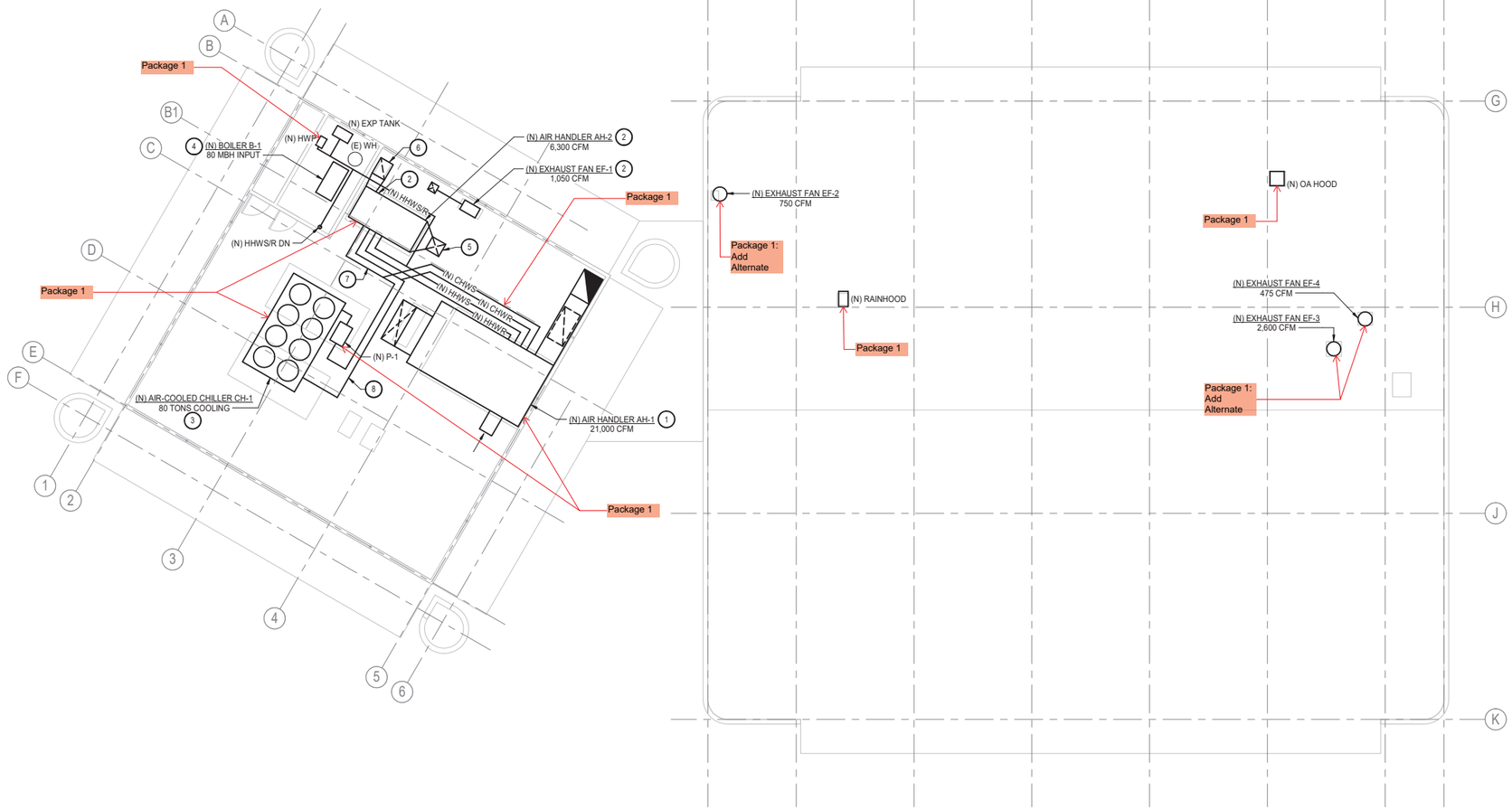

1 MECHANICAL ROOF PLAN
1/8" = 1'-0"

SYMBOL	DESCRIPTION
AC	AIR CONDITIONER
ACC	AIR COOLED CHILLER
AH	AIR HANDLING UNIT
CH	CHILLER
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
DOAS	DEDICATED OUTDOOR AIR SYSTEM
(E)	EXISTING
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EF	EXHAUST FAN
HHWR	HEATING HOT WATER RETURN
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HP	HEAT PUMP
HWP	HOT WATER PUMP
(N)	NEW
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P	PUMP
R	RETURN
RH	REHEAT COIL
RL	REFRIGERANT LIQUID LINE
RS	REFRIGERANT SUCTION LINE
S	SUPPLY
WH	WATER HEATER
VAV	VARIABLE AIR VOLUME

LEGEND

- SUPPLY AIR DIFFUSER
- RETURN AIR GRILLE
- EXHAUST AIR GRILLE
- SUPPLY AIR DUCT RISER
- RETURN AIR DUCT RISER
- EXHAUST AIR DUCT RISER
- POINT OF CONNECTION
- POINT OF DISCONNECT
- (T) THERMOSTAT
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- PD PNEUMATIC DAMPER
- RH REHEAT COIL

KEY NOTES:

1. PROVIDE (N) VARIABLE VOLUME AIR HANDLING UNIT AH-1 OF EQUAL CAPACITY, PERFORMANCE AND DIMENSIONS AS EXISTING AIR HANDLER. INCLUDE NEW EQUIPMENT CURB, INTERNAL SPRING ISOLATION, HEATING AND CHILLED WATER COILS, FILTER BANKS AND CONTROL SYSTEMS. UNIT SHALL BE RATED FOR EXTERIOR INSTALLATION WITH COMPLETE SALT-AIR CORROSION RESISTANCE TO CASING AND COMPONENTS.
2. PROVIDE (N) VARIABLE VOLUME AIR HANDLING UNIT AH-2 OF EQUAL CAPACITY, PERFORMANCE AND DIMENSIONS AS EXISTING AIR HANDLER. INCLUDE NEW EQUIPMENT CURB, INTERNAL SPRING ISOLATION, HEATING AND CHILLED WATER COILS, FILTER BANKS AND CONTROL SYSTEMS. UNIT SHALL BE RATED FOR EXTERIOR INSTALLATION WITH COMPLETE SALT-AIR CORROSION RESISTANCE TO CASING AND COMPONENTS.
3. PROVIDE NEW AIR-COOLED CHILLER OF EQUAL COOLING CAPACITY, PERFORMANCE AND DIMENSIONS AS EXISTING AIR COOLED CHILLER. INCLUDE NEW CURB, SUPPORTS, AND CONTROL SYSTEMS. UNIT SHALL BE RATED FOR EXTERIOR INSTALLATION WITH COMPLETE SALT-AIR CORROSION RESISTANCE TO CASING AND COMPONENTS.
4. PROVIDE NEW INDOOR HYDRONIC HOT WATER BOILER OF EQUAL HEATING CAPACITY, PERFORMANCE AND DIMENSIONS AS EXISTING BOILER. INCLUDE NEW SUPPORTS, FLUES, PUMP AND CONTROL SYSTEMS. UNIT SHALL BE RATED FOR INTERIOR INSTALLATION.
5. PROVIDE NEW SUPPLY DUCT WORK SIZED TO MATCH AIR HANDLER PERFORMANCE. RECONNECT TO EXISTING DUCT CONNECTIONS AT ROOF LEVEL.
6. PROVIDE NEW RETURN DUCT WORK SIZED TO MATCH AIR HANDLER PERFORMANCE. RECONNECT TO EXISTING DUCT CONNECTIONS AT ROOF LEVEL.
7. PROVIDE NEW HYDRONIC HOT WATER PIPING COMPLETE WITH INSULATION AND JACKETING, SUPPORTS, VALVES, PUMPS AND TEMPERATURE GAUGES. SYSTEM SHALL BE SIZED TO ACCOMMODATE ALL INTERCONNECTING HOT WATER COILS.
8. PROVIDE NEW HYDRONIC CHILLED WATER PIPING COMPLETE WITH INSULATION AND JACKETING, SUPPORTS, VALVES, PUMPS AND TEMPERATURE GAUGES. SYSTEM SHALL BE SIZED TO ACCOMMODATE ALL INTERCONNECTING CHILLED WATER COILS.

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KITCHELL
Capital Expenditure Managers
2450 Venture Oaks Way
Suite 500
Sacramento, CA. 95833
(916) 648-9700

MANHATTAN BEACH CITY HALL HVAC IMPROVEMENTS
1400 HIGHLANDS AVE, MANHATTAN BEACH, CA 90266

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NOT FOR CONSTRUCTION

PROJECT STATUS:
SCHEMATIC DESIGN
BUILDINGS:

SHEET TITLE:
MECHANICAL ROOF PLAN

SCALE: 0 1/2 1 — BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

REVISIONS

No.	Description	Date

JOB NO. 6501A3
DATE 04/15/19
SHEET M102

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VRF Design Alternate 4

VRF Design Alternate

This alternative to the phased Like-for-Like replacement is a VRF HVAC system replacement with a new air distribution system. The improvement will give the best improvements to the thermal comfort, system performance and energy usage as this system will give individual control to each occupant zone and greatly improve energy usage through simultaneous heating and cooling. Maintenance will require additional training for in-house staff to accommodate the new system. The overall replacement costs are high in comparison to other solutions due to the need to maintain and replace all VRF components. The total cost for the VRF Design Alternate is **$3,282,687.**

Mechanical

- New Dedicated Outdoor Air System (DOAS) units on the roof of Parks and Recreation building and Counsel Chambers Building will provide outside and relief air to the indoor cassette units. The HVAC equipment over the Parks and Recreation building will be located from view with a new screened enclosure. The HVAC system shall be engineered to meet the cooling/heating and airflow requirements of this building.
- A complete new outside and relief air duct system shall be routed down from the DOAS units to the individual cassettes at both 1st and basement levels. All new ductwork shall be insulated sheet metal construction with new diffusers, registers and grilles. The sidewall diffusers serving the Council Chambers shall remain with new supply duct connections. The ceiling space for both basement and 1st floor levels will not be utilized as a return air plenum.
- All of the existing exhaust fans shall be replaced with new units of equal performance and capacity with new sheet metal ductwork to serve all toilet and general exhaust areas.
- Provide two (2) new 3-ton split system cooling only units for the Server Room. A single unit will be sized to maintain space
  temperature for the existing heating loads. A second split system will provide 100% redundancy. The indoor units will be wall mount with outdoor units located on roof. The existing portable cooling unit will be removed.
- The existing pneumatic Novar controls system shall be replaced with a complete new Building Management System (BMS) to interface and control all new and existing HVAC system components including air handlers, chiller, boiler, fans and pumps.
- Provide two (2) new split system cooling units for the Server Room. A single unit will be sized to maintain space temperature for the existing heating loads. A second split system will provide 100% redundancy. Indoor units will be wall mount with outdoor units located on roof. Remove existing portable cooling unit.

Architectural

- Remove existing bird screen of approximately 2,250 SF in area on the north roof for construction access on roof. Restore screen by tightening existing perimeter and crossover tension wires and install new bird screen after work is complete on the roof.
- Demolish existing roof curbs for two roof top air handlers.
- Remove all roofing from the north roof mechanical area.
- Install 2,450 SF modified bitumen roofing membrane on the equipment well roof, including roofs on enclosed roof access stair and roof top mechanical room.
- Provide roof supports on new condensate drain lines and electrical conduits as needed.
- Tighten existing perimeter and crossover tension wires and install new bird screen.

VRF Design Alternate

- Install 160 linear feet by 5' high of pre-engineered roof top screen walls on the south roof, screening new roof top units and chiller.
- Discard approximately 6,825 SF of suspended acoustic ceiling tile on first floor of the south building while retaining the 4' x 4' structurally supported ceiling tees.
- Temporarily remove lighting fixtures as required for mechanical work overhead. Reinstall lighting fixtures and install new mechanical diffusers, grills and new high performance 2'x4' acoustic ceiling tiles supported by secondary tees.
- Remove approximately 1,960 SF of 12" x 12" adhered ceiling tiles and drywall on suspended framing of the basement and first floor main corridors for replacement of the ductwork overhead. Remove existing can lights as needed for the work. Supplement suspended framing as required and install new drywall and finish 12" x 12" ceiling tiles.
- Remove approximately 200 SF of drywall and framing of ceilings in north washrooms adjacent to the Council Chambers. Install suspended ceiling grid and vinyl faced acoustic ceiling tiles in the washrooms.
- Remainder of the building ceilings of acoustic ceiling tiles in suspended grid will be removed as required and reinstalled for the mechanical duct work.
- Perform any required accessibility improvements for compliance with 2010 ADAS and Title 24 CBC Chapter 11B.

Electrical

- Provide new electrical disconnects, conduit, and conductors to all new HVAC units.
- Provide new circuit breakers in panelboards or motor starters in motor control center to feed new HVAC units.
- Removal and reinstallation of existing light fixtures will require the replacement of existing lighting controls in order to meet Title 24 requirements. Rooms where existing fixtures are being temporarily removed will require occupancy sensors and daylight harvesting controls (where rooms have windows).

