MISSOULA INTERNATIONAL AIRPORT_**MSO / Terminal**

SCHEMATIC DESIGN
OCTOBER 31st 2017

Missoula INTERNATIONAL AIRPORT
Morrison Maierle engineers • surveyors • planners • scientists
a&e ARCHITECTS
Price Simpson Harvey
MARTEL CONSTRUCTION INC.

Executive Summary

Missoula International Airport has been experiencing year-over-year record growth in enplanements for nearly a decade. This is causing significant stress on their existing terminal. It is antiquated, has inadequacies in handling the travel demands of the peak seasons, and struggles to keep up with the flexibility of modern technology.

The new Passenger Terminal Building for the Missoula International Airport is planned to be a state-of-the-art facility for the traveling public. The new facility will upgrade critical spaces of the terminal that are vital to airline safety, homeland security, and airport operations – all of which will ultimately enhance the experience of the public traveling by commercial air.

The Morrison-Maierle led design team, (comprised of A&E Architects, Price Studios and the KPA Group) utilized an integrated design process which successfully engaged stakeholders who are invested in the development of the terminal facility. This process created a consensus that informed the programming and schematic design of this diverse project. Some of those stakeholders included Airport Administration, Federal Aviation Administration, Transportation Security Administration, commercial airline users, and tenants operating within the terminal today.

Project Team

Morrison-Maierle _ Team Lead
A&E Architects _ Architect of Record
Morrison-Maierle _ Structural, Mechanical, Electrical, Plumbing
Price/Simpson/Harvey _ Airport Planner
KPA _ Airport Technical Consultant
Martel Construction _ Pre-Construction Services

Scope

Terminal Building (Phase 1 & II) 205,694 sf
- Site Work
- # of Gates = 8
- # of Jet Bridges = 6

Phase I
- Terminal Building 180,615 sf
- Site Work
- # of Gates = 4
- # of Jet Bridges = 4 (capable of ground loading 3 additional gates)

Phase II
- Terminal Building 25,079 sf
- # of Gates = 4
- # of Jet Bridges = 2

11.18.2022_*Phase 2 - Operational for Passengers*

09.26.2022 - 11.18.22_*Phase 2 - Equipment & FF&E*

09.27.2021 - 09.23.22_*Phase 2 - Construction*

06.07.2021 - 09.24.21_*Phase 2 - Demo Terminal*

05.21.2021_*Phase 1 - Operational for Passengers*

03.22.2021 - 05.21.21_*Phase 1 - Equipment & FF&E*

04.01.2019 - 03.19.21_*Phase 1 - Construction*

10.30.2018 - 03.15.19_*Phase 1 - Demolition*

09.04.2018 - 10.29.18_*Phase 1 - Move Existing Services*

03.26.2019_*Approval of Terminal Construction GMP - Phase 1*

01.19.2019_*Advertise for Bids - Main Terminal Expansion*

07.31.2018_*July Board Meeting, Approval of Early Work Package (Demo, TSA, RAP, Excavation, Access Road, etc.)*

11.28.2017_*November Board Meeting, Approval of Task Order 10 & Pre-Construction Services*

10.31.2017_*Board Meeting, Schematic Design Deliverable*

09.22.2017_*Pricing Package to Martel Construction*

08.10.2017_*Exterior Design Workshop, Missoula, MT*

06.27.2017_*Preliminary Probable Cost to MSO Board, Missoula, MT*

05.30.2017_*Board Update, Missoula, MT*

02.21.2017_*SD Presentation 01, Missoula, MT*

02.01.2017_*Design Charrette, Billings, MT*

10.25.2016_*Final Planning Presentation, Missoula, MT*

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View at bar commons

Interior Rendering

View at bar commons

Interior Rendering

View from 3rd floor observation area

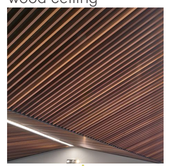
Interior Rendering

view at holdroom

Materials

view at baggage claim / ticketing / holdrooms

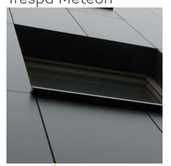
wood ceiling



storefront system

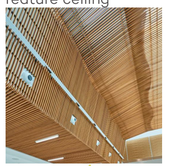
curtainwall system, butt-glazed

composite panel rainscreen system, Trespa Meteon



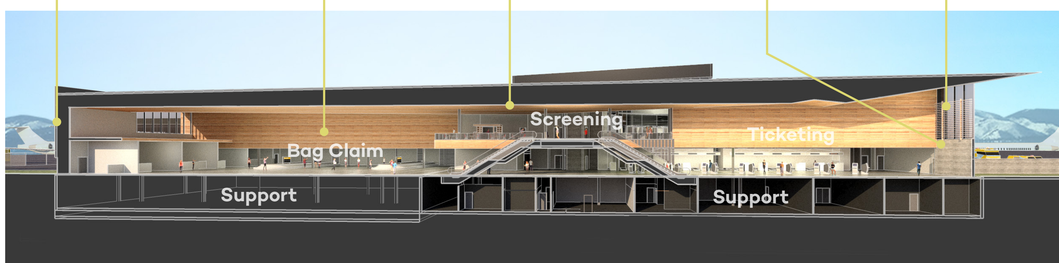
wood feature wall

clerestory feature ceiling



board-formed concrete, 6" horizontal

sunshade



Concept

Design Statement

"With the five valleys of Western Montana converging here, Missoula has always been—and will continue to be—a place that has a lively exchange of ideas, goods and people. Given the multiple mountain ranges and rivers that surround this terminal, it is positioned to be an environmentally responsible and breathtaking gateway to the area's unique land and cultural treasures. This facility will serve Missoulians and tourists alike for generations by being adaptable, timeless, authentic to place and innovative in building technology."

Guiding Principles

1. Design for the user
   [traveling public, community airlines]

2. Intuitive way-finding
   [without the overuse of signage]

3. Design a flexible and expandable facility to meet future accommodations

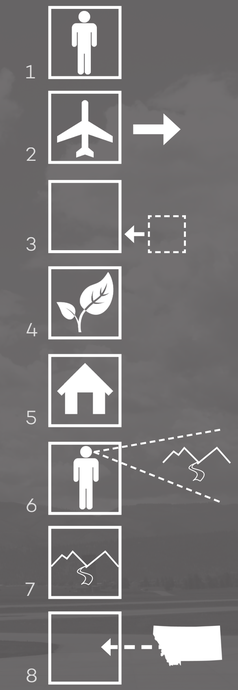
4. Environmentally responsible design
   [lower operational + maintenance costs]

5. Be a warm, inviting and enhanced travel experience

6. Take advantage of the breathtaking views that occur in the Missoula Valley, specifically views to the north & southeast

7. Reflect the local geography, landscape and beauty of Western Montana and it's valleys, rivers and mountains.

8. Reflect the diverse culture of Missoula and Western Montana by bringing local art, food, and community into the design to enhance it's overall impact as an important civic building.

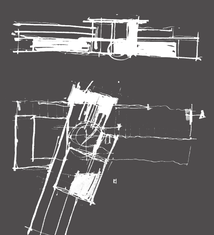


Our Process_Listen, Collaborate, Apply

Listening
- Understanding the community airport needs
- Looking to the existing and natural landscape
- Understanding the culture of Missoula
- Hearing the hopes and fears of our client

Collaborate
- Take what we learned from Listening, and then start to create design parameters
- Meet with client multiple times to discuss and refine (repeat)

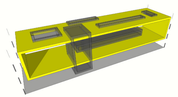
Apply
- Start to create design decisions that reflect all of the preceding work
- Determine design intent
- Refine design intent to reflect design aspirations
- Narrow in on overall design



It all starts with a sketch

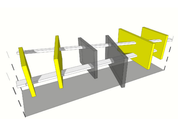
Hopes
- Natural light (10)
- Warm and inviting (10)
- LED lights (7)
- Low cost maintenance (7)
- Functional (7)
- Sustainable (4)
- Ground source heating and cooling (4)
- Need wall protection
- Balanced look and feel
- Behind the scenes / back of house – Done so well it's not noticed

Fears
- Dark
- Too expensive to maintain
- Budget limiting sustainable opportunities
- Access to building systems difficult



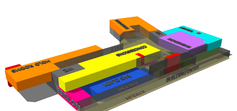
Hopes
- Great wayfinding design with color (14)
- Connected exterior wayfinding (14)
- Intuitive – No need for signs (14)
- Built with expansion in mind (10)
- Adaptable to future technology
- Enjoyable (space, views, etc.) (4)
- Functional (2)
- Future-proof (1)
- Handles oversized/special baggage (i.e. skis)
- Better security area

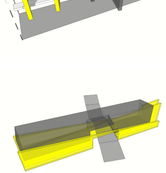
Fears
- Security system too slow, especially at high volume traffic times
- Too many signs
- Changes in TSA operations
- Long lines



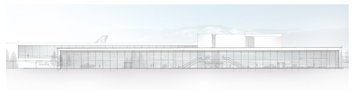
Hopes
- Warm gateway to Western Montana (7)
- Happy, enjoyable experience (7)
- Iconic (5)
- Natural light (4)
- Identified as "Missoula", not generic (4)
- Mountain views (3)
- Open and clean floor plan (3)
- New, modern (3)
- A place for history and art (2)
- Outdoor opportunity (2)

Fears
- Institutional look and feel
- Budget cuts into quality
- Ugly and cold
- Inflexible
- Too much art – Hipsters
- Future capacity





1.



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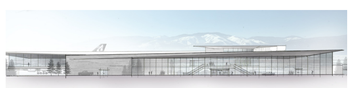


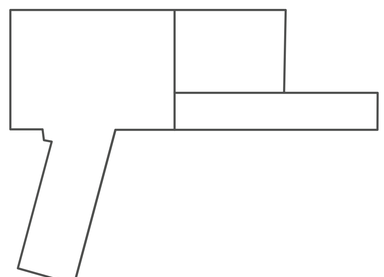
A.

B.

C.

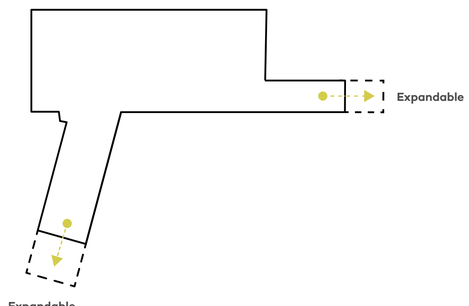
D.