VRF Design Alternate - Cost Estimate

ESTIMATE WORKSHEET

MANHATTAN BEACH CITY HALL

BUILDING: **VRF**

PROJECT: **HVAC UPGRADE**

BUILDING GSF: 27,500

PHASE: **CONCEPTUAL**

ESTIMATE DATE: **JUNE 19, 2019**

BID DATE: **OCTOBER 1, 2019**

PREPARED BY: M. CHAPPELL

5 of 6
6/19/2019
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6501 MB City Hall HVAC_ConR2.xls

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	MECHANICAL DEMOLITION				
	DEMO ROOF MOUNTED AIR COOLED CHILLER CH-1	1	EA	$6,280.50	$6,281
	DEMO ROOF MOUNTED AIR HANDLING UNITS AH-1 & AH-2	2	EA	$1,884.15	$3,768
	DEMO AIR HANDLING UNIT AH-3 IN BASEMENT	1	EA	$1,884.15	$1,884
	DEMO AIR COOLED CONDENSING UNIT ACC-1	1	EA	$1,256.10	$1,256
	DEMO BOILER B-1	1	EA	$1,884.15	$1,884
	DEMO ROOF EXHAUST FANS	4	EA	$314.03	$1,256
	DEMO EXPANSION TANK	1	EA	$94.21	$94
	DEMO HEATING HOT WATER PUMP	1	EA	$188.42	$188
	DEMO CHILLED WATER PUMP	1	EA	$188.42	$188
	DEMO OUTSIDE AIR HOOD	1	EA	$125.61	$126
	DEMO RAINHOOD	1	EA	$125.61	$126
	DEMO PNEUMATIC DAMPER	45	EA	$62.81	$2,826
	DEMO ELECTRIC DUCT REHEAT COIL	2	EA	$157.01	$314
	DEMO PNEUMATIC CONTROLS	1	LS	$6,280.50	$6,281
	DEMO VAV BOX	5	EA	$94.21	$471
	DEMO PORTABLE AC UNIT	1	EA	$125.61	$126
	DEMO DUCTWORK	3,500	LF	$6.28	$21,982
	DEMO CHILLED/HEATING HOT WATER PIPING	1,200	LF	$5.02	$6,029
	DEMO REFRIGERANT PIPING	20	LF	$7.54	$151
	DEMO AIR DISTRIBUTION DEVICES	203	EA	$31.40	$6,375
	NEW MECHANICAL WORK				
	NEW VRF HEAT RECOVERY HEAT PUMPS HP 1-4	96	TONS	$3,014.64	$289,406
	NEW DEDICATED OUTSIDE AIR UNITS DOSA 1,2,3 (3 TOTAL)	6,000	CFM	$6.28	$37,683
	NEW OUTSIDE AIR AND RELIEF AIR DUCTWORK W/INSULATION	8,250	LBS	$11.30	$93,265
	NEW EXHAUST DUCTWORK	27,500	SF	$1.26	$34,543
	NEW CASSETTE CEILING MOUNTED VRF FAN COIL UNITS	65	EA	$1,884.15	$122,470
	NEW WALL MOUNTED FAN COIL COIL UNITS	4	EA	$1,507.32	$6,029
	NEW REFIGERANT PIPING	2,760	LF	$50.24	$138,673
	NEW VRF CONTROLLERS	8	EA	$4,396.35	$35,171
	NEW PACKAGED GAS/ELECTRIC AIR HANDLING UNIT AH-1	10,000	CFM	$6.28	$62,805
	NEW ROOF EXHAUST FANS	4	EA	$2,260.98	$9,044
	NEW 3 TON SPLIT SYSTEM COOLING UNITS FOR THE SERVER ROOM	2	EA	$9,420.75	$18,842
	NEW ENERGY MANAGEMENT CONTROL SYSTEM	27,500	SF	$5.65	$155,442
	NEW TEST AND BALANCE	27,500	SF	$1.57	$43,178
	ELECTRICAL WORK				
	DEMO CONNECTIONS TO MECHANICAL EQUIPMENT	18	EA	$567.18	$10,209
	REMOVE & REINSTALL LIGHT FIXTURES	26,655	SF	$7.09	$188,977
	NEW LIGHTING CONTROLS	26,655	SF	$5.67	$151,182
	NEW CONNECTION TO VRF HEAT PUMP UNITS	4	EA	$2,126.93	$8,508
	NEW CONNECTION TO DOSA UNITS	3	EA	$1,701.54	$5,105
	NEW CONNECTION TO CEILING CASSETTE FAN COIL UNITS	65	EA	$1,417.95	$92,167
	NEW CONNECTION TO AIR HANDLING UNITS (AH-1)	1	EA	$1,701.54	$1,702
	NEW CONNECTION TO WALL FAN COIL UNITS	4	EA	$1,417.95	$5,672
	NEW CONNECTION TO EXHAUST FANS	4	EA	$1,417.95	$5,672
	NEW CONNECTIONS TO SPLIT SYSTEMS	2	EA	$1,063.46	$2,127

VRF Design Alternate - Cost Estimate

ESTIMATE WORKSHEET

MANHATTAN BEACH CITY HALL

BUILDING: **VRF**

PROJECT: **HVAC UPGRADE**

BUILDING GSF: 27,500

PHASE: **CONCEPTUAL**

ESTIMATE DATE: **JUNE 19, 2019**

BID DATE: **OCTOBER 1, 2019**

PREPARED BY: M. CHAPPELL

6 of 6
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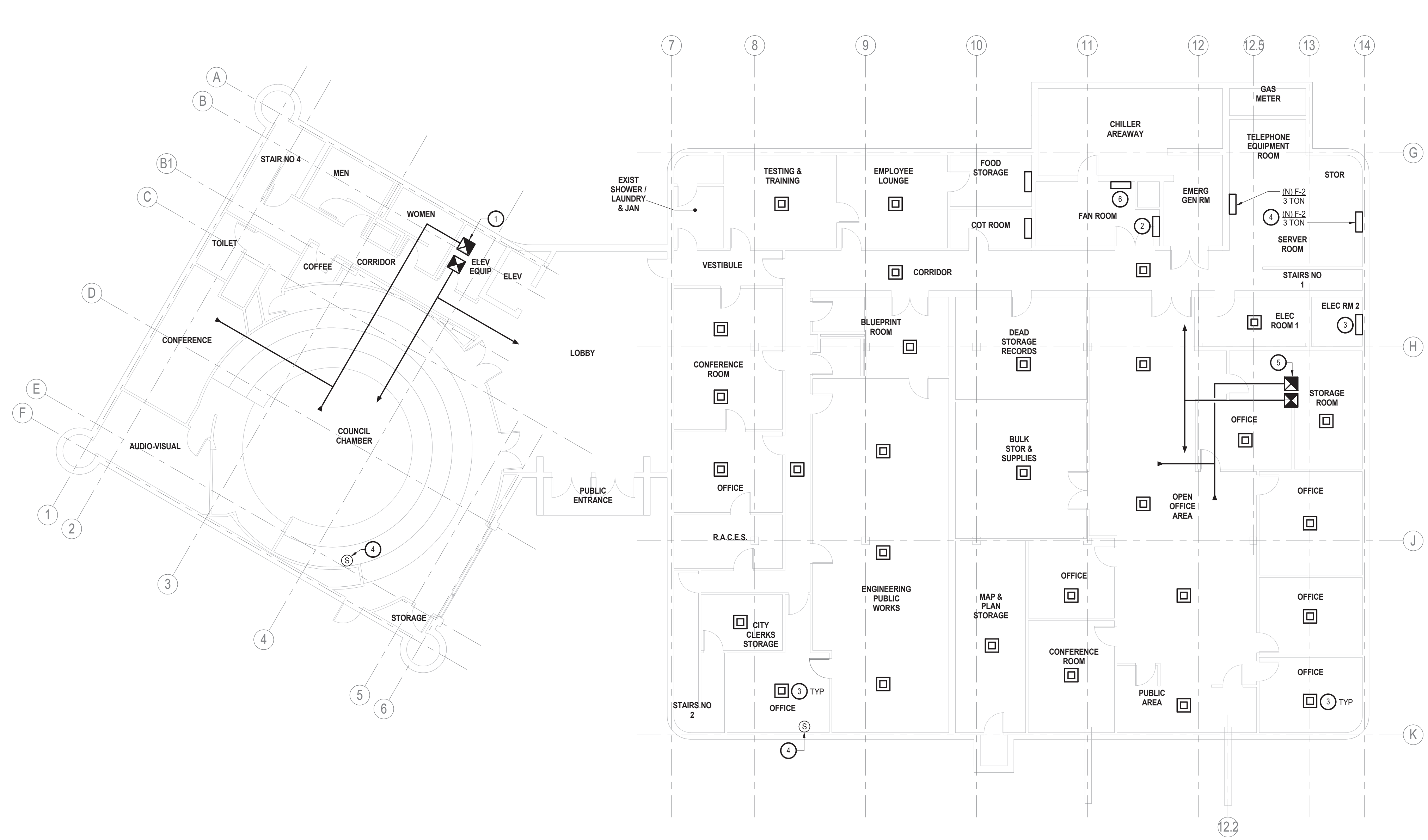
6501 MB City Hall HVAC_ConR2.xls

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	NEW CIRCUITS IN EXISTING PANEL	50	EA	$708.98	$35,449
	GENERAL BUILDING WORK				
	RE-ROOFING TO ACCOMMODATE NEW HVAC EQUIPMENT	2,450	SF	$20.00	$49,000
	PATCH EXISTING ROOF	1	LS	$15,000.00	$15,000
	SCREEN WALL FOR MECHANICAL EQUIPMENT	800	SF	$75.00	$60,000
	STRUCTURAL STEEL FOR ROOFTOP EQUIPMENT	1	LS	$5,000.00	$5,000
	REMOVE & REINSTALL SUSPENDED CEILING	19,437	SF	$4.00	$77,748
	REPLACE SUSPENDED CEILING (ASSUME 20%)	5,068	SF	$10.00	$50,680
	REPLACE HARD CEILING	2,160	SF	$17.00	$36,720
	REPLACE GLUE ON TILE	1,960	SF	$2.50	$4,900
	REMOVE & REPLACE BIRD SCREEN	2,250	SF	$2.50	$5,625
	SUBTOTAL HARD COSTS				**$1,919,598**
	CONTINGENCY				
	ESTIMATING CONTINGENCY	15.00%			**$287,940**
	SUBTOTAL CONSTRUCTION COSTS				**$2,207,538**
	MARK-UPS				
	GENERAL CONDITIONS	14.00%			$309,055
	OVERHEAD & PROFIT	12.00%			$301,991
	INSURANCE & BONDS	3.00%			$84,558
	SUBTOTAL MARK-UPS				**$695,604**
	SUBTOTAL CONSTRUCTION COSTS & MARK-UPS				**$2,903,142**
	ESCALATION				
	ESCALATION	4.17%			**$121,061**
	TOTAL CONSTRUCTION COSTS				**$3,024,203**
	ADA PATH OF TRAVEL ALTERATIONS	2.00%			**$60,484**
	FEES				
	DESIGN FEE				**$198,000**
	TOTAL FOR VRF:				**$3,282,687**

VRF Design Alternate - Drawings



1 MECHANICAL BASEMENT LEVEL - OPTION 3

1/8" = 1'-0"

SYMBOL	DESCRIPTION
AC	AIR CONDITIONER
ACC	AIR COOLED CHILLER
AH	AIR HANDLING UNIT
CH	CHILLER
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
DOAS	DEDICATED OUTDOOR AIR SYSTEM
(E)	EXISTING
E	EXHAUST
EF	EXHAUST FAN
HHWR	HEATING HOT WATER RETURN
HHWS	HEATING HOT WATER SUPPLY
HP	HEAT PUMP
HWP	HOT WATER PUMP
(N)	NEW
OA	OUTSIDE AIR
P	PUMP
R	RETURN
RH	REHEAT COIL
RL	REFRIGERANT LIQUID LINE
RS	REFRIGERANT SUCTION LINE
S	SUPPLY
WH	WATER HEATER
VAV	VARIABLE AIR VOLUME

LEGEND

- SUPPLY AIR DIFFUSER
- RETURN AIR GRILLE
- EXHAUST AIR GRILLE
- SUPPLY AIR DUCT RISER
- RETURN AIR DUCT RISER
- EXHAUST AIR DUCT RISER
- POINT OF CONNECTION
- POINT OF DISCONNECT
- (T) THERMOSTAT
- LINEAR DIFFUSER
- PD PNEUMATIC DAMPER
- RH REHEAT COIL

KEY NOTES:

1. PROVIDE NEW SUPPLY AND RETURN AIR DUCT FROM AIR HANDLER AH-2 ON ROOF AND ROUTE NEW INSULATED SHEET METAL DUCT DISTRIBUTION AND ASSOCIATED SUPPORTS ABOVE CEILING SPACE. SUPPLY AND RETURN DUCTS SHALL BE ROUTED TO ACCOMMODATE BRANCH DUCTS FOR ALL INDIVIDUAL ROOMS. PROVIDE INDIVIDUAL BRANCH DUCTS AND DIFFUSERS/REGISTERS TO SERVE ALL INDIVIDUAL ROOMS SHOWN ON THE PLAN. RECONNECT TO EXISTING SIDEWALL SUPPLY REGISTERS THAT ARE TO REMAIN IN COUNSEL CHAMBERS. TYPICAL.
2. PROVIDE AN ENGINEERED REFRIGERANT PIPING SYSTEM TO INTERCONNECT WITH REFRIGERANT PIPING MANIFOLD, OUTDOOR HEAT PUMP UNIT AND ALL IDU UNITS.
3. PROVIDE NEW INDIVIDUAL ROOM BY ROOM CEILING CASSETTE(S) TO SERVE EACH INDIVIDUAL ROOM AT 1ST AND BASEMENT FLOORS. PROVIDE AN INSULATED OUTSIDE AND RELIEF AIR DUCTING SYSTEM TO AIR TO EACH INDOOR UNITS (IDU) LOCATED IN BASEMENT AND FIRST FLOOR. THE MAJORITY OF THE INDOOR UNITS WILL BE CASSETTE TYPE CEILING MOUNTED UNITS. PROVIDE VOLUME DAMPERS TO CONTROL OUTSIDE AIR TO EACH INDOOR CASSETTE TYPE UNIT.
4. PROVIDE NEW THERMOSTAT/SENSORS AND ALL ASSOCIATED WIRING AND CONTROL PANELS FOR A COMPLETE AND CODE COMPLIANT BUILDING MANAGEMENT SYSTEM (BMS). INSTALL NEW THERMOSTAT/SENSOR CONTROL FOR EACH THERMAL ZONE. TYPICAL FOR ALL AIR HANDLING AND INDOOR UNITS.
5. PROVIDE NEW OUTSIDE AIR/EXHAUST AIR DUCT DROPS DOWN THROUGH ROOF FROM INDIVIDUAL DEDICATED DOAS UNITS AND ROUTE A SHEET METAL DISTRIBUTION SYSTEM TO INDOOR FAN COIL CASSETTES AND ROOM RELIEF.