Where we are today



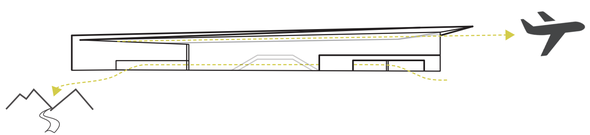
Design Diagrams

These design diagrams help illustrate certain design decisions and give meaning to why we designed the building the way we did. They are meant to supplement the following design material: floor plans, area plans, exterior design, narratives.



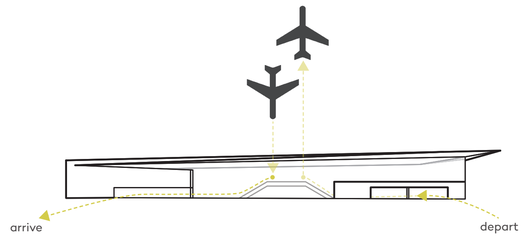
Past / Present / Future

The form of the building responds to the existing runway flight path.
It provides new easily accessible gates for present needs,
while allowing for future expansion.



Function / Context

Facade Articulation
Defined by the function & landscape
Flight (Function) - relating to the roof articulation
Carving (landscape) - relating to the articulation of the base of the building,
as the river carves the valley



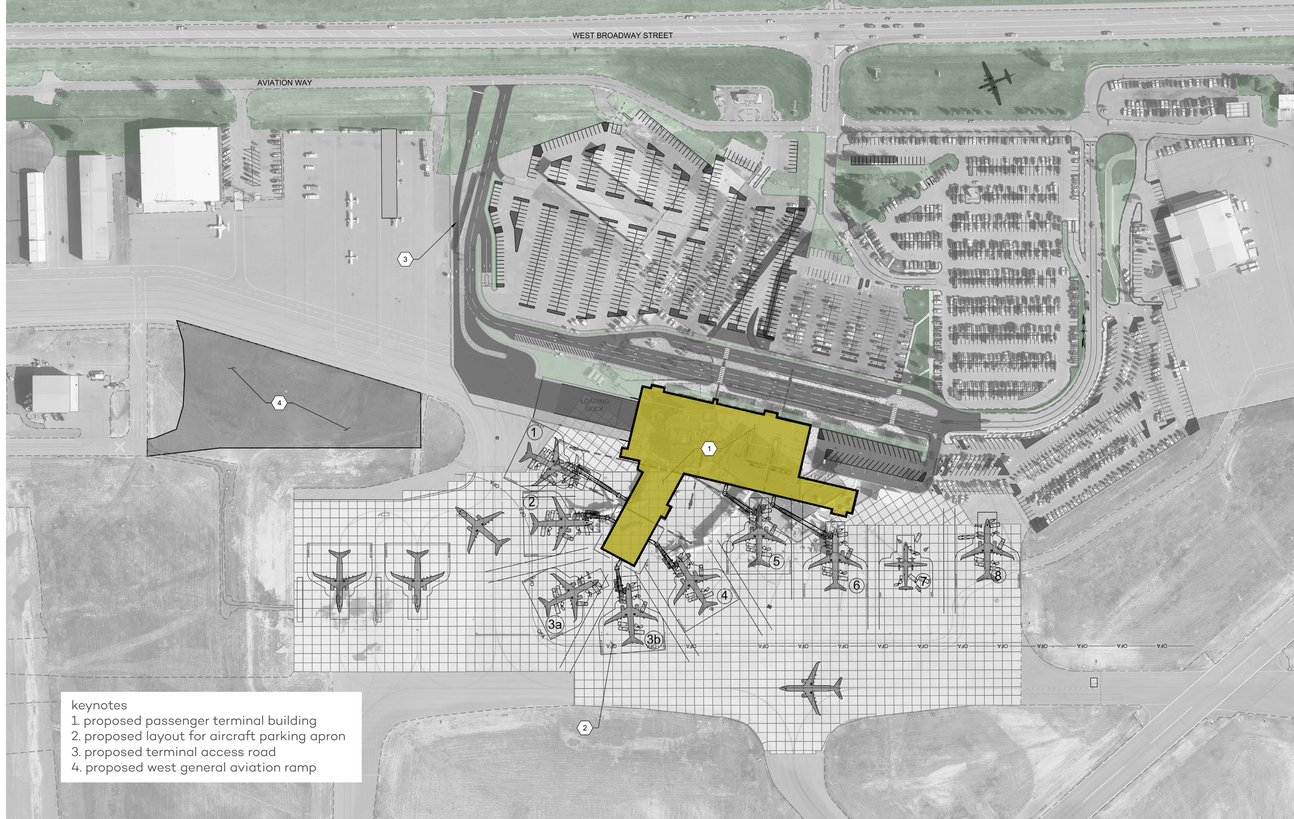
People / Movement

Organization of Spaces
Defined by Views, Transparency, and Movement through space

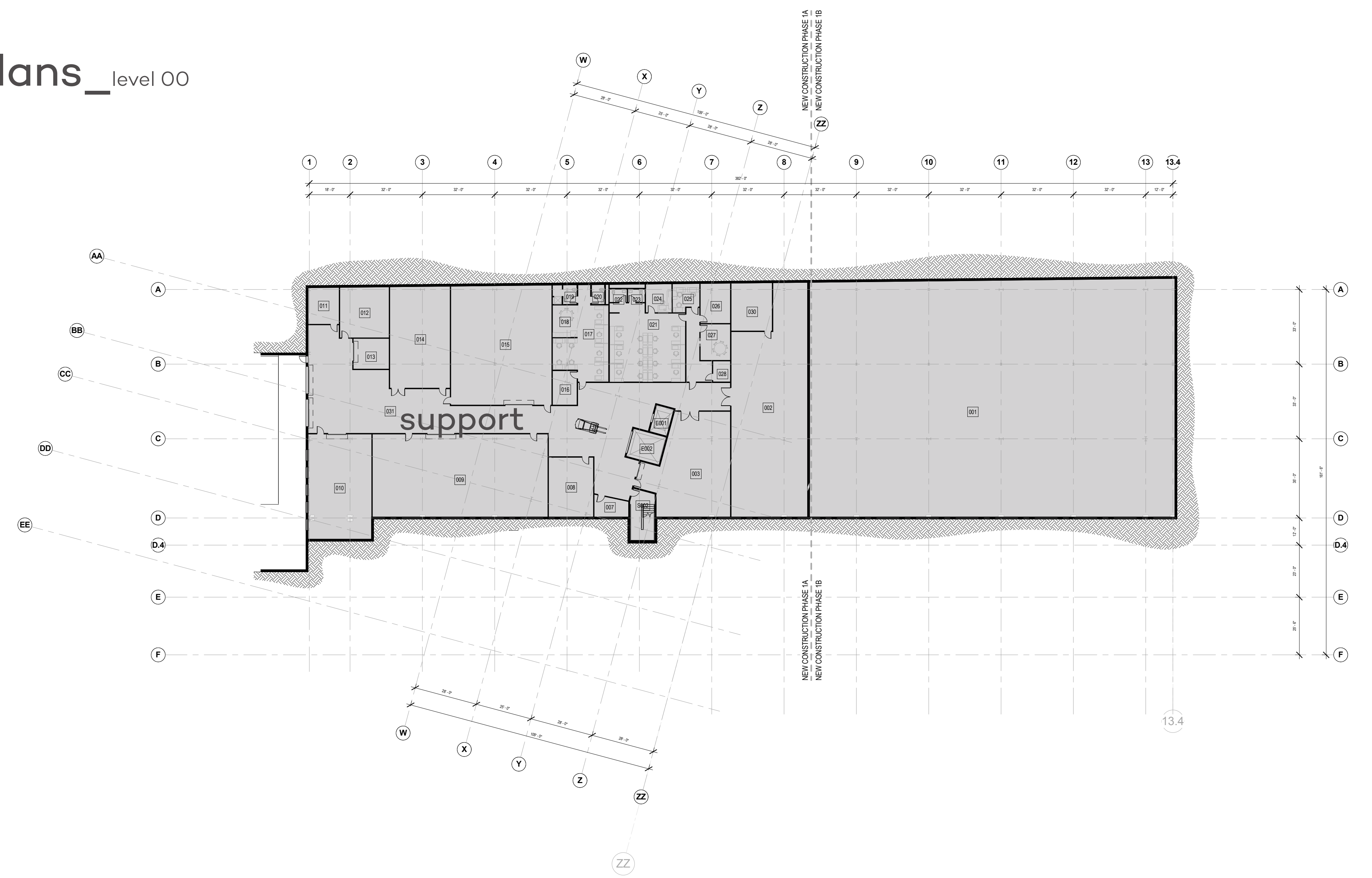
Design

PLANS

site development
floor plans
program area plans



Floor Plans_ level 00



secure

ROOM SCHEDULE - LEVEL 00		
ROOM NUMBER	ROOM NAME	AREA
001	UNFINISHED	16,872 SF
002	MECHANICAL	3,088 SF
003	SECURE CONCESSION STORAGE	1,507 SF
007	STORAGE	126 SF
008	MAIN IT	519 SF
009	MECHANICAL	2,833 SF
010	GENERATOR	1,299 SF
011	NON- SCREENED CONCESSION STORAGE	219 SF
012	WALK-IN COOLER	483 SF
013	PRE-SCREEN	212 SF
014	MAIN ELECTRICAL ROOM	1,192 SF
015	MAINTANENCE SHOP	2,349 SF
016	OFFICE	162 SF
017	OPS OPEN OFFICE	669 SF
018	BREAK ROOM	155 SF
019	RESTROOM	87 SF
020	RESTROOM	48 SF
021	TSA OPEN OFFICE	1,084 SF
022	RESTROOM	44 SF
023	RESTROOM	43 SF
024	FSD M.	144 SF
025	OLC T.	136 SF
026	OPS S.	233 SF
027	BREAKROOM	211 SF
028	STOR.	70 SF
029	CORRIDOR	242 SF
030	WATER	382 SF
031	CORRIDOR	4,360 SF

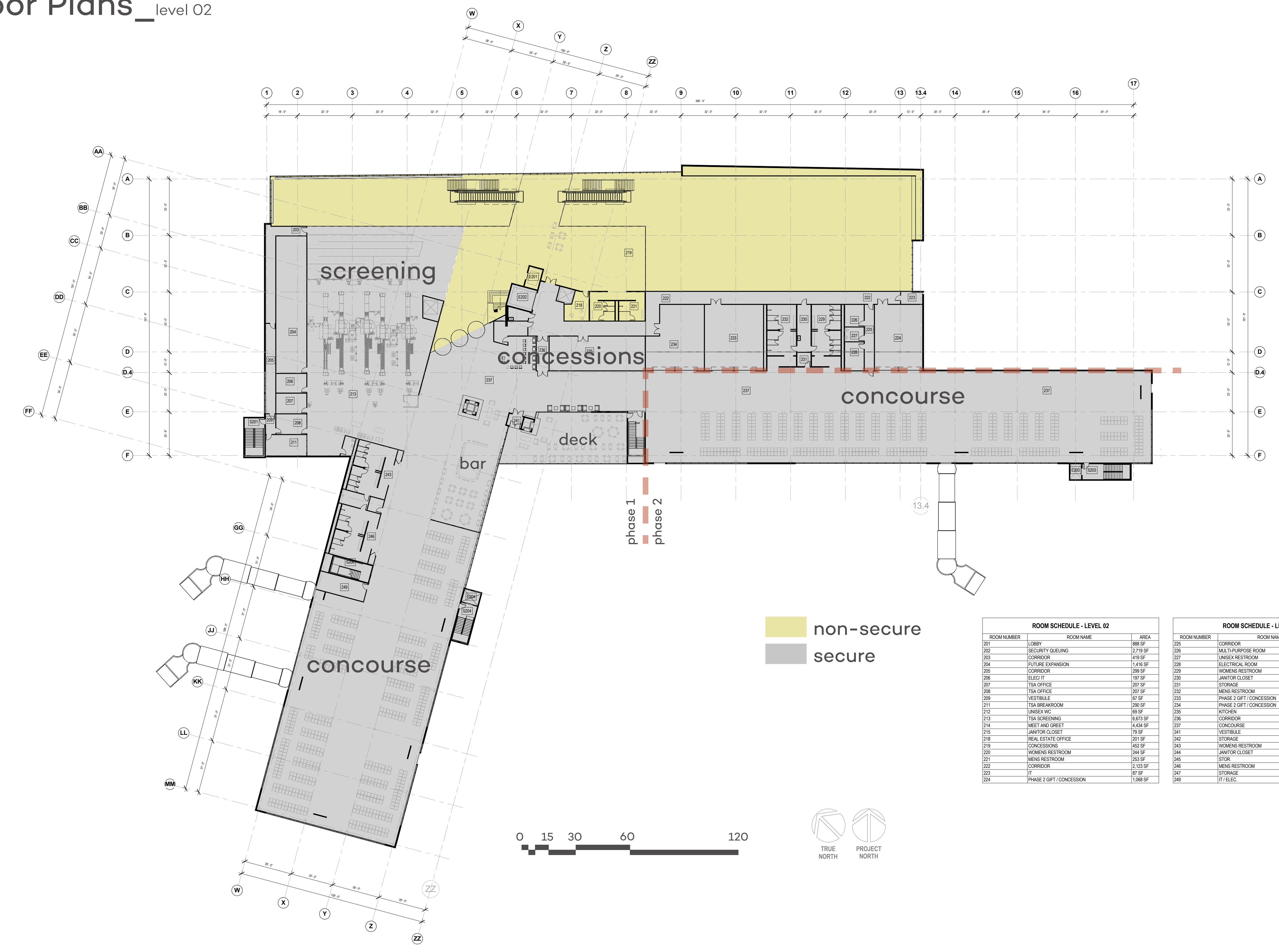
Floor Plans_ level 01

non-secure
secure

ROOM SCHEDULE - LEVEL 01		
ROOM NUMBER	ROOM NAME	AREA
101	VESTIBULE	291 SF
102	VESTIBULE	99 SF
103	VESTIBULE	267 SF
105	TICKETING/ QUEUING	3,595 SF
106	TICKETING	1,372 SF
107	KIOSK	65 SF
108	BAGGAGE CLAIM	12,479 SF
109	TSA OUTGOING BAGGAGE SCREENING	6,595 SF
110	BAGGAGE HANDLING	18,362 SF
111	ATO #3 B / T	758 SF
112	ATO OFFICE	124 SF
113	ATO OFFICE	125 SF
114	STORAGE	176 SF
115	ATO OFFICE	124 SF
116	ATO OFFICE	125 SF
117	ATO #1 B / T	457 SF
118	CORRIDOR	527 SF
120	ATO #4 B / T	758 SF
121	ATO OFFICE	125 SF
122	ATO OFFICE	124 SF
123	STORAGE	176 SF
124	ATO OFFICE	125 SF
125	ATO OFFICE	125 SF
126	ATO #2 B / T.	462 SF
127	CORRIDOR	746 SF
130	TRAVEL OFFICE	479 SF
131	STORAGE	272 SF

ROOM SCHEDULE - LEVEL 01		
ROOM NUMBER	ROOM NAME	AREA
133	RESTROOM	56 SF
134	RESTROOM	57 SF
135	PSO TRAINING	356 SF
136	PSO OPERATIONS	584 SF
137	PSO BADGING	156 SF
138	PSO OFFICE	149 SF
139	PSO RECEPTION	338 SF
140	CORRIDOR	603 SF
141	FAMILY WC	51 SF
142	RESTROOM	643 SF
143	RESTROOM	545 SF
144	JANITOR CLOSET	137 SF
145	BSO	246 SF
146	MSO BOARD ROOM	1,378 SF
147	OPS/STORAGE & MAINTENANCE	1,718 SF
149	CORRIDOR	275 SF
150	INCOMING BAGGAGE	9,308 SF
151	CORRIDOR	190 SF
152	FUTURE	324 SF
153	ALAMO / NATIONAL	324 SF
154	ENTERPRISE	324 SF
155	AVIS / BUDGET	324 SF
156	HERTZ	314 SF
157	IT	63 SF
158	CORRIDOR	171 SF
160	CORRIDOR	143 SF

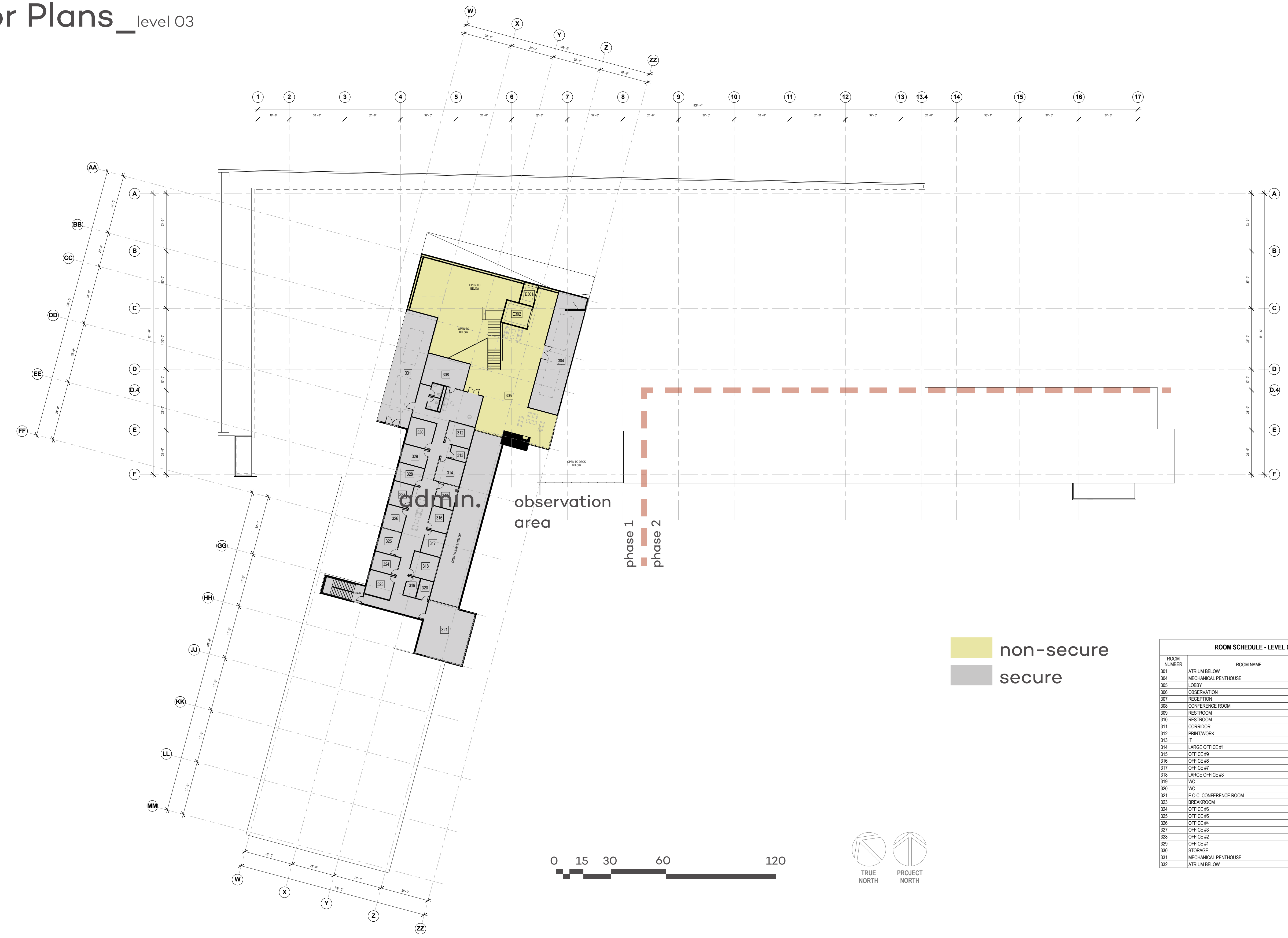
Floor Plans_level 02



ROOM SCHEDULE - LEVEL 02		
ROOM NUMBER	ROOM NAME	AREA
201	LOBBY	888 SF
202	SECURITY QUEUING	2,719 SF
203	CORRIDOR	419 SF
204	FUTURE EXPANSION	1,416 SF
205	CORRIDOR	299 SF
206	ELEC/ IT	197 SF
207	TSA OFFICE	207 SF
208	TSA OFFICE	207 SF
209	VESTIBULE	67 SF
211	TSA BREAKROOM	290 SF
212	UNISEX WC	69 SF
213	TSA SCREENING	6,673 SF
214	MEET AND GREET	4,434 SF
215	JANITOR CLOSET	79 SF
218	REAL ESTATE OFFICE	201 SF
219	CONCESSIONS	452 SF
220	WOMENS RESTROOM	244 SF
221	MENS RESTROOM	253 SF
222	CORRIDOR	2,123 SF
223	IT	87 SF
224	PHASE 2 GIFT / CONCESSION	1,068 SF