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KITCHELL

Capital Expenditure Managers
2450 Venture Oaks Way
Suite 500
Sacramento, CA. 95833
(916) 648-9700

MANHATTAN BEACH CITY HALL HVAC IMPROVEMENTS

1400 HIGHLANDS AVE, MANHATTAN BEACH, CA 90266

NOT FOR BID
NOT FOR CONSTRUCTION

PROJECT STATUS:

SCHEMATIC DESIGN

BUILDINGS:

SHEET TITLE:

MECHANICAL BASEMENT PLAN - **VRF**

SCALE: 0 1/2 1 BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

REVISIONS

No.	Description	Date

JOB NO.	SHEET
6501A3	M400
DATE 04/15/19	

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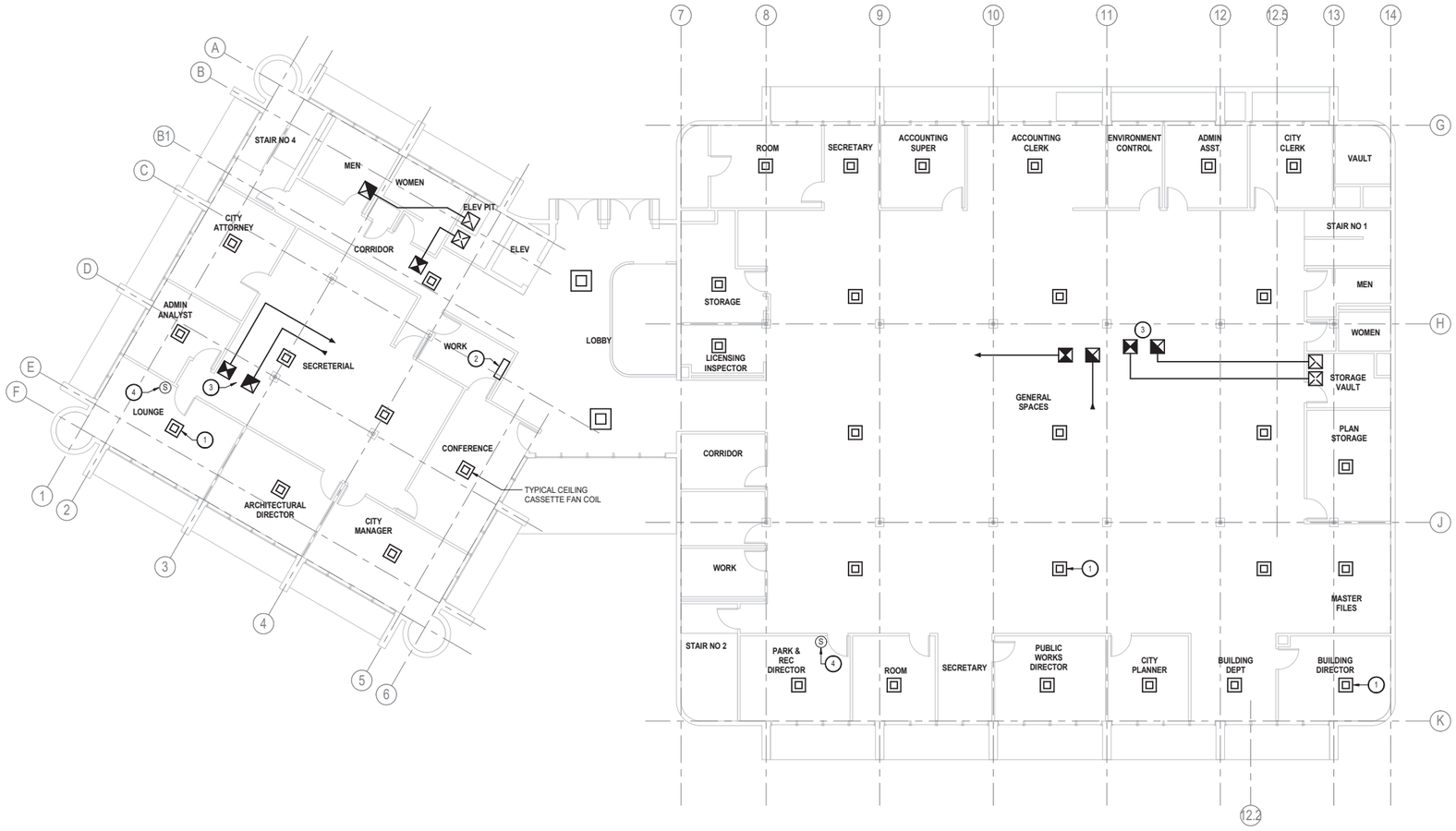
VRF Design Alternate - Drawings



1 — MECHANICAL 1ST FLOOR PLAN - OPTION 3
1/8" = 1'-0"

SYMBOL	DESCRIPTION
AC	AIR CONDITIONER
ACC	AIR COOLED CHILLER
AH	AIR HANDLING UNIT
CH	CHILLER
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
DOAS	DEDICATED OUTDOOR AIR SYSTEM
(E)	EXISTING
E	EXHAUST
EF	EXHAUST FAN
HHWR	HEATING HOT WATER RETURN
HHWS	HEATING HOT WATER SUPPLY
HP	HEAT PUMP
HWP	HOT WATER PUMP
(N)	NEW
OA	OUTSIDE AIR
P	PUMP
R	RETURN
RH	REHEAT COIL
RL	REFRIGERANT LIQUID LINE
RS	REFRIGERANT SUCTION LINE
S	SUPPLY
WH	WATER HEATER
VAV	VARIABLE AIR VOLUME

LEGEND

- SUPPLY AIR DIFFUSER
- RETURN AIR GRILLE
- EXHAUST AIR GRILLE
- SUPPLY AIR DUCT RISER
- RETURN AIR DUCT RISER
- EXHAUST AIR DUCT RISER
- POINT OF CONNECTION
- POINT OF DISCONNECT
- THERMOSTAT
- LINEAR DIFFUSER
- PD — PNEUMATIC DAMPER
- RH — REHEAT COIL

KEY NOTES:

1. PROVIDE NEW INDIVIDUAL ROOM BY ROOM CEILING CASSETTE(S) TO SERVE EACH INDIVIDUAL ROOM AT 1ST AND BASEMENT FLOORS. PROVIDE AN INSULATED OUTSIDE AND RELIEF AIR DUCTING SYSTEM TO AIR TO EACH INDOOR UNITS (IDU). THE MAJORITY OF THE INDOOR UNITS WILL BE CASSETTE TYPE CEILING MOUNTED UNITS. PROVIDE VOLUME DAMPERS TO CONTROL OUTSIDE AIR TO EACH INDOOR CASSETTE TYPE UNIT.
2. PROVIDE AN ENGINEERED REFRIGERANT PIPING SYSTEM TO INTERCONNECT WITH REFRIGERANT PIPING MANIFOLD, OUTDOOR HEAT PUMP UNIT AND ALL IDU UNITS.
3. PROVIDE NEW OUTSIDE AIR/EXHAUST AIR DUCT DISTRIBUTION SYSTEM FROM DEDICATED DOAS UNITS TO INDOOR FAN COIL CASSETTES.
4. PROVIDE NEW THERMOSTAT/SENSORS AND ALL ASSOCIATED WIRING AND CONTROL PANELS FOR A COMPLETE AND CODE COMPLIANT BUILDING MANAGEMENT SYSTEM (BMS). INSTALL NEW THERMOSTAT/SENSOR CONTROL FOR EACH THERMAL ZONE. TYPICAL FOR ALL AIR HANDLING AND INDOOR UNITS.

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KITCHELL
Capital Expenditure Managers
2450 Venture Oaks Way
Suite 500
Sacramento, CA. 95833
(916) 648-9700

MANHATTAN BEACH CITY HALL
HVAC IMPROVEMENTS
1400 HIGHLANDS AVE, MANHATTAN BEACH, CA 90266

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PROJECT STATUS:
SCHEMATIC DESIGN
BUILDINGS:

SHEET TITLE:
MECHANICAL 1ST FLOOR PLAN - **VRF**

SCALE: 0 1/2 1 — BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

REVISIONS

No.	Description	Date

JOB NO. 6501A3
DATE 04/15/19
SHEET **M401**

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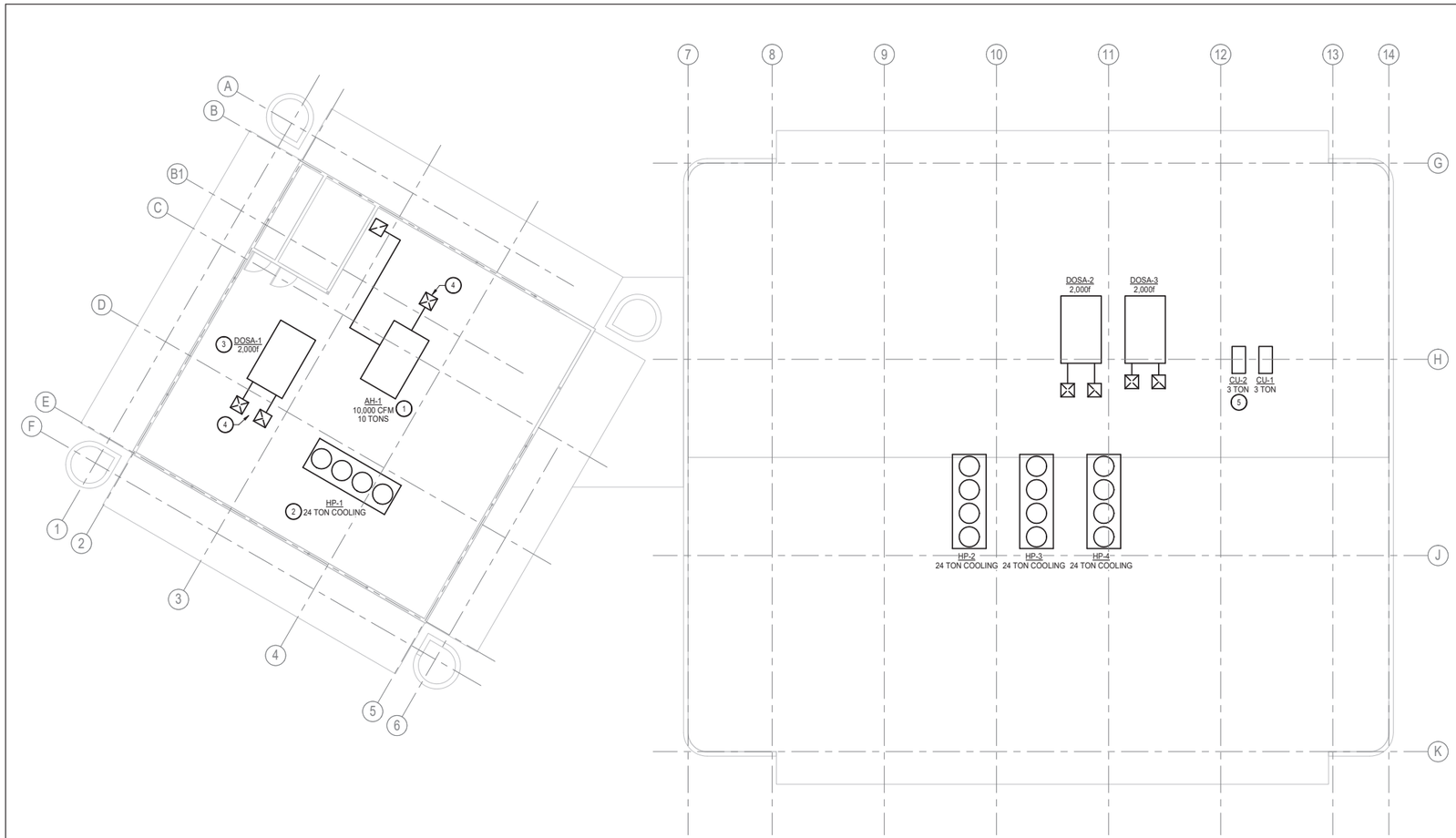
VRF Design Alternate - Drawings



1 MECHANICAL ROOF PLAN - OPTION 3
1/8" = 1'-0"

SYMBOL	DESCRIPTION
AC	AIR CONDITIONER
ACC	AIR COOLED CHILLER
AH	AIR HANDLING UNIT
CH	CHILLER
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
DOAS	DEDICATED OUTDOOR AIR SYSTEM
(E)	EXISTING
E	EXHAUST
EF	EXHAUST FAN
HHWR	HEATING HOT WATER RETURN
HHWS	HEATING HOT WATER SUPPLY
HP	HEAT PUMP
HWP	HOT WATER PUMP
(N)	NEW
OA	OUTSIDE AIR
P	PUMP
R	RETURN
RH	REHEAT COIL
RL	REFRIGERANT LIQUID LINE
RS	REFRIGERANT SUCTION LINE
S	SUPPLY
WH	WATER HEATER
VAV	VARIABLE AIR VOLUME

LEGEND

- SUPPLY AIR DIFFUSER
- RETURN AIR GRILLE
- EXHAUST AIR GRILLE
- SUPPLY AIR DUCT RISER
- RETURN AIR DUCT RISER
- EXHAUST AIR DUCT RISER
- POINT OF CONNECTION
- POINT OF DISCONNECT
- T THERMOSTAT
- LINEAR DIFFUSER
- PD PNEUMATIC DAMPER
- RH REHEAT COIL

KEY NOTES:

1. PROVIDE (N) ROOF MOUNTED AIR HANDLING UNIT WITH VRF COIL AND HEAT RECOVERY CAPABILITIES. UNIT SHALL BE OF EQUAL CAPACITY, AND PERFORMANCE AS EXISTING AIR HANDLER SERVING THIS ZONE. INCLUDE NEW EQUIPMENT CURB, INTERNAL SPRING ISOLATION, VRF COIL, FILTER BANKS AND CONTROL SYSTEMS. UNIT SHALL BE RATED FOR EXTERIOR INSTALLATION WITH COMPLETE SALT-AIR CORROSION RESISTANCE TO CASING AND COMPONENTS.
2. PROVIDE (N) ROOF MOUNTED HEAT PUMP UNIT WITH HEAT RECOVERY CAPABILITIES, (HP). PROVIDE EQUIPMENT CURB, REFRIGERANT PIPING, CONTROLS AND REFRIGERANT PIPING MANIFOLD SYSTEM.
3. PROVIDE NEW DEDICATED OUTDOOR AIR SYSTEM WITH NEW INSULATED DUCT TO PROVIDE OUTSIDE AIR TO INDOOR UNITS (IDU) LOCATED IN BASEMENT AND FIRST FLOOR. THE MAJORITY OF THE INDOOR UNITS WILL BE CASSETTE TYPE CEILING MOUNTED UNITS. PROVIDE VOLUME DAMPERS TO CONTROL OUTSIDE AIR TO EACH INDOOR CASSETTE TYPE UNIT. FOR ROOMS WITH WALL MOUNTED INDOOR UNITS (IDU), PROVIDE OUTSIDE AIR TO ALL ROOMS USING CEILING/WALL MOUNTED SUPPLY AIR DIFFUSERS AND VOLUME DAMPERS.
4. PROVIDE NEW SUPPLY/RETURN/EXHAUST AIR DUCT DROPS DOWN THROUGH ROOF FROM AIR HANDLER AH-1 AND INDIVIDUAL DEDICATED DOAS UNITS TO INDOOR FAN COIL CASSETTES.
5. PROVIDE SPLIT SYSTEM FAN COIL UNITS WITH ROOF MOUNTED CONDENSING UNITS. SPLIT SYSTEMS SHALL BE SIZED TO ACCOMMODATE HEAT GAIN OF EXISTING SERVER EQUIPMENT. FUTURE GROWTH IS NOT INCLUDED IN SYSTEM COOLING CAPACITY. EACH SEPARATE SYSTEM WILL BE SIZED TO ACCOMMODATE FULL HEAT LOAD OF EXISTING SERVER EQUIPMENT AND PROVIDE 100% BACK-UP IN THE EVENT OF A SINGLE SYSTEM FAILURE.

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KITCHELL
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NOT FOR CONSTRUCTION

PROJECT STATUS:
SCHEMATIC DESIGN

BUILDINGS:

SHEET TITLE:
MECHANICAL ROOF PLAN - **VRF**

SCALE: 0 1/2 1 BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

REVISIONS

No.	Description	Date

JOB NO. 6501A3
DATE 04/15/19
SHEET **M402**

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Appendix A - Test and Balancing Report 5

American Air Balance Company

Innovation • Knowledge • Service

Manhattan Beach City Hall
AH-1, AH-2 and AH-3 Air Survey
1400 Highland Ave.
Manhattan Beach, CA 90266

Architect

Engineer

Sosoka & Associates

Client

City of Manhattan Beach

Project Number 191360

Date April 2, 2019

Survey Analysis

Report Certification

for

Manhattan Beach City Hall
AH-1, AH-2 and AH-3 Air Survey
1400 Highland Ave.
Manhattan Beach, CA 90266

This is to certify that **American Air Balance Co., Inc.** has surveyed the systems described herein as to the actual operating conditions. Measuring and documentation has been performed in accordance with the standard requirements and procedures of the Associated Air Balance Council and the results of these tests are herein recorded.

Certification Number

191360

Date

April 2, 2019

Approved

Bob Conboy, Test and Balance Engineer

Supervisor

Joe Sieber

Managing Technician

Ed Thorenll

Corporate Headquarters

American Air Balance Co.., Inc. • phone: 714-693-3700 • fax: 714-693-9509 • www. aabccorp.com • mail@aabccorp.com

AABC

Associated Air Balance Council

Annual Certificate

Awarded to

Robert A. Conboy

American Air Balance Co., Inc.

In recognition of his qualifications as a

Certified Test and Balance Engineer

under the rules, regulations, and requirements of the Associated Air Balance Council. The above named is fully authorized to perform total system balance in accordance with the standards as established by the AABC and as a member of the Associated Air Balance Council for the year

2019

This registration number **92-01-30** *is fully recognized by the bylaws and charter of this professional association. Certification is renewable on an annual basis after examination of the agency's record for the preceding year. This certificate expires December 31, 2019.*

ASSOCIATED AIR BALANCE COUNCIL
AABC
2019

Benjiman J. Link, *President*

Raymond R. Bert, *Executive Director*

AABC

Associated Air Balance Council

hereby certifies that

Edward R. Thornell

has met all requirements and passed the necessary examination to perform testing and balancing as an AABC

Certified Test & Balance Technician

under the supervision of a certified test and balance engineer for

American Air Balance Co., Inc.

This registration number 281-01-14 *is only recognized under the auspices of the above named AABC member agency. This certificate expires December 31, 2019 and is renewable on an annual basis.*

Benjiman J. Link, *President*

Raymond R. Bert, *Executive Director*

American

Air Balance Co., Inc.

TEST AND BALANCE INSTRUMENTATION

The following instruments were used to successfully measure and set each device on this project.

Instrument	Manufacturer	Model	Serial #	Calib. Date
Air Data Multi Meter	Shortridge	ADM 860C	M15315	03/27/19
Amp Volt Meter	Fluke	333	91756563	
Drill	Dewalt	DCD771C2	303853	
Flow Hood	Shortridge	84000		
Hydrodata Meter	Shortridge	HDM-250	W17080	12/03/18
Ladder	Husky	6'		
Laptop Computer	Dell	Latitude E6430	JK16YW1	
Noncontact Thermometer	Ray Tek Mini Temp	RAYMT4U	RAYL000669830	12/3/218
Pitot Tube	Dwyer	48"	160-48	

Las Vegas
Phone: (702) 255-7331 / Fax: (702) 294-1306

Corporate Headquarters
4721 E. Hunter Ave.
Anaheim, CA 92807
mail@americanairbalance.com

Anaheim
Phone: (714) 693-3700 / Fax: (714) 693-9696

American
Air Balance Co., Inc.

Definitions of Abbreviations, Terminology, Symbols & Conversions

#:	Symbol for PSI or Pounds per square inch
Δ:	Symbol for Delta - difference, net decrease or increase
A:	Nameplate Amps
AABC:	Associated Air Balance Council
ABS:	Absolute
AC or ACU:	Air Conditioner or Air Conditioning Unit
ACCU:	Air-Cooled Condensing Unit
ACGIH:	American Conference of Governmental Hygienists
ACH	Air Changes Per Hour
ACT:	Actual
ADP:	Apparatus Dew Point
AEE:	Association of Energy Engineers
AFE:	Association of Facility Engineering
AHU:	Air Handling Unit
AK:	Free Area Factor
ALT:	Altitude
AMB:	Ambient
AMP:	Ampere
ANSI:	American National Standards Institute
AP:	Access Point
A-Scale or Db(A):	A filtering system which roughly matches the response characteristics of the human ear
ASHRAE:	American Society of Heating, Air Conditioning and Refrigeration Engineers
ASTM:	American Society for Testing and Materials
ATM:	Atmosphere
AVG:	Average
AZ:	Azimuth
B:	Boiler
BHP:	Brake Horsepower
BP:	Boiling Point
BSC:	Building Systems Commissioning
BTU:	British Thermal Unit
BTUH:	British Thermal Units per Hour
C:	Celsius
C to C:	Center to Center
CAV:	Constant Air Volume or Continuous Air Volume
CC:	Cooling Coil
CCW:	Counter-Clockwise
CD:	Ceiling Diffuser
CEG:	Ceiling Exhaust Grille
CER:	Ceiling Exhaust Register
CFM:	Cubic Feet per Minute
CH:	Chiller

Corporate Headquarters
4721 E. Hunter Ave.
Anaheim, CA 92807
mail@aabccorp.com

Las Vegas
Phone: (702) 255-7331 / Fax: (702) 294-1306

Anaheim
Phone: (714) 693-3700 / Fax: (714) 693-9509

American
Air Balance Co., Inc.

Definitions of Abbreviations, Terminology, Symbols & Conversions

CHW or CHWS:	Chilled Water Supply
CHWR:	Chilled Water Return
CM^2	Square Centimeters
CM/SEC	Centometers per Second
CMD:	Count Mean Diameter
Cp	Specific Heat: water = 1.0 BTU / lb per ℉ air = 0.24 BTU / lb per ℉
CP or P:	Circulating Pump
CPT:	Capacity Performance Testing (Building Commissioning)
CR:	Ceiling Register
CRR:	Ceiling Return Register
CT:	Cooling Tower
CU:	Condensing Unit
CUH:	Cabinet Unit Heating
CV:	Specific Heat at Constant Volume
CV:	Valve Constant
CW:	Chilled Water
CWR:	Condenser Water Return
CW or CWS:	Condenser Water Supply
DAT:	Discharge Air Temperature
Db:	Decibel
DB:	Dry Bulb
DC:	Direct Current
DD:	Direct Drive
Delta (Δ):	Difference - net decrease or increase
DIA:	Diameter
DNL:	Data Not Listed
DOP:	Dioctyl Phthalate, an aerosol generated by blowing air through liquid Dioctyl Phthalate (mean particle diameter is between 0.2 and 0.4 microns)
Δ P:	Differential Pressure or Pressure Drop, net change in Pressure
DPT:	Dew Point Temperature
D_{STD}:	Standard Air Density, equals 0.075 lb / Cu. Ft. @ 29.92 in, Hg
Δ T:	Differential Temperature, net change in temperature
EAT:	Entering Air Temperature
EC:	Evaporative Cooler
Economizer:	Controls and componentry that allow an air handler to logically utilize outdoor air for cooling as opposed to the use of mechanical cooling
EDC:	Electric Duct Coil
EDH:	Electric Duct Heater
EER:	Energy Efficiency Ratio
EF or E:	Exhaust Fan
EFF:	Efficiency
EG:	Exhaust Grille
EMCS:	Energy Management Control System(s)

Corporate Headquarters
4721 E. Hunter Ave.
Anaheim, CA 92807
mail@aabccorp.com

Las Vegas
Phone: (702) 255-7331 / Fax: (702) 294-1306

Anaheim
Phone: (714) 693-3700 / Fax: (714) 693-9509

American
Air Balance Co., Inc.