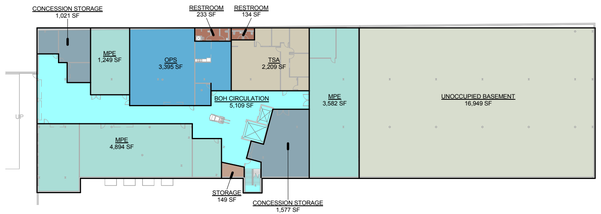
ROOM SCHEDULE - LEVEL 02		
ROOM NUMBER	ROOM NAME	AREA
225	CORRIDOR	213 SF
226	MULTI-PURPOSE ROOM	142 SF
227	UNISEX RESTROOM	91 SF
228	ELECTRICAL ROOM	163 SF
229	WOMENS RESTROOM	596 SF
230	JANITOR CLOSET	218 SF
231	STORAGE	63 SF
232	MENS RESTROOM	596 SF
233	PHASE 2 GIFT / CONCESSION	1,312 SF
234	PHASE 2 GIFT / CONCESSION	1,156 SF
235	KITCHEN	1,111 SF
236	CORRIDOR	141 SF
237	CONCOURSE	38,276 SF
241	VESTIBULE	56 SF
242	STORAGE	17 SF
243	WOMENS RESTROOM	671 SF
244	JANITOR CLOSET	135 SF
245	STOR.	66 SF
246	MENS RESTROOM	663 SF
247	STORAGE	16 SF
249	IT / ELEC.	310 SF

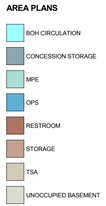
Floor Plans_level 03



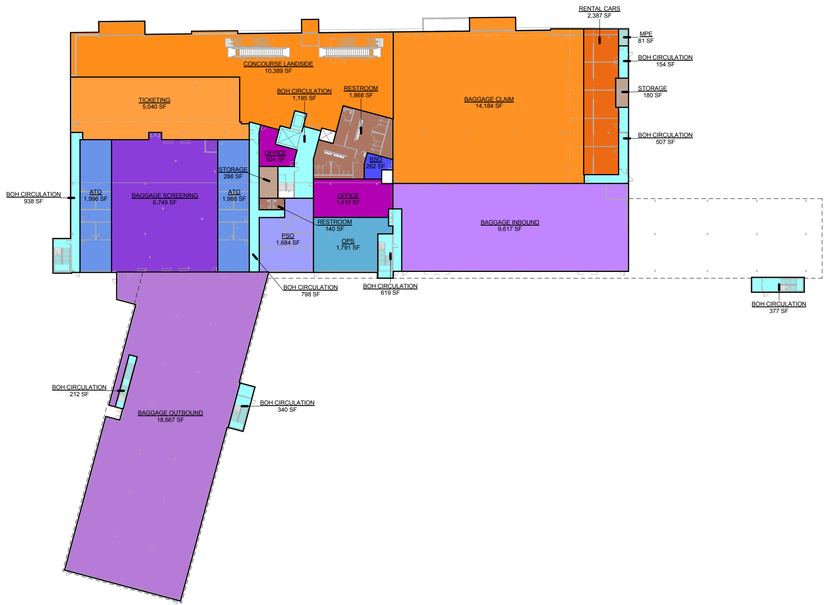
ROOM SCHEDULE - LEVEL 03		
ROOM NUMBER	ROOM NAME	AREA
301	ATRIUM BELOW	2,479 SF
304	MECHANICAL PENTHOUSE	1,171 SF
305	LOBBY	1,605 SF
306	OBSERVATION	831 SF
307	RECEPTION	392 SF
308	CONFERENCE ROOM	400 SF
309	RESTROOM	45 SF
310	RESTROOM	45 SF
311	CORRIDOR	1,422 SF
312	PRINT/WORK	187 SF
313	IT	75 SF
314	LARGE OFFICE #1	210 SF
315	OFFICE #9	158 SF
316	OFFICE #8	158 SF
317	OFFICE #7	158 SF
318	LARGE OFFICE #3	210 SF
319	WC	81 SF
320	WC	82 SF
321	E.O.C. CONFERENCE ROOM	855 SF
323	BREAKROOM	206 SF
324	OFFICE #6	157 SF
325	OFFICE #5	157 SF
326	OFFICE #4	157 SF
327	OFFICE #3	157 SF
328	OFFICE #2	157 SF
329	OFFICE #1	157 SF
330	STORAGE	232 SF
331	MECHANICAL PENTHOUSE	2,967 SF
332	ATRIUM BELOW	1,739 SF

Program Area Plans_level 00

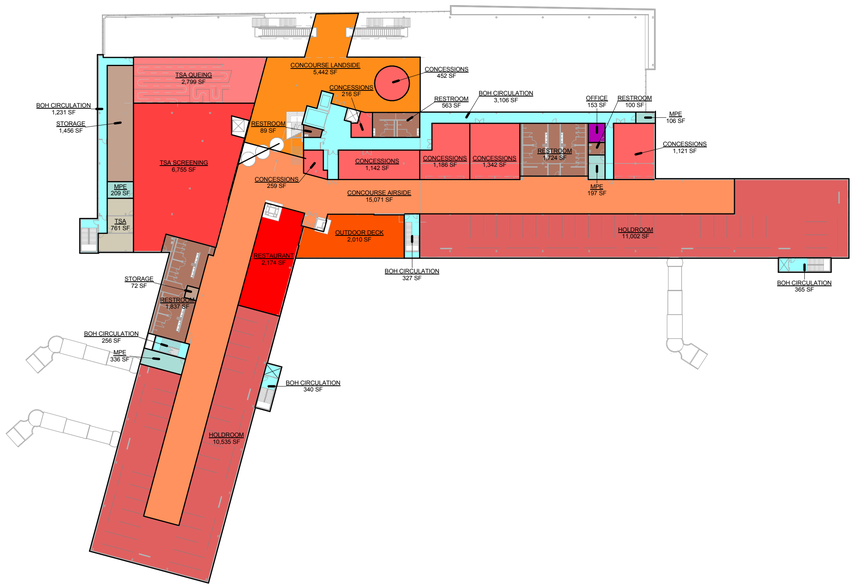




Program Area Plans_level 01



Program Area Plans_level 02



AREA PLANS

- BOH CIRCULATION
- CONCESSIONS
- CONCOURSE AIRSIDE
- CONCOURSE LANDSIDE
- HOLDROOM
- MPE
- OFFICE
- OUTDOOR DECK
- RESTAURANT
- RESTROOM
- STORAGE
- TSA
- TSA QUEING
- TSA SCREENING

Program Area Plans_level 03

AREA PLANS

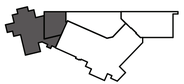
- BOH CIRCULATION
- CONCOURSE LANDSIDE
- MPE
- OFFICE
- RESTROOM

Phasing

During all phases of the construction of the new airport and the demolition of the existing, the airport will remain operational.

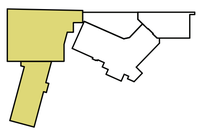
Existing Terminal

Phase 1A



Phase 1A_Demolition

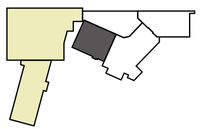
Demolish Existing TSA Screening and Baggage Handling



Phase 1A_New Construction

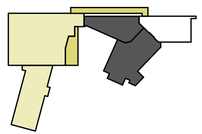
Construct Main Terminal & South Concourse

Phase 1B



Phase 1B_Demolition

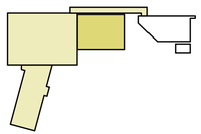
Demolish West Portion of Existing Holdrooms and Concessions



Phase 1B_New Construction / Demolition

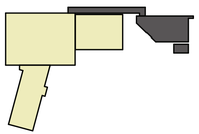
Construct Remainder of Main Terminal
Construct Connector
Demolish Remainder of Existing Holdrooms and Concessions

Phase 1C



Phase 1C_New Construction

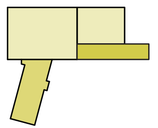
Construct New Bag Claim



Phase 1C_Demolition

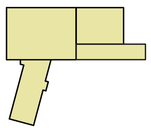
Demolish Connector
Demolish Existing Baggage Claim

Phase 2



Phase 2_New Construction

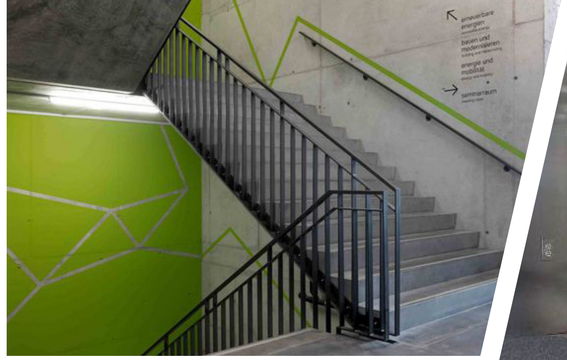
Construct East Concourse



New Terminal

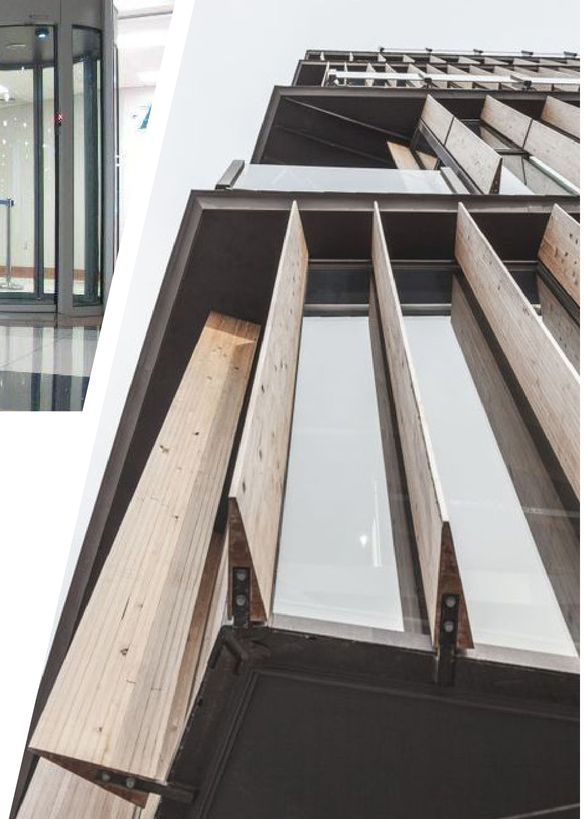
VISUAL GUIDE

The following images act as a visual guide to the aspirations of the design team and MSO staff. These images - while not specifically the actual design - perform as precedent images for what the new terminal might look and feel like from a material standpoint.