Definitions of Abbreviations, Terminology, Symbols & Conversions

EMF:	Electromotive Force
EMS	Energy Management System(s)
ENT:	Entering
EP:	Electro-Pneumatic Switches
ER:	Exhaust Register
ESD:	Electrostatic Discharge
ESP:	External Static Pressure
EWT:	Entering Water Temperature
°F:	Degrees Fahrenheit
F to F:	Face to Face
FAF:	Forced Air Fan
FCU:	Fan Coil Unit
FDA:	Food and Drug Administration
FG:	Floor Grille
FH:	Fume Hood
FIV:	Field Installation Verification (Building Commissioning)
FLA:	Full Load Amperage
FLTS:	Filters
FP:	Freezing Point
FPB:	Fan Powered Box
FPM:	Feet Per Minute
FPS:	Feet Per Second
FPT:	Functional Performance Testing (Building Commissioning)
FR:	Floor Register
FTU:	Fan Terminal Unit
G or g:	Gravitational Constant
GA:	Gauge
GC:	General Contractor
GPH:	Gallons Per Hour
GPM:	Gallons Per Minute
GR:	Grain - measurement of actual moisture in an air sample, 7000 grains = one pound of water
GSD:	Geometric Standard Division
H:	Enthalpy
H2O:	Water
HC:	Heating Coil
HD:	Head pressure measured in inches or feet of water
Heater O.L.:	Thermal Overload protection for motors located at the motor starter
HEPA:	High Efficiency Particulate Arrestance
HEPA Filter:	High Efficiency Particulate Air Filter
Hg:	Mercury
HOA:	Hand/Off/Auto switch
HP:	HorsePower
HPS:	High Pressure Steam

Corporate Headquarters
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Las Vegas
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Definitions of Abbreviations, Terminology, Symbols & Conversions

HPU:	Heat Pump Unit
HRC:	Heat Recovery Coil or Heat Reclaim Coil
HTHW:	High Temperature Hot Water
HV:	Heating Ventilator
HVAC:	Heating, Ventilating & Air Conditioning
HW:	Hot Water
HWR:	Hot Water Return or Heating Water Return
HWS:	Hot Water Supply or Heating Water Supply
HX:	Heat exchanger
Hydronic:	Indicates the use or conveyance of liquid for thermal transfer
Hz:	Hertz
I.D.:	Inside Diameter
I/O:	Input / Output
ID:	Impeller Diameter (pump)
IES:	Institute of Environmental Sciences
IV:	Inlet Vanes
K:	Correction Factor
KW:	Kilowatts
KWH:	Kilowatt Hour
LAT:	Leaving Air Temperature
L/S:	Lter per Second
LD:	Linear Diffuser
LF:	Linear Foot
LPS:	Low Pressure Steam
LPS:	Liters Per Second
LTD:	Least Temperature Difference
LTHW:	Low Temperature Hot Water
LV or LVG:	Leaving
LWG:	Low Wall Grille
LWR:	Low Wall Register
LWT:	Leaving Water Temperature
MAU or MUA:	Make-up Air Unit or Make-Up Air
MAX:	Maximum
MB:	Mixing Box
MBH:	Mega BTU's per Hour
MET:	Mean Effective Temperature
Micron:	1.0 x 10-6 meter
Mil.:	2.54 x 10-5 meter
MIN	Minimum
MM:	Millimeters
MM X MM:	Millimeters by Millimeters
MMD:	Mass Mean Diameter
MTD:	Mean Temperature Difference
MVD:	Manual Volume Damper

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Definitions of Abbreviations, Terminology, Symbols & Conversions

MZ:	MultiZone
N/A:	Not Applicable or Not Available
NASA:	National Aeronautics and Space Administration
NC:	Noise Criteria or Normally Closed
NIC:	Not in Contract
N/L:	Not Listed
NM:	Not Measured
NO:	Normally Open
NPFC:	Naval Publications and Forms Center
NPSHA:	Net Positive Suction Head Available
NS:	Not Specified
NSF:	National Sanitation Foundation
NTIS:	National Technical Information Service
NTS:	Not To Scale
NVL:	No Valid Location for Testing
OB:	Octave Band - a range of frequency where the highest frequency of the band is double the lowest frequency of the band. The band is usually specified by the center frequency. The preferred octave bands are designated by the following center frequencies: 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000, 16000.
OBD:	Opposed Blade Damper
O.D.:	Outside Diameter
OAT:	Outside Air Temperature
OPT:	Operational Performance Testing (Building Commissioning)
O.S.A. or OA:	Outside Air
P.E.:	Professional Engineer
P:	Circulating Pump
Pa:	Pascal - 1 Pascal = 6.894 x 10^{-3} psi
PCT:	Percent
PD:	Differential Pressure or Pressure Drop
PE:	Pneumatic Electric Switch
PF:	Power Factor
PH:	Phase(s)
PHC:	PreHeat Coil
PMP:	Circulating Pump
PNC:	Preferred Noise Criterion Curves
PPM:	Parts Per Million
PSI:	Pounds per Square Inch
PSIA:	Pounds per Square Inch Absolute
PSIG:	Pounds per Square Inch Gauge
PSL:	Polystyrene Latex Spheres - used to generate an aerosol challenge medium where electronic & semi-conductor products are manufactured
PWR:	Power

Corporate Headquarters
4721 E. Hunter Ave.
Anaheim, CA 92807
mail@aabccorp.com

Las Vegas
Phone: (702) 255-7331 / Fax: (702) 294-1306

Anaheim
Phone: (714) 693-3700 / Fax: (714) 693-9509

American
Air Balance Co., Inc.

Definitions of Abbreviations, Terminology, Symbols & Conversions

R:	Rankine (absolute temperature) - Rankine = 1.8 Kelvin
RA:	Return Air
RAT:	Return Air Temperature
RCC:	Room Criterion Curves
RD:	Round (for sizes)
REQ:	Required
RF:	Return air Fan
RH:	Relative Humidity
RHC:	ReHeat Coil
RPM:	Revolutions Per Minute
RTU:	Roof Top Unit
S:	Entropy
SA:	Supply Air
SAR:	Supply Air Register
SAT:	Supply Air Temperature
SD:	Smoke detector or Smoke Damper
SEER:	Season Energy Efficient Ratio
SEF:	Smoke Exhaust Fan
SF (AIR):	Supply Fan
SF (ELECT):	Service Factor
SF (MOTOR):	Safety Factor by which actual amps can exceed rated amperage, at the expense of expected motor life
SHC:	Steam Heating Coil
SMACNA:	Sheet Metal and Air Conditioning Contractors National Association
SP:	SetPoint
SP:	Static Pressure
S.P. "W.C.":	Static Pressure resistance measured in inches of Water Column
SP VOLUME:	Specific Volume
SPF:	Stairwell Pressurization Fan
SQ:	Square
STD:	Standard
SWG:	SideWall Grille
SWR:	SideWall Register
SWS:	SideWall Supply
T STAT:	Thermostat
TAB:	Testing, Adjusting and Balancing
TD:	Differential Temperature - Net temperature decrease or increase
TDH:	Total Dynamic Head or Total Dead Head (pressure differential when flow equals zero)
T.I.	Travel In
T.O.	Travel Out
THROW:	Distance an airdtream travels after leaving an air outlet before the air stream velocity is reduced to approximately 50 fpm

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4721 E. Hunter Ave.
Anaheim, CA 92807
mail@aabccorp.com

Las Vegas
Phone: (702) 255-7331 / Fax: (702) 294-1306

Anaheim
Phone: (714) 693-3700 / Fax: (714) 693-9509

American
Air Balance Co., Inc.

Definitions of Abbreviations, Terminology, Symbols & Conversions

TON (Air Cond.):	Equals 12,000 BTU per hour
TP:	Traverse Point or Test Point.
TP (Motor):	Thermal Protected (opens motor circiutry if rated amps are exceeded)
TR:	Thermal Resistance
TSP:	Total Static Pressure
UH:	Unit Heater
ULPA Filter:	Ultra Low Penetration Air Filter
UV:	Unit Ventilator
V:	Volt or Voltage
VA:	Volt Atmossphere
VAC:	Vacuum
VAV:	Variable Air Volume
VD:	Volume Damper
VEL:	Velocity
VFD:	Variable Frequency Drive (electric motor speed controller)
VP:	Velocity Pressure
W:	Watts
WB:	Wet Bulb
W.G.:	Water Gage
WT:	Weight
WTR:	Water
Z:	Zone
Zoning:	The practice of dividing a building into small sections for heating and cooling control, selected so that one thermostat can be used to determine each section's heating & cooling requirements

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Anaheim, CA 92807
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Las Vegas
Phone: (702) 255-7331 / Fax: (702) 294-1306

Anaheim
Phone: (714) 693-3700 / Fax: (714) 693-9509

American
Air Balance Co., Inc.

Manhattan Beach City Hall - AH-1, AH-2 and AH-3 Air Survey
Manhattan Beach, CA 90266

CERT #191360

American Air Balance Co., Inc is a Testing and Balancing Agency that engages in testing, adjusting and balancing of air and water moving systems. American Air Balance Co., Inc. does not undertake the construction of HVAC systems, fans, ductwork, terminal boxes, dampers, air distribution or other components. Additionally, our firm does not undertake construction of other building systems, such as walls, doors, windows, lights, that may have a direct affect on the performance of the system(s) being tested.

This report represents the optimal obtainable results given the limits of the installed system and the existing conditions at the time of certification. The data and information provided herein is factual, accurate and based upon the information provided in addition to the existing conditions of the building at the time the tests were conducted.

Each system's component installation and design dictates limitations and test parameters. System specific procedures must be followed to duplicate the results listed herein. American Air Balance Co., Inc. employs the standards and procedures per the latest version of the AABC National Standards and Test and Balance Procedures, as applicable, unless otherwise dictated by the project specifications and/or project system specific requirements.

Verification of the report contents must be carried out within 45 days of certification and shall be accomplished by our Field Technician, using the same instruments, under the same test conditions used to develop this report; otherwise this project warranty is null and void. Our office must receive requests for field verification in writing within 30 days of certification.

American Air Balance Co., Inc. makes no representation or warranty that the systems and data contained herein will remain in the condition recorded beyond the date of certification. Adjustment(s), change(s) and/or tampering with component of the systems will affect the values listed herein. Changes, modifications and/or adjustment to the building structure, systems and/or sub systems, including but not limited to Architectural, Mechanical, Electrical, Plumbing, Building Automation Controls and Fire/Life Safety Alarm Systems will adversely affect the integrity of the systems and alter the data listed herein. Any such changes void American Air Balance Co., Inc.'s warranty and the AABC National Performance Guaranty.

Proper building and HVAC system(s) maintenance must be followed to maintain efficient conditions. Improper system maintenance directly affects system performance.

Corporate Headquarters
4721 E. Hunter Ave.
Las Vegas **Anaheim**, CA 92807 **Anaheim**
Phone: (702) 255-7331 / Fax: (702) 294-1306 mail@americanairbalance.com Phone: (714) 693-3700 / Fax: (714) 693-9509

Explanation of "K" Value and Flow Hood Readings

Air distribution was read with a Shortridge Flow Hood; Air Data Multi-Meter, model ADM-860, where possible, and where 1.0 is listed as the effective area, "K" in our report, unless otherwise noted. This flow hood is a direct reading instrument that compensates and corrects for hood backpressure, altitude, density and temperature when appropriate; therefore a 1.0 is listed as the effective area. The velocity listed in this report reflects the velocity through the flow hood and not the diffuser neck or face.

General Procedures – All Projects

Duct traverse readings were provided where possible and a sufficient length of straight duct was installed. Readings were not provided when one or more of the following conditions existed:

- Insufficient lengths of straight duct were installed.
- We were unable to obtain accurate readings.
- Inadequate access to the ductwork.

Scope of Work

American Air Balance Co., Inc. has been requested to provide a Survey for the above referenced project. This work is inclusive of:

Air Survey

1. Measure and record the air handling systems data to determine the existing conditions and performance. Obtain and record all actual and required HVAC unit information, as available on equipment tags to include fan manufacturer, model & serial number, motor manufacturer, HP, service factor, design FLA, actual AMP draw, sheave and belt information, total supply, return and OSA CFM and actual static pressures for: AHU-1, AHU-2 and AHU-3.
2. Provide a static pressure profile of each component for: AHU-1, AHU-2 and AHU-3.
3. Measure and record the actual CFM by duct traverse and static pressure within each main duct by means of duct traverse to determine the Supply, Return and Outside Air Total CFM for: AHU-1, AHU-2 and AHU-3.
4. Examine filters and fan belt and provide a recommendation for replacement if required for: AHU-1, AHU-2 and AHU-3.
5. Measure and record the minimum & maximum Primary Air CFM of the Fan Powered Box for: AHU-1 / 1st Floor - MB-1, MB-2, MB-3, MB-4, MB-5 and MB-6.
6. Measure and record the actual CFM, supply air distribution for: AHU-1.
7. Measure and record the minimum & maximum total CFM for: AHU-2 / Basement - Approximately (6) Variable Air Volume Terminal Boxes.
8. Measure and record the actual CFM, supply air distribution for: AHU-2.
9. Develop schematic CAD diagrams showing the approximate location of supply air distribution only for: AHU-2.
10. Measure and record the minimum & maximum total CFM for: AHU-3 / Basement - Approximately (12) Variable Air Volume Terminal Boxes.
11. Measure and record the actual CFM, supply air distribution for: AHU-3.
12. Normal and Off-hours as required to complete the scope of work.

13. Identify, document and describe any observed conditions that may affect system performance.
14. All work will be provided and/or supervised by "AABC Certified Technicians" with current certification.
15. Six (6) copies of "Test & Balance Analysis Report" within five working days of completion.
16. Provide password protected client access, to archived Air Balance Reports in a PDF format via the American Air Balance Co. Inc., website.

The exclusions specifically not included in our price for this project are as follows:

A. Any system adjustment.
B. CAD Report Plans, (this is optional listed as an Alternate Add).
C. Performance and/or Payment Bonds.
D. Repair and/or installation of any mechanical devices (i.e., purchasing, sizing and/or installing sheaves and belts or volume dampers on air moving systems as required to obtain design values).
E. Overtime.
F. Liquidated Damages.
G. Re-testing and/or Re-inspections.
H. Downtime in excess of fifteen (15) minutes as a result of incomplete systems.
I. Additional insurance coverage (AI) Endorsement, changes to our policy limits, Pollution Liability, Environmental Impairment Liability, Extended Overhead costs related to OCIP and/or Waiver of Subrogation.
J. Control Programs, Components, Software & Hardware.
K. Fan Speed / Drive Changes Exclusion: Any cost related to motor damage or failure as a result of increasing the fan speed to meet the required air quantity is excluded.
L. Fire Alarm/Life Safety Systems Testing.
M. Participation in the commissioning process.
N. Commissioning of the systems.
O. As-building of ductwork drawings, specifically scaled drawings indicating exact size, elevation and location of ductwork, zone dampers, CAV/VAV boxes, smoke/fire damper, humidifier, and re-heat coil sizes and exact locations and ceiling / attic space dimensions and elevations.
P. Verification of the HVAC Control System(s) operation and calibration.
Q. Thermostat location, operation and calibration verification.