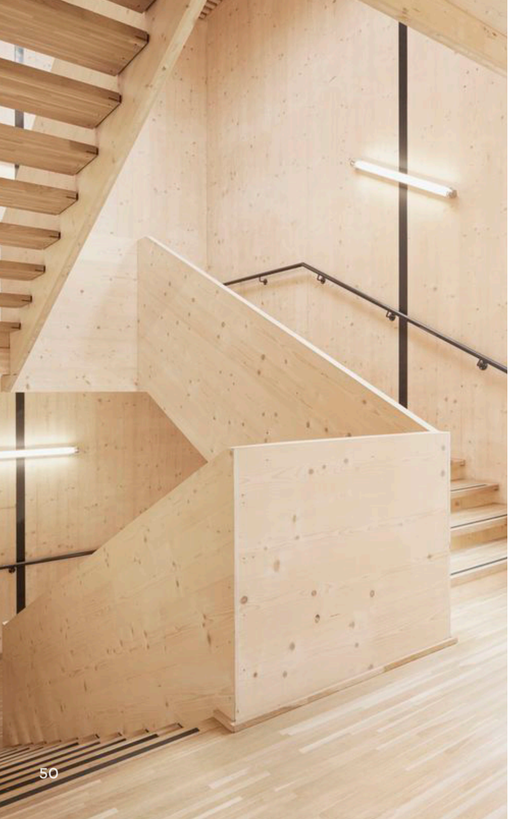


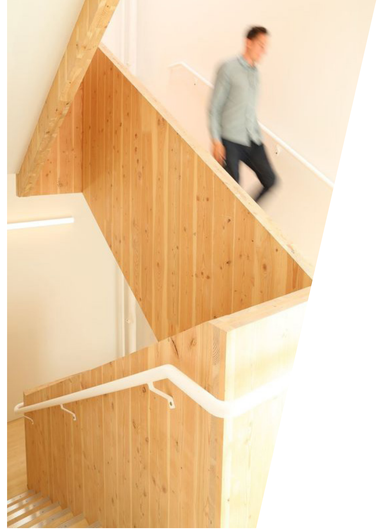
environmental graphics

revolving door, exit



sunshade



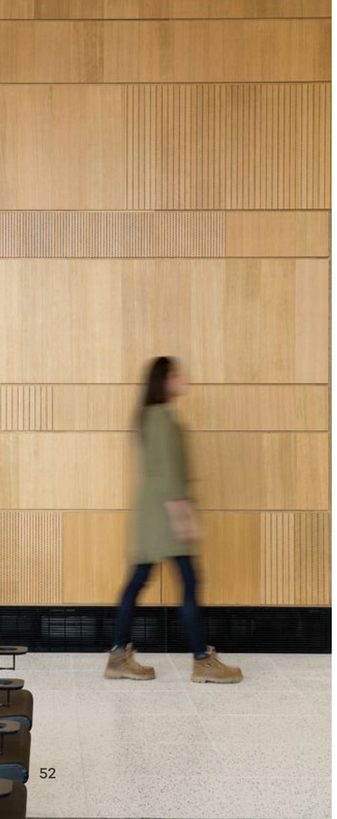


cross-laminated timber
(CLT) stair

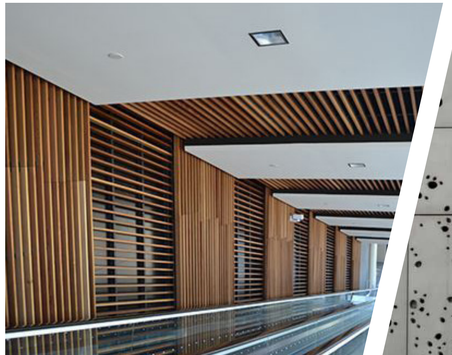
monument stair

steel framed / glass stair

cast-in-place concrete stair

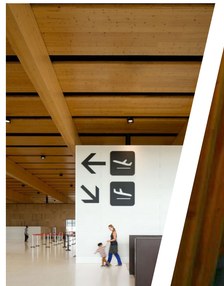


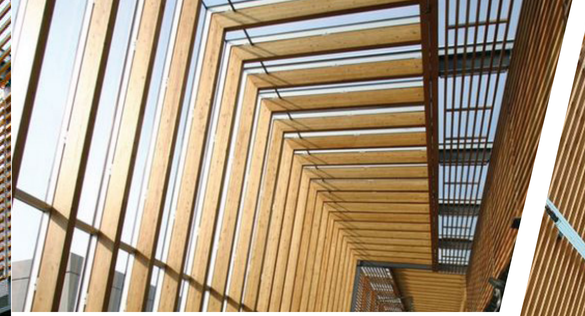
feature wall



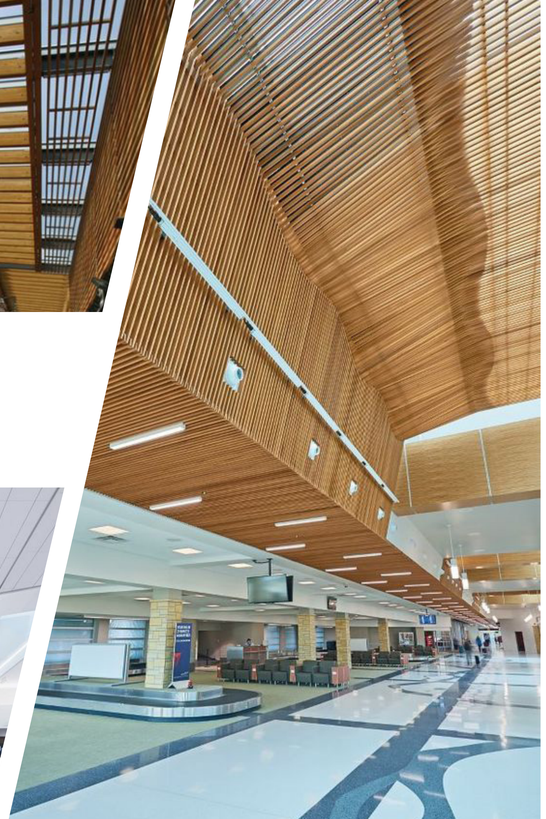
mural

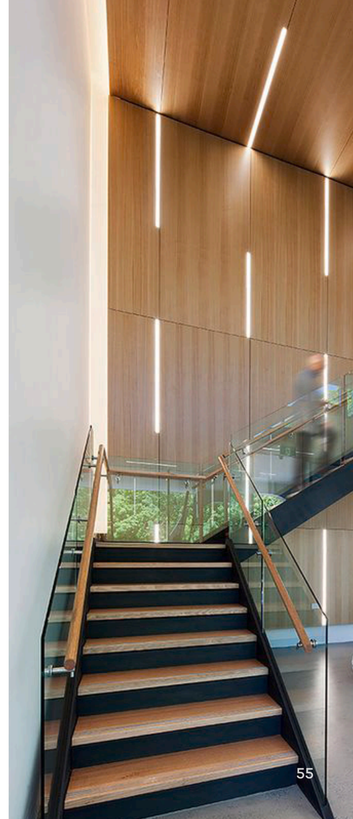
wood ceiling, holdrooms





clerestory / feature ceiling





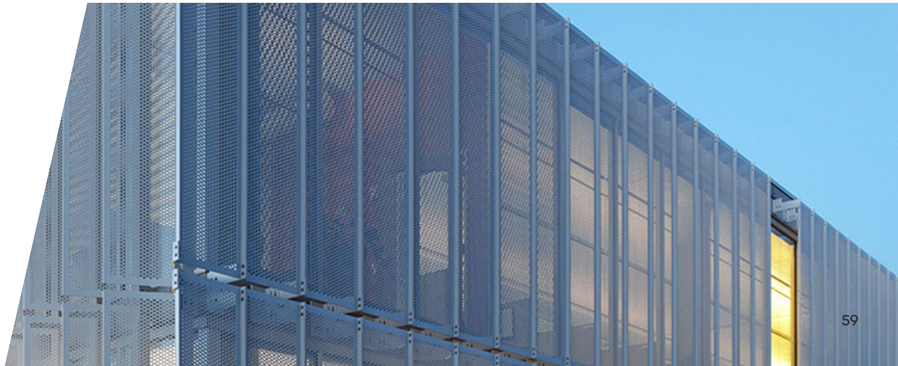
curtainwall system, butt-glazed

storefront system

board-formed concrete, 6" horizontal

metal panel rainscreen system

metal panel screenwall



composite panel rainscreen system, Trespa Meteon

composite panel rainscreen system, Trespa Meteon

NARRATIVES

Code_Narrative

APPLICABLE CODES & STANDARDS

All design and construction work shall comply with all applicable building codes, standards, and ordinances adopted by Government, State and local jurisdiction in effect and include but are not limited to the following:

- 2012 International Building Code (IBC)
- 2012 International Mechanical Code (IMC)
- 2012 International Energy Conservation Code (IECC)
- 2012 Uniform Plumbing Code (UPC)
- 010 ASHRAE Standard 90.1 – Energy Standard for Buildings
- 2010 ASHRAE Standard 62.1 – Ventilation for Acceptable Indoor Air Quality
- 2010 ASHRAE Standard 55 – Thermal Environmental Conditions for Human Occupancy
- National Fire Protection Association (NFPA), Codes, Standards and Recommended Practices

Mechanical_Narrative

HEATING, VENTILATION & AIR CONDITIONING

Heating Hot Water

Heating hot water will be circulated through the building by redundant circulation pumps located in the basement mechanical room. The circulation pumps shall be base mounted, end suction type with suction diffuser and vibration isolation bases and inverter duty motors. The basis of design is Taco FI series.