Project Specific Comments

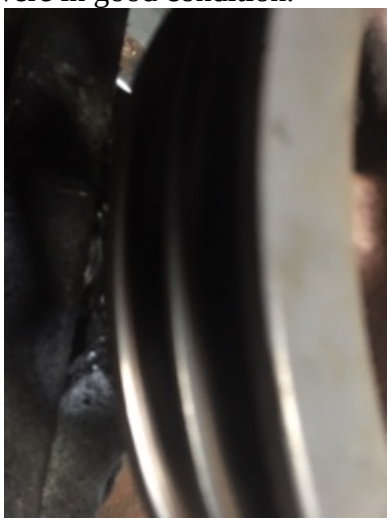
This section of our report is used to describe project special conditions, system observations and/or operational comments. At times, as applicable, items that remain outstanding and/or values that are not with the allowable project tolerances are footnoted on each individual test sheet will also be listed herein.

American Air Balance Co., Inc. has noted the following upon conclusion of the Survey of this project:

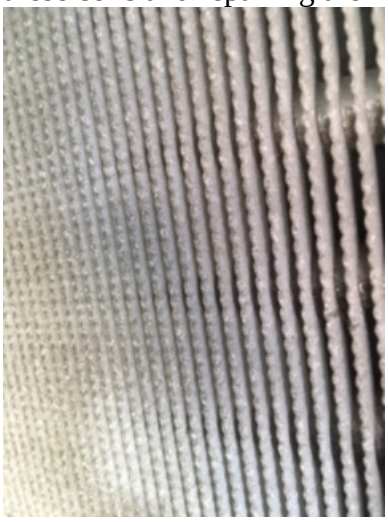
AH-1

- The filters on the unit were clean and the belts and sheaves were in good condition.





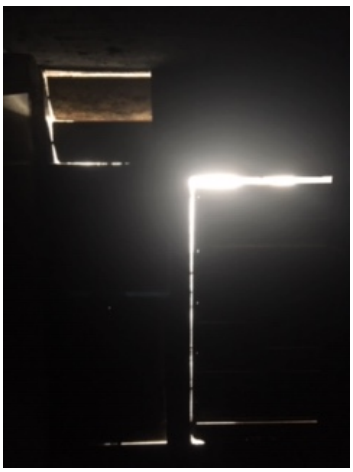
- The coils on the unit have minor corrosion on them along with damaged fins. Cleaning these coils and repairing the fins will increase performance and air quality.



- The overall condition of the fan is poor. There are holes from corrosion throughout the unit. The dampers for the economizer and outside air are corroded. The insulation from inside the fan compartment is coming off the unit walls and the fan itself is dirty and needs to be cleaned.

- Due to the economizer damper not being the correct size and various holes on and around the mixing plenum, the total outside air for this unit was determined by the total supply minus the traversed return.

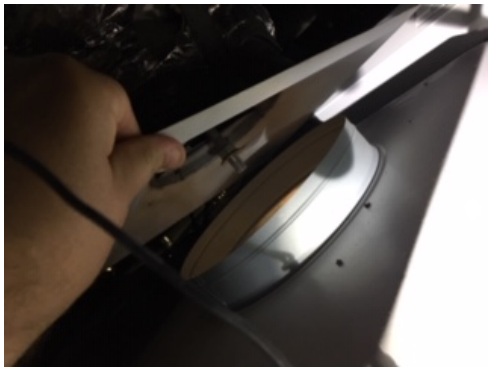




- There is no air flow on VAV's 3, 4, 12, 16, 19, 25, 29 and 38. This is due to no control's controller being hooked up to the VAV box.

- The fan powered boxes that are shown on the original print have been gutted and abandoned in the ceiling.

- The air distribution associated with VAV-44 which serves the chambers conference room, is not connected properly. This is allowing air to enter the attic space which in turn is not cooling the required space properly. Properly attaching the diffusers will increase the unit's ability to cool the space.

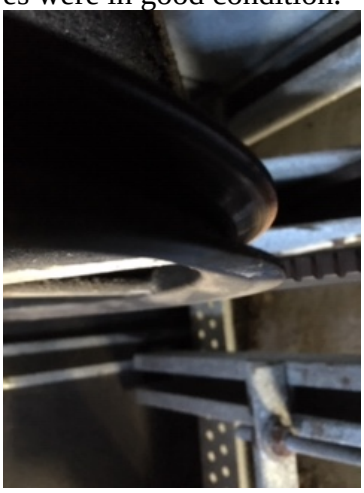



- Air Distribution 7,9 and 10 associated with VAV-30 have an actual CFM of 0. This is due to the diffuser being capped.


AH-2

- The filters on the unit were clean and the belts and sheaves were in good condition.





- The coils on the unit have minor corrosion on them along with damaged fins. Cleaning these coils and repairing the fins will increase performance and air quality.

- The fan compartment and fan wheel on this unit is dirty and needs to be cleaned. There are debris located on the bottom of the unit that may enter the conditioned space.



- The supply duct work has damage to it which is leaking air. Sealing this duct work will insure that it will reach the conditioned space.


- Due to inadequate lengths of straight duct work, the return total was determined by taking traversed supply minus the traversed outside air.

- Air Distribution numbers 22 and 23 show an actual CFM of 0. This is due to them being capped off at the diffuser.

AH-3

- The filters on the unit were clean and the belts and sheaves were in good condition.



- The coils on the unit have minor corrosion on them along with damaged fins. Cleaning these coils and repairing the fins will increase performance and air quality.

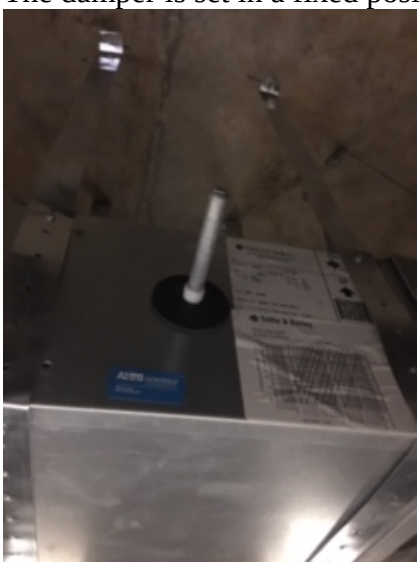
- The fan compartment and fan wheel on this unit are dirty and needs to be cleaned. There are debris that is on the bottom of the unit that may enter the conditioned space due to it being located after the filters.



- AH-3 has a VFD that is not operational.

- AH-3 has a power exhaust fan that is not operational. It appears it has not functioned in some time.

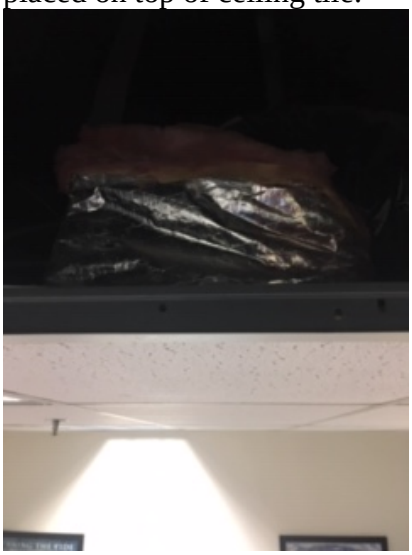
- VAV-Women's which serves the restroom does not have a controls actuator installed. The damper is set in a fixed position.

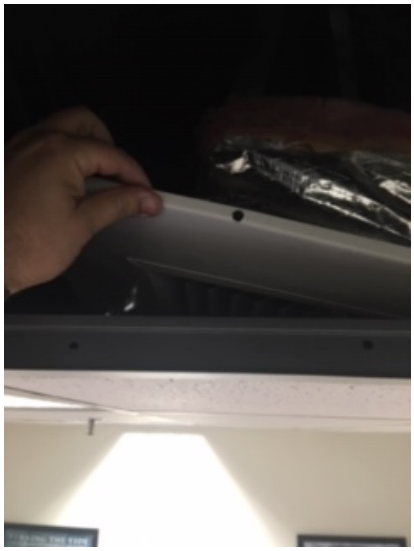


- Air Distribution 9, 10, 12 and 13 have an actual CFM of 0. On 9,10 and 12 that is due to the ductwork not being installed properly on the ceiling diffuser and possibly blowing above the ceiling. Drop 13 has no air flow due to the duct work not being connected.

- Off VAV-40 there is a supply drop that is open to the ceiling and is possible supplying air above the ceiling.

- Drop number two off VAV-53 had no air flow. This is due to the ceiling diffuser being placed on top of ceiling tile.





- There is no air flow off VAV-41and 42A. This is due to a possible bad VAV controller.

American
Air Balance Co., Inc.

Manhattan Beach City Hall

TABLE OF CONTENTS

Las Vegas
Phone: (702)255-7331 / Fax: (702)294-1306

Corporate Headerquarters
4721 E. Hunter Ave
Anaheim, CA 92807
mail@americanairbalance.com

Anaheim
Phone: (714)693-3700 / Fax: (714)693-9509

AABC Certified Member

American
Air Balance Co., Inc.

Manhattan Beach City Hall

TABLE OF CONTENTS

Las Vegas
Phone: (702)255-7331 / Fax: (702)294-1306

Corporate Headerquarters
4721 E. Hunter Ave
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April 2, 2019

American Air Balance Co., Inc.

Air Moving Equipment Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST AH-1

Fan Information

FAN NUMBER EXIST AH-1	SERVING 1ST FLOOR/BASEMENT LOBBY
FAN MANUFACTURER TRANE	MODEL DAMAGED TAG
FAN SERIAL NUMBER DAMAGED TAG	MOTOR MANUFACTURER BALDOR FR256T

CFM

	Required	Actual
Total - Fan	N/A	16230
Return	0	11840
O.S.A	0	4390

S.P.

	Required	Actual
Suction	N/A	-0.70
Discharge	N/A	1.96
Total	External N/A	Total SP 2.66

115

Conditions

	Required			Actual		
SP Drop Across FLTS	N/A			0.08		
Motor (HP/RPM)	20.00	1765		20.00	1770	
Motor (Volts/Phase)	460	3		470	3	
Motor Amps	26.00	26.00	26.00	17.50	17.89	17.78
Brake HorsePower	13.94		EFFICIENCY 0.89		POWER FACTOR 0.81	
Service Factor	N/A					
Fan RPM	N/L			1152		

MOTOR SHEAVE 2VP72 X 1 5/8	% OPEN 50%
FAN SHEAVE 9.75" OD X 2 7/16	DRIVE BELTS (2) 5VX570
CTR. TO CTR. 16.00	MOTOR **T.I.** 1.00 **T.O.** 2.00
V.F.D. HERTZ SET POINT N/A	OPERATING STATIC PRESSURE SET POINT 1.5

115 PLEASE REFER TO THE PROJECT SUMMARY.

April 2, 2019

American
Air Balance Co., Inc.

Coil Traverse - Rectangular

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXSIT AH-1 TOTAL SUPPLY

461	430	414	409	441	442
390	421	431	383	452	457
434	438	407	382	407	353
377	373	399	400	408	342

COIL SIZE		COIL AREA
L 108.0	**W** 62.0	39.53
AK FACTOR		AIR TEMP
0.85		N/A
FINAL AVERAGE VELOCITY		
410.5		
REQUIRED CFM		ACTUAL CFM
N/A		16230.0

April 2, 2019

American Air Balance Co., Inc.

Duct Traverse - Rectangular

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST AH-1 RETURN

1806	1612
1795	1800
919	895
789	1208

DUCT SIZE		DUCT AREA
L 28.0	**W** 45.0	8.75
DUCT S.P.		AIR TEMP
N/A		N/A
FINAL AVERAGE VELOCITY		
1353.0		
REQUIRED CFM		ACTUAL CFM
N/A		11840.0

April 2, 2019

American
Air Balance Co., Inc.