Heating water piping shall be routed to all heating devices including: air handling units, VAV terminal boxes, baseboard heaters, unit heaters and cabinet heaters.

Heating water piping 2" NPS and larger shall be schedule 40 black steel (ASTM A53 Grade A) with grooved mechanical couplings and shall be insulated with 2" thick preformed mineral fiber insulation. The pipe insulation shall include an all service jacket (ASJ) and have a thermal conductivity of at least 0.27 Btu - in / (h – ft2 – F). Piping that is exposed in mechanical rooms will have a field applied PVC jacket. All grooved mechanical fittings shall be rigid type.

Heating water piping 1-1/2" and smaller shall be Type L hard copper (ASTM B88 & ANSI/NSF 61) with sweat fittings and joints and shall be insulated with 1-1/2" thick preformed mineral fiber insulation. The pipe insulation shall include an all service jacket (ASJ) and have a thermal conductivity of at least 0.27 Btu - in / (h – ft2 – F). Piping that is exposed in mechanical rooms will have a field applied PVC jacket. Piping that is exposed in mechanical rooms will have a field applied PVC jacket.

Connections between copper and steel piping shall be made with dielectric nipples or PEX separator. Dielectric unions will not be allowed. Isolation valves shall be installed on the inlet and outlet of all dielectric connections.

All valves in the heating water system that are 2" and larger will have iron body with grooved or flanged connections and will be 150 psi rated. All valves in the heating water system that are 1-1/2" and smaller will have bronze body with sweat connections.

All heating devices will be equipped with isolation valves, y-strainer, flow control device (automatic or manual), drain connection and an air vent.

Isolation valves will be installed throughout the heating hot water system to allow shutdown or small portions of the building for maintenance.

All valves 2" and larger shall be insulated with removable insulation covers similar to Thermaxx Insulation Jackets (www.thermaxxjackets.com).

All hydronic piping and equipment shall be seismically braced per the 2012 International Building Code and the current version of ASCE-7.

Chilled Water

Chilled water piping will be routed to all air handling units and zone level cooling devices.

A closed loop of chilled water will be circulated through the heat exchangers to the building by redundant circulation pumps located in the basement mechanical room. The circulation pumps shall be base mounted, end suction type with suction diffuser and seismically compliant vibration isolation bases (Mason BMK/KSL or equal) and inverter duty motors. The basis of design is Taco FI series.

Chilled water piping 2" NPS and larger shall be schedule 40 black steel with grooved mechanical couplings and shall be insulated with 2" thick preformed mineral fiber insulation. The pipe insulation shall include an all service jacket (ASJ) with a vapor barrier and have a thermal conductivity of at least 0.27 Btu - in / (h – ft2 – F). Piping that is exposed in mechanical rooms will have a field applied PVC jacket.

Chilled Water piping 1-1/2" and smaller shall be Type L hard copper with sweat fittings and joints and shall be insulated with 1-1/2" thick preformed mineral fiber insulation. The pipe insulation shall include an all service jacket (ASJ) with a vapor barrier and have a thermal conductivity of at least 0.27 Btu - in / (h – ft2 – F). Piping that is exposed in mechanical rooms will have a field applied PVC jacket.

Connections between copper and steel piping shall be made with dielectric nipples or PEX separator. Dielectric unions will not be allowed. Isolation valves shall be installed on the inlet and outlet of all dielectric connections.

All valves in the chilled water system that are 2" and larger will have iron body with grooved or flanged connections and will be 150 psi rated. All valves in the heating water system that are 1-1/2" and smaller will have bronze body with sweat connections.

All cooling devices will be equipped with isolation valves, y-strainer, flow control device (automatic or manual), drain connection and an air vent.

Isolation valves will be installed throughout the chilled water system to allow shutdown or small portions of the building for maintenance.

All valves 1-1/2" and smaller shall be insulated with "No Sweat" removable valve covers and all valves 2" and larger shall be insulated with removable insulation covers similar to Thermaxx Insulation Jackets (www.thermaxxjackets.com).

Heat Generating Systems

The heating plant shall be located in the basement mechanical room. The heating plant will consist of three (3) gas fired, dual fuel, high efficiency, condensing, stainless steel fire tube, heating water boilers. Each Boiler shall be sized for 50% of the building load. Basis of design for the boiler shall be Lochinvar "Crest" FBN5000. The boilers shall be capable of running on natural gas and propane.

Each boiler will vent through the roof via an independent flue. The flue shall be constructed from listed stainless steel venting material (AL294C). Combustion air shall be ducted from a roof intake to each boiler using 10" diameter galvanized spiral ductwork.

Each boiler will be equipped with a circulation pump that will circulate water between the building heating hot water circulation system and the boiler. Basis of design is Taco "1900" series. The boiler pumps will be variable speed and controlled by the boiler to maximize the temperature differential through each boiler to maximize efficiency.

The heating hot water system will be equipped with an air separator, expansion tank, and automatic glycol feeder.

Each boiler will discharge condensate to a condensate neutralization tank and then to a floor sink.

Cooling Generating Systems

Chilled water will be generated from ground water that is extracted by two supply wells with variable speed submersible wells pumps. The ground water will be piped to redundant flat plate heat exchangers in the basement mechanical rooms and then to an injection well where the water is returned to the aquifer.

The flow rate of water from the ground water wells will be varied to maintain a chilled water supply temperature of 52F.

Distribution Systems

A variety of systems will be used to distribute ventilation, heating and cooling air to the building. All air handling units will be variable air volume (VAV) and will supply directly to a zone. Terminal re-heat boxes will be used to vary the flow air and control the temperature of air delivered to a zone.

The basis of design for all air handling units will be Daikin/Mcquay "Vision" or JCI/York "Solution". Each air handler will be configured for its application but all air handlers are intended to include the following components at a minimum:

- Outside air pre-filter (Merv-8)
- Outside air hot water frost prevention coil
- Energy recovery wheel
- Energy recovery bypass dampers
- Hot water heating coil
- Chilled water cooling coil
- Supply fan or fans (direct drive plenum fan with redundant VFDs)
- Return air filters (Merv-8 pre filter and Merv-13 final filter)
- Return air bypass
- Exhaust fan or fans (direct drive plenum fan with redundant VFDs)

All air handling units shall have internally isolated fans, perforated sound attenuation on the walls of all fan sections. All pipe and duct connections shall be made with flexible connectors.

Duct mounted sound attenuators shall be installed in the supply and return ductwork between the air handling unit and the first branch or duct opening.

Air handling units shall be mounted on 4" tall concrete housekeeping pads with ¾" thick rubber waffle pads (Mason Super "W" or equal) between the unit and the housekeeping pad.

All units serving the basement and main level will be located in the basement. A vertical shaft from the basement to the roof will allow the air handling units to draw in fresh air and exhaust relief air.

All unit serving the 2nd and 3rd floor will be located in mechanical spaces on the 3rd floor. These units will draw outside air from side wall intake louvers and exhaust relief air to roof mounted tiered penthouses.

Air handling Unit AHU-1
Serves: Admin Offices
Total airflow: 15,000 cfm
Number of Zones Served: 22

Air handling Unit AHU-2
Serves: Baggage Claim & Rental Car
Total airflow: 16,500 cfm
Number of Zones Served: 6

Air handling Unit AHU-3
Serves: Baggage Claim and Arrivals Exit
Total airflow: 16,000 cfm
Number of Zones Served: 1

Air handling Unit AHU-4
Serves: Concessions & Concourse Corridor
Total airflow: 27,500 cfm
Number of Zones Served: 9

Air handling Unit AHU-5
Serves: Departures Entry
Total airflow: 18,500 cfm
Number of Zones Served: 1

Air handling Unit AHU-6
Serves: North Facing Concourse
Total airflow: 18,000 cfm
Number of Zones Served: 12

Air handling Unit AHU-7
Serves: Offices and Board Room
Total airflow: 20,000 cfm
Number of Zones Served: 20

Air handling Unit AHU-8
Serves: Restaurant & Waiting
Total airflow: 30,000 cfm
Number of Zones Served: 10

Air handling Unit AHU-9
Serves: South Facing Concourse
Total airflow: 15,500 cfm
Number of Zones Served: 1

Air handling Unit AHU-10
Serves: Ticketing and Baggage Screening
Total airflow: 30,000 cfm
Number of Zones Served: 16

Air handling Unit AHU-11
Serves: TSA
Total airflow: 25,000 cfm
Number of Zones Served: 11

Air handling Unit AHU-12
Serves: TSA Offices
Total airflow: 7,000
Number of Zones Served: 10

Air handling Unit AHU-13
Serves: West Facing Concourse
Total airflow: 20,000 cfm
Number of Zones Served: 1

Terminal Units

All vestibules and building entries will be equipped with hot water cabinet heaters.

All Ductwork that penetrates fire rated walls shall have a combination smoke/fire damper with access door and duct mounted smoke detector.

The storefront/curtain wall areas shall have free standing pedestal type hot water baseboard heaters along their entire length. Basis of design shall be Airedale Model PA with steel grille.

Conditioned air will be delivered to all enclosed office and open office areas by VAV boxes equipped with hot water re-heat coils.

IT & Data Rooms: Each IT room will be conditioned by a packaged precision HVAC system. The basis of design is Liebert Mini-Mate2, with low ambient DX cooling, roof mounted condensing unit, electric re-heat, canister humidifier and BACnet interface for integration in to the building management system (BMS).

Snowmelt Systems

The front entry sidewalks and pedestrian areas will be equipped with hot water radiant snow melt systems. Flexible PEX piping will be embedded into the slab, circulating hot water when the outdoor air temperature is below freezing, and the snowmelt sensors detect moisture on the surface.

The loading ramp to the basement will also include a hot water radiant snow melt system to prevent snow and ice buildup on the ramp. Melted snow and ice will drain to a trench drain to remove excess water from the ramp.

Controls & Instrumentation

The HVAC system shall be controlled by a building management system (BMS). The building management system (BMS) will be comprised of distributed stand-alone application specific controllers (ASC), freely programmable primary equipment controllers (PEC), and one or more Network Area Controllers (NAC). The controllers communicate on various common controller networks (LON, BACnet). Third party devices (chillers, boilers, variable speed drives, etc...) may also communicate on the LON or BACnet network. A network area controller (NAC) shall act as the gateway for human interfacing and management.

The NAC is a "web-enabled" application server that provides integrated control, supervision, network management, and integration between different protocol devices. The NAC also performs alarm management, historical trend data collection, and equipment scheduling. The NAC acts as a web server for access to graphics, schedules, and logs via a standard web browser. Complex control strategies are structured in a "block programming" format.

The NAC shall utilize the Tritium AX platform.

Connectivity to the building's computer backbone is accomplished with a standard TCP/IP Ethernet connection. Once connected, any personal computer (PC) on the sites network, without any additional software, can achieve access with a standard web browser. Security is achieved with secure passwords allowing flexible administration of access and adjustments.

A PC connected to the building's computer backbone is used to access all information throughout the control system and for modifying set points, time schedules, and control variables. The mechanical systems are graphically presented at the web browser, with "live data" displayed to aid the user.

All air handling units and VAV boxes shall have discharge re-set control to adjust the discharge air temperature as a function of the space temperature deviation from space temperature set point. All zones shall include night setback with manual override to allow a user to force a zone into occupied mode for a 2hr period.

The building management system shall have sufficient storage capacity to maintain logs of all critical data for up to 3 months.

All Variable Frequency Drives (VFDs) for HVAC equipment shall be furnished and installed by the temperature controls contractor. Power connection from the load center to the VFD shall be by the electrical contractor.

Acceptable temperature control systems and control contractors are: Delta Controls by Electro Controls.

Systems Testing & Balancing

All hydronic and air systems shall be tested and balanced by a NEBB certified test and balance contractor in accordance with SMACNA, NEBB and ASHRAE standards.

Approved Test and balance contractors are: RGO Inc or Highlands Balancing.

Commissioning of HVAC Systems

The HVAC system shall be commissioned in accordance with the provisions of C408 of the International Energy Conservation Code by a registered professional.

Approved Commissioning Professionals are: Elkhorn Commissioning Group.

Electrical_Narrative

Power Distribution System

The existing electrical service will supply temporary power to the existing structure and systems during early phases of the project. As the project progresses, electrical equipment to be demolished will be disconnected and removed. The new electrical service will feed the new loads as portions of the building are completed. Finally, the new system will feed the entire facility and the old service will be removed by the Utility.

The new facility will be supplied by a new electrical service consisting of a new pad-mount transformer provided by the utility. NorthWestern Energy (NWE) will form a service loop, supplying the new utility transformer from a location at the north side of the site and also from the south side of the site. In this way, if NWE has an interruption on either the north or the south loop, the facility can be fed from the other direction. The new service will be 480/277V, three-phase wye configuration, and will serve 4,000A main switchgear on the exterior of the building. From this NEMA 3R switchgear, the 480/277V, three-phase feed will continue to a 4,000A main switchboard in the basement of the terminal.

The entire electrical system will be backed up with emergency power. This will be supplied by (4) 500kW diesel generators, and provision will be made for the future installation of a fifth 500kW generator. Each generator will be tied, via paralleling breakers, to a 4,000A switchboard. Generator input and loading will then be managed automatically by the switchboard. The first generator to start up will link to the electrical bus in the switchboard. This will give the power reference for the other generators as they come on and tie into the system.

The normal/emergency power system will be separated into three separate branches. The use of separate branches allows categorization of loads to make sure that the most critical loads have top priority. The branches will be as follows:

Level 1
Loads where loss of power could create loss of human life or serious injury. These include:

- o Illumination of means of egress
- o Exit signs
- o Alarm and alerting systems
- o Fire alarm with voice evacuation
- o Public address
- o Communications systems
- o Lighting in generator set and transfer switch location
- o Generator set accessories essential for generator operation
- o Fuel transfer pumps
- o Cooling/ventilation system
- o Electrically operated louvers
- o Generator controls
- o Lighting, control, communication and signaling systems associated with elevator cars
- o Access control and automatically operated doors used for building egress

Level 2
Loads that are less critical to human life and safety, but are critical for effective airport terminal operations. These include:

- o Heating/cooling and ventilation
- o Baggage handling
- o TSA screening and security
- o Refrigeration for food in the café/restaurant
- o Power to the cooking and serving portions of the café/restaurant

Level 3
Loads that are not essential, but that will allow the terminal to function in a normal manner whether the power source is normal utility power or emergency power. These loads include:

- o Power to the gift shop

“even in the worst imaginable situation, the Level 1 branch, designed to protect from loss of human life or serious injury, will be kept running until the very last moment.”

Each branch will have its own Automatic Transfer Switch (ATS). Each of these switches will be fully rated for the specific branch load and will be a closed-transition switch with bypass isolation. The advantage with a closed-transition switch comes after a power outage when the system is ready to be transferred from generator power back to normal Utility power. Instead of experiencing another brief loss of power while the load transfers back to normal power, this transfer can be done seamlessly. This also comes into play when the Utility has a planned outage and shares that information with the airport. The facility can seamlessly transfer to generator power before the outage, and the airport is then completely unaffected by the utility outage. The bypass isolation allows the closed-transfer portion of switch to be isolated from the circuit for maintenance, or even replacement, while the switch continues to operate as a normal automatic transfer switch.

The transfer switches will be coordinated so that, when a power outage occurs, the Level 1 branch (which will be the smallest) will always transfer first (within 10 seconds of the power outage). The switch for the Level 2 branch, which will have the largest amperage draw, will be delayed so that the Level 1 loads are energized before it transfers. After Levels 1 and 2 are up and running the switch for Level 3 branch will transfer. In case of a catastrophic situation where the fuel was running low, or one or more of the generators was not able to run, the system will be set up for load shedding. The Level 3 branch would go off-line first, followed by the Level 2 branch. Therefore, even in the worst imaginable situation, the Level 1 branch, designed to protect from loss of human life or serious injury, will be kept running until the very last moment.

Panels for each branch of the electrical system will be located around the facility to ensure that circuits for individual loads never have to go too far to get back to the appropriate panel. Having separate panels on separate branches in similar locations will increase the cost of distributing the power throughout the building. However, as noted above, the three branches of power allow the most vital loads to be kept separate from less important loads.

Power Outlets

Tamper-resistant receptacles will be called out for lounge and waiting areas, where a child could attempt to insert something into the receptacle. Outlets that include USB charging ports will also be installed in the lounge and waiting areas, as well as in other areas where passengers may wait for their flight or where employees would plug in their devices to charge them while they work.

Lighting

In general, the lighting design will be based on IESNA recommended lighting levels for the tasks being accomplished in the various spaces. Lighting will be 277V and LED fixtures will be utilized throughout the facility. Because LEDs can easily be dimmed and can come with differing color temperatures, these factors will be exploited in the lighting design. In areas, such as ticket counters and security screening areas, where mental acuity is paramount, brighter lighting with a higher color temperature (similar to cool white fluorescent) will be installed. In lounges and waiting rooms, where a calming effect is desired, lower color temperature lighting (similar to incandescent lamps) at lower intensities will be installed.

The interior lighting control system will be a low voltage control system capable of being networked and integrated into the building management software, similar to the Wattstopper DLM system. Features and controls will include: daylight sensors, occupancy sensors, manual dimmer switches and toggle switches. Energy will be saved when light fixtures near banks of windows are dimmed due to natural sunlight streaming into the area, energy will be saved when lights are turned off based on a lack of occupants in an office or conference room, and energy will be saved when lights are dimmed in public waiting areas when they are not occupied by passengers anticipating their flight.

Exterior lighting will be controlled with a central photo cell and time clock and will turn on only when it is dark outside. For energy efficiency, in areas where vehicle and pedestrian traffic is not constant, the fixtures will have motion sensors so that they will only be at full output when someone is in the area and will then drop to a lower lighting level when no one is in the area. For security purposes, the exterior lighting will never completely turn off when it is dark outside. Exterior lighting will be carefully chosen and placed to minimize glare and interference with pilots’ use of the runways and taxiways.

Low Voltage (Tele/Data) System

The raceway for the low voltage communication systems will consist of conduits with pullstrings, cable trays and rough-in for tele/data outlets at proposed jack locations. The Owner’s IT group will select, specify and install all other equipment and tele/data cabling, both copper and fiber. Switches, racks, routers, outside plant, backbone and horizontal fiber and copper cabling will not be part of this project.

Security System

All security equipment, including cameras, monitors, recording devices, etc. will be selected and specified by others. The locations of all security devices will be coordinated with the Owner, TSA and security contractor to ensure that the appropriate power and raceways are provided for that equipment.

Access Control System

All access control equipment, including card readers, electronic strikes, door position sensors, magnetic locks, etc. will be selected and specified by others. Locations of these devices will be coordinated with the Owner, TSA and the security contractor to ensure that the appropriate power and raceways are provided for that equipment.

Fire Alarm System

A fully addressable fire alarm system will be installed throughout the building. The system will provide voice evacuation throughout the facility and care will be taken to maintain intelligibility of the recorded or live voice messages in all areas. It may be determined that this voice evacuation can be tied into the public address system. The system will interface with the fire sprinkler system and any fire alarms will be automatically sent to an off-site monitoring facility. The control panel, batteries and remote annunciator will be situated in locations as determined by the local Fire Marshall.

Public Address System

Public address equipment, including amplifiers, equalizers, speakers, microphones, receivers, potential UL listed interface with fire alarm system, etc. will be selected and specified by others. Locations of these devices will be coordinated with the Owner to ensure that the appropriate power and raceways are provided for that equipment.

Television Monitors

Cable/satellite TV equipment will be selected and specified by others. Locations for monitors and equipment will be coordinated with the Owner to ensure that the appropriate power and raceways are provided for that equipment.

Fire Protection_Narrative

FIRE PROTECTION:

Automatic Fire Sprinkler System

The building will be protected throughout by an automatic fire sprinkler system. The fire protection water service shall be 8".

A wet pipe sprinkler system will be used to protect all areas of the building except areas exposed to freezing.