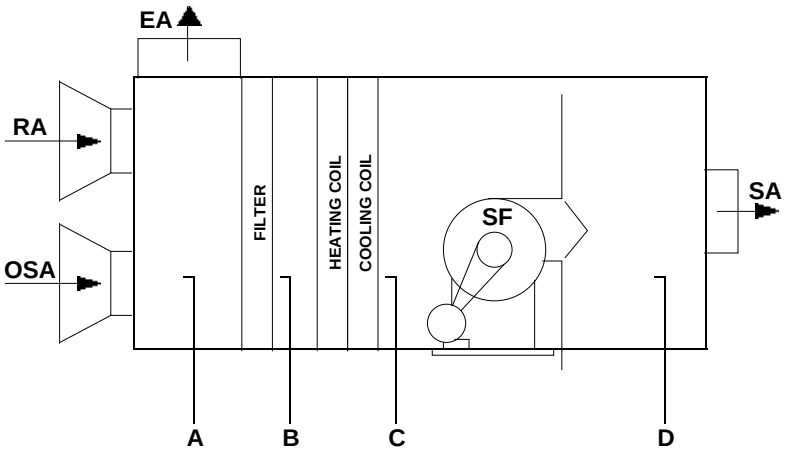
Static Pressure Profile

PROJECT

Manhattan Beach City Hall

DESCRIPTION

EXIST AH-1 STATIC PROFILE



A	B	C	D
-0.34	-0.42	-0.70	1.96

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-01

Air Distribution Information	
MODEL	SIZE
TITUS DESV	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	150
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X 48	1.000			150	150
Totals:							150

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-02

Air Distribution Information	
MODEL	SIZE
TITUS DESV	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	150
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X 48	1.000			150	150
Totals:							150

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-03

Air Distribution Information	
MODEL	SIZE
TITUS DESV	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	0
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X 48	1.000			0	0
Totals:							0

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-04

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	0
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
GEN OFFICE	1	1 X 48	1.000			0	0
GEN OFFICE	2	1 X 48	1.000			0	0
GEN OFFICE	3	1 X 48	1.000			0	0
Totals:							0

April 2, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-05

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	840
Maximum Design Air Flow	N/A	840
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
GEN OFFICE	1	1 X 48	1.000			260	260
GEN OFFICE	2	1 X 48	1.000			265	265
GEN OFFICE	3	1 X 48	1.000			315	315
Totals:							840

April 2, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-06

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	190
Maximum Design Air Flow	N/A	190
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
GEN OFFICE	1	1 X 48	1.000			190	190
GEN OFFICE	2	1 X 48	1.000			0	0
Totals:							190

April 2, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-07

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	925
Maximum Design Air Flow	N/A	925
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
GEN OFFICE	1	1 X 48	1.000			355	355
GEN OFFICE	4	1 X 48	1.000			165	165
GEN OFFICE	4	1 X 48	1.000			230	230
GEN OFFICE	4	1 X 48	1.000			175	175
Totals:							925

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-09

Air Distribution Information	
MODEL	SIZE
TITUS DESV	8"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	275
Maximum Design Air Flow	N/A	275
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
STORAGE	1	8 X 8	1.000			70	70
STORAGE	2	10 X 10	1.000			60	60
GEN OFFICE	3	1 X 48	1.000			0	0
GEN OFFICE	4	1 X 48	1.000			145	145
Totals:							275

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-10

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	230
Maximum Design Air Flow	N/A	485
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X 48	1.000			240	240
OFFICE	2	1 X 48	1.000			245	245
Totals:							485

April 2, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-11

Air Distribution Information	
MODEL	SIZE
TITUS DESV	8"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	330
Maximum Design Air Flow	N/A	440
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X 48	1.000			180	180
OFFICE	2	1 X 48	1.000			120	120
OFFICE	3	1 X 48	1.000			140	140
Totals:							440

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-12

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	0
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X 48	1.000			0	0
OFFICE	2	1 X 48	1.000			0	0
Totals:							0

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-13

Air Distribution Information	
MODEL	SIZE
TITUS DESV	12"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	1330
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
CONFERNECE	1	1 X 48	1.000			210	210
CONFERENCE	2	1 X 48	1.000			225	225
CONFERENCE	3	1 X 48	1.000			200	200
CONFERENCE	3	8 X 8	1.000			380	380
CONFERENCE	4	8 X 8	1.000			315	315
Totals:							1330

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-14

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	445
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X 48	1.000			210	210
OFFICE	2	1 X 48	1.000			235	235
Totals:							445

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-15

Air Distribution Information	
MODEL	SIZE
TITUS DESV	12"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	210
Maximum Design Air Flow	N/A	210
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X 48	1.000			90	90
OFFICE	2	1 X 48	1.000			120	120
OFFICE	3	1 X 48	1.000			0	0
Totals:							210

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-16

Air Distribution Information	
MODEL	SIZE
TITUS DESV	12"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	0
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X 48	1.000			0	0
Totals:							0

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-17

Air Distribution Information	
MODEL	SIZE
TITUS DESV	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	210
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
GEN OFFICE	1	1 X 48	1.000			100	100
GEN OFFICE	2	12 X 24	1.000			110	110
Totals:							210

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-18

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	270
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
GEN OFFICE	1	1 X 48	1.000			120	120
GEN OFFCIE	3	1 X 48	1.000			150	150
GEN OFFCIE	3	1 X 48	1.000			0	0
Totals:							270

April 2, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-19

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	0
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
GEN OFFICE	1	1 X 48	1.000			0	0
GEN OFFICE	2	1 X 48	1.000			0	0
GEN OFFICE	3	1 X 48	1.000			0	0
Totals:							0

April 2, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-20

Air Distribution Information	
MODEL	SIZE
TITUS DESV	8"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	190
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
GEN OFFICE	1	1 X 48	1.000			70	70
GEN OFFICE	2	1 X 48	1.000			120	120
Totals:							190

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-21

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	655
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
GEN OFFICE	1	1 X 48	1.000			120	120
GEN OFFICE	4	1 X 48	1.000			185	185
GEN OFFICE	4	1 X 48	1.000			170	170
GEN OFFICE	4	1 X 48	1.000			180	180
Totals:							655

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-22

Air Distribution Information	
MODEL	SIZE
TITUS DESV	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	125
Maximum Design Air Flow	N/A	370
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X 48	1.000			210	210
OFFICE	2	1 X 48	1.000			160	160
Totals:							370

April 2, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-23

Air Distribution Information	
MODEL	SIZE
TITUS DESV	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	255
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X 48	1.000			210	210
OFFICE	2	1 X 48	1.000			45	45
Totals:							255

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-24

Air Distribution Information	
MODEL	SIZE
TITUS DESV	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	250
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X 48	1.000			145	145
OFFICE	2	1 X 48	1.000			105	105
Totals:							250

April 2, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-25

Air Distribution Information	
MODEL	SIZE
TITUS DESV	8"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	0
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
GEN OFFICE	1	1 X 48	1.000			0	0
GEN OFFICE	2	1 X 48	1.000			0	0
GEN OFFICE	3	1 X 48	1.000			0	0
Totals:							0

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-26

Air Distribution Information	
MODEL	SIZE
TITUS DESV	8"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	210
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
GEN OFFICE	1	1 X 48	1.000			120	120
GEN OFFICE	2	1 X 48	1.000			90	90
Totals:							210

April 2, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-27

Air Distribution Information	
MODEL	SIZE
TITUS DESV	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	275
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X 48	1.000			135	135
OFFICE	2	1 X 48	1.000			140	140
Totals:							275

April 2, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-28

Air Distribution Information	
MODEL	SIZE
TITUS DESV	8"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	570
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X48	1.000			165	165
OFFICE	2	1 X 48	1.000			230	230
OFFICE	3	1 X 48	1.000			175	175
Totals:							570

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-29

Air Distribution Information	
MODEL	SIZE
TITUS DESV	12"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	510
Maximum Design Air Flow	N/A	510
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	1 X 48	1.000			80	80
OFFICE	2	1 X 48	1.000			60	60
GEN OFFICE	3	1 X 48	1.000			85	85
GEN OFFICE	4	1 X 48	1.000			70	70
OFFICE	5	1 X 48	1.000			85	85
OFFICE	6	1 X 48	1.000			0	0
OFFICE	7	1 X 48	1.000			60	60
OFFICE	8	1 X 48	1.000			70	70
Totals:							510

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-30

Air Distribution Information	
MODEL	SIZE
TITUS DESV	12"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	755
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
LOBBY	1	2 X 48	1.000			60	60
LOBBY	2	2 X 48	1.000			110	110
LOBBY	3	2 X 48	1.000			110	110
LOBBY	4	2 X 48	1.000			130	130
LOBBY	5	2 X 48	1.000			100	100
LOBBY	6	2 X 48	1.000			100	100
LOBBY	7	2 X 48	1.000			0	0
LOBBY	8	2 X 48	1.000			145	145
LOBBY	9	2 X 48	1.000			0	0
LOBBY	10	2 X 48	1.000			0	0
Totals:							755

March 25, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-31

Air Distribution Information	
MODEL	SIZE
TITUS DESV	12"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	860
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OPEN OFFIE	1	24 X 24	1.000			0	0
OPEN OFFIC	2	24 X 24	1.000			90	90
OPEN OFFIC	3	24 X 24	1.000			80	80
OPEN OFFIC	4	24 X 24	1.000			100	100
OPEN OFFIE	5	24 X 24	1.000			100	100
OPEN OFFIC	6	24 X 24	1.000			55	55
ATTOR SEC	7	24 X 24	1.000			75	75
OPEN OFFIC	8	24 X 24	1.000			70	70
OPEN OFFIC	9	24 X 24	1.000			70	70
COPIER RM	10	24 X 24	1.000			50	50
OFFICE	11	24 X 24	1.000			70	70
OPEN OFFIC	12	24 X 24	1.000			100	100
Totals:							860

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-32

Air Distribution Information	
MODEL	SIZE
TITUS DESV	12"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	60
Maximum Design Air Flow	N/A	975
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
CONFERENCE	1	24 X 24	1.000			430	430
CONFERENCE	2	24 X 24	1.000			125	125
CONFERENCE	3	24 X 24	1.000			210	210
CONFERENCE	4	24 X 24	1.000			210	210
Totals:							975

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-33

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	780
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
CITY MANAR	1	24 X 24	1.000			470	470
CITY MANAG	2	24 X 24	1.000			310	310
Totals:							780

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-34

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	300
Maximum Design Air Flow	N/A	300
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
CITY CLERK	1	24 X 24	1.000			60	60
CITY MANGR	2	24 X 24	1.000			110	110
COUNCIL	3	24 X 24	1.000			130	130
Totals:							300

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-35

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	340
Maximum Design Air Flow	N/A	340
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
CITY CLERK	1	24 X 24	1.000			250	250
CITY CLERK	2	24 X 24	1.000			90	90
Totals:							340

April 2, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-36

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	125
Maximum Design Air Flow	N/A	470
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
COUNCIL	1	24 X 24	1.000			260	260
COUNCIL	2	24 X 24	1.000			210	210
Totals:							470

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-37

Air Distribution Information	
MODEL	SIZE
TITUS DESV	8"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	90
Maximum Design Air Flow	N/A	450
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
MAYOR	1	24 X 24	1.000			450	450
Totals:							450

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-38

Air Distribution Information	
MODEL	SIZE
TITUS DESV	8"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	0
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
CITY ATTOR	1	24 X 24	1.000			0	0
Totals:							0

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-39

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	160
Maximum Design Air Flow	N/A	160
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
CITY ATTOR	1	24 X 24	1.000			70	70
MAYOR	2	24 X 24	1.000			90	90
Totals:							160

April 2, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-43

Air Distribution Information	
MODEL	SIZE
TITUS DESV	12"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	750
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
LOBBY	1	2 X 48	1.000			120	120
LOBBY	2	2 X 48	1.000			100	100
LOBBY	3	2 X 48	1.000			145	145
LOBBY	4	2 X 48	1.000			120	120
LOBBY	5	2 X 48	1.000			135	135
LOBBY	6	2 X 48	1.000			130	130
Totals:							750

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-44

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	230
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
CHAMB CON	1	24 X 24	1.000			80	80
CHAMB CON	2	24 X 24	1.000			80	80
CHAMB CONF	3	24 X 24	1.000			70	70
Totals:							230

April 2, 2019

American Air Balance Co., Inc.

Air Moving Equipment Test

PROJECT	
Manhattan Beach City Hall	
DESCRIPTION	
EXIST AH-2	

Fan Information

FAN NUMBER	SERVING
EXIST AH-2	COUNCIL CHAMBERS
FAN MANUFACTURER	MODEL
TRANE	DAMAGED TAG
FAN SERIAL NUMBER	MOTOR MANUFACTURER
DAMAGED TAG	EMERSON FR 213T

CFM

	Required	Actual
Total - Fan	N/A	6465
Return	0	6180
O.S.A	0	285

S.P.

	Required	Actual
Suction	N/A	-1.94
Discharge	N/A	0.41
Total	External N/A	Total SP 2.35

115

Conditions

	Required			Actual		
SP Drop Across FLTS	N/A			0.03		
Motor (HP/RPM)	7.50	1765		7.50	1770	
Motor (Volts/Phase)	460	3		470	3	
Motor Amps	10.00	10.00	10.00	7.30	7.00	8.30
Brake HorsePower	5.71	EFFICIENCY 0.88		POWER FACTOR 0.79		
Service Factor	1.15					
Fan RPM	N/L			1098		

MOTOR SHEAVE	% OPEN
1VP71 X 1 3/8	50%
FAN SHEAVE	DRIVE BELTS
10"OD X 1 7/16	(1) B46
CTR. TO CTR.	MOTOR
11.00	**T.I.** 5.00 **T.O.** 1.00

115 PLEASE REFER TO THE PROJECT SUMMARY.

April 2, 2019

American
Air Balance Co., Inc.

Coil Traverse - Rectangular

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST AH-2 TOTAL SUPPLY

600	597	593	672
533	588	632	649

COIL SIZE		COIL AREA
L 60.0	**W** 30.0	10.63
AK FACTOR		AIR TEMP
0.85		N/A
FINAL AVERAGE VELOCITY		
608.0		
REQUIRED CFM		ACTUAL CFM
N/A		6465.0

April 2, 2019

American
Air Balance Co., Inc.

Duct Traverse - Rectangular

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST AH-2 OSA

89	71
62	46

DUCT SIZE	DUCT AREA
L 28.0 **W** 22.0	4.28
DUCT S.P.	AIR TEMP
N/A	N/A
FINAL AVERAGE VELOCITY	
67.0	
REQUIRED CFM	ACTUAL CFM
N/A	285.0

126 TAKEN WITH VEL-GRID AT O.S.A. INLET.

April 2, 2019

American
Air Balance Co., Inc.

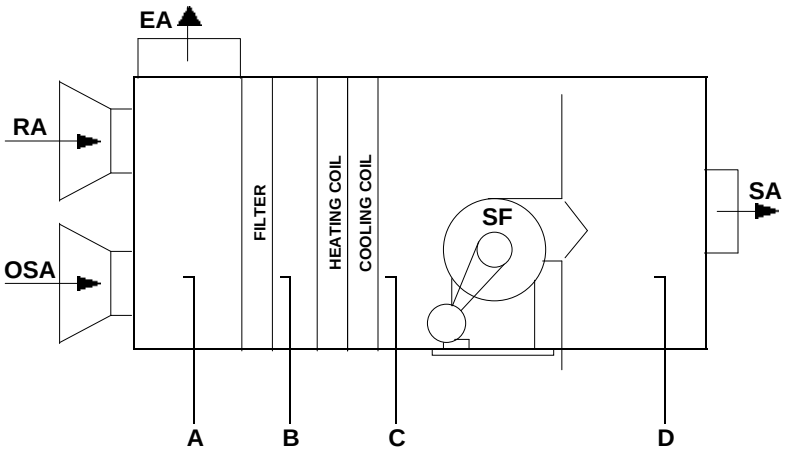
Static Pressure Profile

PROJECT

Manhattan Beach City Hall

DESCRIPTION

EXIST AH-2 STATIC PROFILE



A	B	C	D
-1.32	-1.35	-1.94	0.41

April 2, 2019

American Air Balance Co., Inc.

Air Distribution Schedule

PROJECT

Manhattan Beach City Hall

DESCRIPTION

EXIST AH-2 SUPPLY

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
ELEV MACHN	1	10 X 10	1.000			200	200
CHAMBERS	2	6 X 36	1.500			272	410
CHAMBERS	3	6 X 36	1.500			127	190
CHAMBERS	4	6 X 36	1.500			134	200
CHAMBERS	5	6 X 36	1.500			0	0
CHAMBERS	6	6 X 36	1.500			193	290
CHAMBERS	7	6 X 36	1.500			192	290
CHAMBERS	8	6 X 36	1.500			55	80
CHAMBERS	9	6 X 36	1.500			177	265
CHAMBERS	10	6 X 36	1.500			91	135
CHAMBERS	11	6 X 36	1.500			123	185
CHAMBERS	12	6 X 36	1.500			165	250
CHAMBERS	13	6 X 36	1.500			138	210
CHAMBERS	14	6 X 36	1.500			125	190
CHAMBERS	15	6 X 36	1.500			128	190
CHAMBERS	16	6 X 36	1.500			175	260
CHAMBERS	17	6 X 36	1.500			145	220
CHAMBERS	18	6 X 36	1.500			176	265
CHAMBERS	19	6 X 36	1.500			153	230
CHAMBERS	20	6 X 36	1.500			166	250
CHAMBERS	21	6 X 36	1.500			165	250
CHAMBERS	22	4 X 24	0.670			0	0
CHAMBERS	23	4 X 24	0.670			0	0

March 25, 2019

American
Air Balance Co., Inc.

Air Distribution Schedule

PROJECT

Manhattan Beach City Hall

DESCRIPTION

EXIST AH-2 SUPPLY

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
CHAMBERS	24	4 X 24	0.670			156	105
CHAMBERS	25	4 X 24	0.670			164	110
CHAMBERS	26	4 X 24	0.670			134	90
CHAMBERS	27	4 X 24	0.670			127	85
CHAMBERS	28	4 X 24	0.670			164	110
CHAMBERS	29	4 X 24	0.670			179	120
CHAMBERS	30	4 X 24	0.670			119	80
CHAMBERS	31	4 X 24	0.670			149	100
CHAMBERS	32	4 X 24	0.670			201	135
CHAMBERS	33	4 X 24	0.670			164	110
CHAMBERS	34	4 X 24	0.670			134	90
CHAMBERS	35	4 X 24	0.670			127	85
Totals:							5780

April 2, 2019

American Air Balance Co., Inc.

Air Moving Equipment Test

PROJECT	
Manhattan Beach City Hall	
DESCRIPTION	
EXIST AH-3	

Fan Information

FAN NUMBER	SERVING
EXIST AH-3	BASEMENT
FAN MANUFACTURER	MODEL
CARRIER	39LC1152CA1034-L
FAN SERIAL NUMBER	MOTOR MANUFACTURER
2194T54429	NIDEC MOTOR FR213T

CFM

	Required	Actual
Total - Fan	N/A	7980
Return	0	6285
O.S.A	0	1695

S.P.

	Required	Actual
Suction	N/A	-1.25
Discharge	N/A	0.56
Total	External N/A	Total SP 1.81

Conditions

	Required			Actual		
SP Drop Across FLTS	N/A			0.37		
Motor (HP/RPM)	7.50	1765		7.50	1770	
Motor (Volts/Phase)	460	3		473	3	
Motor Amps	9.10	9.10	9.10	6.00	6.90	7.00
Brake HorsePower	5.57	EFFICIENCY 0.91		POWER FACTOR 0.84		
Service Factor	1.25					
Fan RPM	N/L			866		

MOTOR SHEAVE	% OPEN
4.75"OD X 1 1/8	FIXED
FAN SHEAVE	DRIVE BELTS
BK90H X 1 7/16	(1) BX42
CTR. TO CTR.	MOTOR
12.00	**T.I.** 6.00 **T.O.** 2.00
V.F.D. HERTZ SET POINT	OPERATING STATIC PRESSURE SET POINT
60	N/A

April 2, 2019

American Air Balance Co., Inc.

Duct Traverse - Rectangular

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST AH-3 TOTAL OSA

600	550	322	309	69
619	504	448	226	152
590	391	398	493	374
648	519	493	493	273
676	450	524	270	206

DUCT SIZE	DUCT AREA
L 24.0 **W** 24.0	4.00
DUCT S.P.	AIR TEMP
-0.16	N/A
FINAL AVERAGE VELOCITY	
423.9	
REQUIRED CFM	ACTUAL CFM
N/A	1695.0

April 2, 2019

American Air Balance Co., Inc.

Duct Traverse - Rectangular

PROJECT

Manhattan Beach City Hall

DESCRIPTION

EXIST AH-3 TOTAL SUPPLY

505	637	562	575
496	483	511	556
418	481	562	442
459	488	438	366

DUCT SIZE	DUCT AREA
L 48.0 **W** 48.0	16.00
DUCT S.P.	AIR TEMP
N/A	N/A
FINAL AVERAGE VELOCITY	
498.7	
REQUIRED CFM	ACTUAL CFM
N/A	7980.0

April 2, 2019

American
Air Balance Co., Inc.

Duct Traverse - Rectangular

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST AH-3 TOTAL RETURN

1416	1556	979
1275	1129	1356

DUCT SIZE	DUCT AREA
L 32.0 **W** 22.0	4.89
DUCT S.P.	AIR TEMP
N/A	N/A
FINAL AVERAGE VELOCITY	
1285.2	
REQUIRED CFM	ACTUAL CFM
N/A	6285.0

April 2, 2019

American
Air Balance Co., Inc.

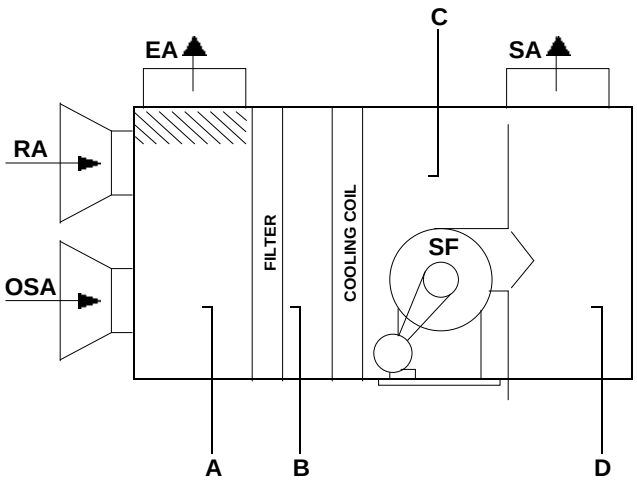
Static Pressure Profile

PROJECT

Manhattan Beach City Hall

DESCRIPTION

EXIST AH-3 STATIC PROFILE



A	B	C	D
-0.37	-0.74	-1.25	0.56

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-40

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	290
Maximum Design Air Flow	N/A	290
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
CONFRENCE	1	24 X 24	1.000			140	140
CONFRENCE	2	24 X 24	1.000			150	150
Totals:							290

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-41

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	0
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
CONFRENCE	1	24 X 24	1.000			0	0
CONFRENCE	2	24 X 24	1.000			0	0
Totals:							0

April 2, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-42

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	560
Maximum Design Air Flow	N/A	805
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OPEN OFFIC	1	24 X 24	1.000			115	115
OPEN OFFIC	2	24 X 24	1.000			150	150
OPEN OFFIC	3	24 X 24	1.000			150	150
OPEN OFFIC	4	24 X 24	1.000			55	55
OPEN OFFIC	5	24 X 24	1.000			165	165
OPEN OFFIC	6	24 X 24	1.000			170	170
Totals:							805

April 2, 2019

American Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-42A

Air Distribution Information	
MODEL	SIZE
TITUS	8"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	0
Electronic Set Points	PNEUMATIC	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OPEN OFFIC	1	24 X 24	1.000			0	0
OPEN OFFIC	2	24 X 24	1.000			0	0
Totals:							0

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-45

Air Distribution Information	
MODEL	SIZE
TITUS DESV	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	50
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	8 X 8	1.000			50	50
Totals:							50

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-46

Air Distribution Information	
MODEL	SIZE
TITUS DESV	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	160
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	8 X 8	1.000			160	160
Totals:							160

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-47

Air Distribution Information	
MODEL	SIZE
TITUS DESV	8"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	190
Maximum Design Air Flow	N/A	310
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
CONFERENCE	1	8 X 8	1.000			165	165
STORAGE	2	10 X 10	1.000			145	145
Totals:							310

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-48

Air Distribution Information	
MODEL	SIZE
TITUS DESV	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	150
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	8 X 8	1.000			150	150
Totals:							150

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-49

Air Distribution Information	
MODEL	SIZE
TITUS DESV	10"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	915
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OPEN OFFIC	1	10 X 10	1.000			320	320
OPEN OFFIC	2	10 X 10	1.000			300	300
OPEN OFFIC	3	10 X 10	1.000			295	295
Totals:							915

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-50

Air Distribution Information	
MODEL	SIZE
TITUS DESV	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	50
Maximum Design Air Flow	N/A	105
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	8 X 8	1.000			105	105
Totals:							105

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-51

Air Distribution Information	
MODEL	SIZE
TITUS DESV	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	30
Maximum Design Air Flow	N/A	180
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	8 X 8	1.000			180	180
Totals:							180

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-52

Air Distribution Information	
MODEL	SIZE
TITUS DESV	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	0
Maximum Design Air Flow	N/A	110
Electronic Set Points	N/A	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	8 X 8	1.000			110	110
Totals:							110

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-53

Air Distribution Information	
MODEL	SIZE
TITUS DESV	12"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	85
Maximum Design Air Flow	N/A	335
Electronic Set Points	N/A	

Data

Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
OFFICE	1	24 X 24	1.000			335	335
OFFICE	2	24 X 24	1.000			0	0 *115*
OFFICE	3	24 X 24	1.000			0	0
OFFICE	4	24 X 24	1.000			0	0
Totals:							335

115 PLEASE REFER TO THE PROJECT SUMMARY.

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-MENS

Air Distribution Information	
MODEL	SIZE
TITUS	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	40
Maximum Design Air Flow	N/A	40
Electronic Set Points	PNEUMATIC	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
MENS RR	1	24 X 24	1.000			40	40
Totals:							40

April 2, 2019

American
Air Balance Co., Inc.

VAV / CAV Terminal Test

PROJECT
Manhattan Beach City Hall
DESCRIPTION
EXIST VAV-WOMENS

Air Distribution Information	
MODEL	SIZE
TITUS	6"

General Conditions		
	Required	Actual
Minimum Design Air Flow	0	110
Maximum Design Air Flow	N/A	110
Electronic Set Points	NO CONTROLS	

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
WOMENS RR	1	24 X 24	1.000			110	110
Totals:							110

April 2, 2019

American
Air Balance Co., Inc.

Air Distribution Schedule

PROJECT

Manhattan Beach City Hall

DESCRIPTION

EXIST AH-3 SUPPLY

Data							
Room No.	Terminal No.	Terminal Size	K	Req. VEL	Req. CFM	Actual VEL	Actual CFM
COPY	1	24 X 24	1.000			40	40
DATA RM	2	18 X 28	3.500			546	1910
DATA RM	3	20"RD	1.000			575	575
ELEC RM	4	6 X 10	0.420			541	230
ELEC RM	5	6 X 10	0.420			460	190
BREAK RM	6	10 X 10	1.000			220	220
BREAK RM	7	10 X 10	1.000			125	125
OFFICE	8	10 X 10	1.000			110	110
OFFICE	9	10 X 10	1.000			0	0
OFFICE	10	24 X 24	1.000			0	0
OFFICE	11	24 X 24	1.000			50	50
OFFICE	12	24 X 24	1.000			0	0
OFFICE	13	24 X 24	1.000			0	0
Totals:							3450


KITCHELL


KITCHELL