A dry pipe sprinkler system will be used to protect the overhangs and areas exposed to freezing conditions such as entry vestibules and loading docks.

Clean agent fire protection system (FM200 or similar) will be used to protect the IT and Data Rooms.

Sprinkler heads in the Public Lobbies, Public Corridors, Courtrooms, Community Room and Training Room shall be fully recessed.

Sprinkler heads in all other areas shall be semi-recessed and chrome.

Sprinkler heads in mechanical spaces, and vehicle areas shall have protective cages.

Plumbing_Narrative

PLUMBING:

All plumbing fixtures shall be commercial grade and meet the EPA WaterSense performance requirements.

All fixtures shall be provided with commercial grade ¼ turn stop valves, chrome p-traps, commercial carriers where needed and insulation for under fixtures piping where required for ADA compliance.

Domestic Water Distribution

Based on the current architectural drawings, a 4" domestic water service will be needed to meet the anticipated maximum water flow rate as determined by Appendix A of the 2009 Uniform Plumbing Code. The domestic water service will enter room 103 Water Entry.

The domestic water service entrance riser shall include insolation valves on inlet to the riser and out to the building, inlet pressure gauge, pressure reducing valve set to 70 psi, y-pattern strainer, a water meter that complies with the City of Missoula requirements, a reduced pressure back flow preventer (Watts Model LF009 or approved equal), and an outlet pressure gauge. A full size bypass with isolation valves and a reduced pressure back flow preventer shall be installed around the primary backflow preventer (Watts Model LF009 or approved equal), to facilitate testing of the primary backflow preventer without interruption of building operation.

All domestic hot, cold and recirculation water piping shall be Type L hard copper (ASTM B88 & ANSI/NSF 61) with sweat fittings and joints. All Domestic water piping smaller that 1-1/2" NPS shall be insulated with ½" insulation and all domestic water piping 2" and larger shall be insulated with 1" insulation. All domestic water piping insulation shall be performed mineral fiber with vapor barrier, all service jacket (ASJ) and have a conductivity of at least 0.27 Btu - in / (h – ft2 – F).

All domestic hot, cold and recirculation water valves shall be non-ferrous and lead free. All domestic water isolation valves shall be bronze, two piece, lead free, and full-port ball type valves with stainless steel trim.

Domestic hot water will be generated by gas fired, tank type water heaters. The basis of design is Lochinvar Shield Model # SNA201-100. The water heater shall be equipped with an ASSE approved temperature limiting device. The temperature limiting device shall be Armstrong International "The Brain" valve and piping assembly or prior approved equal.

Water heaters will be located as close as possible to the fixture groups they serve to minimize pipe runs.

Domestic hot water recirculation pumps shall be provided for the domestic hot water recirculation system. The recirculation pump shall have a stainless steel housing and bronze impeller and be rated for potable water use.

Sanitary Waste

The waste and vent system shall be designed, sized and installed per the 2012 Uniform Plumbing Code. Due to the size of the building, a 6" sanitary sewer service will be required.

A 3,000 gallon pre-cast concrete grease interceptor will be installed to collect grease waste for the restaurants and concessions areas.

All grease waste piping both above and below ground will be service weight no-hub cast iron pipe and fittings that conform to CISPI 301 and ASTM A888 with heavy duty no-hub couplings that conform to CISPI 310, ASTM C 1277, ASTM C 1540 and FM 1680 Class 1.

A 3,000 gallon concrete sand/oil interceptor will be installed to collect sand, oil, and other contaminants from the loading ramp and incoming baggage areas.

All below slab sanitary waste and vent piping shall be solid wall PVC Schedule 40 pipe that conform to ASTM D 1785 with socket type solvent cement joints and DWV PVC fittings that conform to ASTM D 2665. All above grade sanitary waste and piping shall be service weight no-hub cast iron pipe and fittings that conform to CSIPI 301 and ASTM A888 with heavy duty no-hub couplings that conform to CISPI 310, ASTM C 1277, ASTM C 1540 and FM 1680 Class 1.

A pre-assembled duplex grinder sump pump will be installed in the basement to sump any fixtures located below the main sanitary elevation.

Floor drains shall be installed in all bathrooms. Floor drain shall be JR Smith 2010 series with round nickel bronze strainer or approved equal.

Floor sinks shall be installed in all mechanical spaces for indirect drainage from mechanical equipment. Floor sinks shall be Zurn model # Z1902 with stainless steel dome strainer and ¾ grate or approved equal.

Electronic trap primers will be used to ensure the traps for all floor drains and floor sinks remain full. The basis of design of the electronic trap primers shall be Zurn Z1020 with 10 outlets and balancing/throttling valves on each outlet.

Rain Water Drainage

The flat portions of the building's roof will be equipped with primary and secondary overflow drains. The primary roof drain will be piped through the building to below grade and connect to the site storm drain system. The secondary overflow drains will be piped through the building to outlets on the exterior walls approx. 18"-24" above grade.

The roof drain will be JR Smith 1800 series with expansion joint or prior approved equal.

All above grade roof drain piping shall be service weight no-hub cast iron pipe and fittings that conform to CSIPI 301 and ASTM A888 with heavy duty no-hub couplings that conform to CISPI 310, ASTM C 1277, ASTM C 1540 and FM 1680 Class 1.

All above grade roof drain piping shall be insulated with 1" of preformed mineral fiber insulation. The pipe insulation shall include an all service jacket (ASJ) and have a thermal conductivity of at least 0.21 Btu - in / (h – ft2 – F).

Other Plumbing Systems

A natural gas service shall be sized per the 2012 International Fuel Gas Code to provide sufficient gas to the fuel fired appliances. The natural gas service will be NorthWestern Energy.

A new gas meter, regulator, shutoff and earthquake valve shall be installed outside the building, but in a secure area.

An underground, liquefied propane gas tank will be used as a back-up fuel source for the boilers. The size of the tank is to be determined.

All plumbing piping and equipment shall be seismically braced per the 2012 International Building Code and the current version of ASCE-7.

HVAC System Energy Comparison

New Missoula Airport Terminal HVAC System Energy Comparison

The following document and attached system comparison is an analysis for the new Missoula Airport Terminal building. This analysis is intended to provide a comparison of the difference in annual energy cost for several systems in each building. While the modeling of the systems is quite detailed, the modeling of the building and its materials is very simple. Our models consider the program for each building, the relative arrangement – i.e. the general building shape, and number of floors, but uses IECC minimums for envelope and fenestrations.

The results of this analysis do not predict the operating of each building with different systems, but give the percent difference in annual cost for the different systems. The systems were modeled area as follows:

BASELINE: Variable Air Volume with Hot Water Boiler and Ground Water Cooling

This system uses central air handlers equipped with hot water heating coils and cooling coils and VAV boxes with hot water re-heat coils to allow for zone level control. Heating water will be generated by gas fired high efficiency hot water boilers and chilled water will be generated by an open loop of ground water in conjunction with flat plate heat exchangers.

Alternative #1: Variable Air Volume with Hot Water Boiler and Air Cooled Direct Expansion Cooling

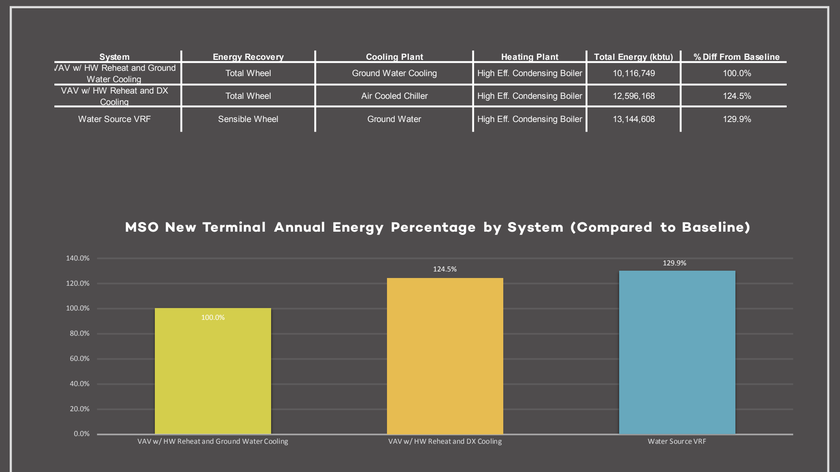
This system uses central air handler equipped with hot water heating coils and direct exchange (DX) cooling coils and VAV boxes with hot water re-heat coils to allow for zone level control. The air handlers were modeled as packaged DX, either rooftop style or split DX type units. With this system heating water will be generated by gas fired high efficiency hot water boilers.

Alternative #2: Water Source Variable Refrigerant Flow

This system uses central heat pumps to supply refrigerant to fan coils that heat and cool the rooms or spaces. Hot water boilers provide heat to the heat pumps and a ground water is used to reject heat from the heat pumps. Dedicated outside air units with hot water heating coils and VRF cooling coils provide ventilation to the building.

The following table and chart show that the baseline system "Variable Air Volume with Hot Water Boiler and Ground Water Cooling" uses the least energy of the three (3) systems in our analysis. We feel the superior energy performance, coupled with this

System	Energy Recovery	Cooling Plant	Heating Plant	Total Energy (kbtu)	% Diff From Baseline
VAV w/ HW Reheat and Ground Water Cooling	Total Wheel	Ground Water Cooling	High Eff. Condensing Boiler	10,116,749	100.0%
VAV w/ HW Reheat and DX Cooling	Total Wheel	Air Cooled Chiller	High Eff. Condensing Boiler	12,596,168	124.5%
Water Source VRF	Sensible Wheel	Ground Water	High Eff. Condensing Boiler	13,144,608	129.9%



PROBABLE PROJECT COSTS

PROBABLE PROJECT COSTS

Estimated Total Project Cost	Phase I Range		Phase II Range		Phase I + Phase II Total Range	
	low	high	low	high	low	high
Building & Sitework	$ 56,481,703	$ 61,547,861	$ 9,045,839	$ 12,530,054	$ 65,527,543	$ 74,077,914
Design Fees	$ 7,075,000	$ 7,075,000	$ -	$ -	$ 7,075,000	$ 7,075,000
Construction Management Services - M&M Contract	$ 3,000,000	$ 3,000,000	$ 750,000	$ 750,000	$ 3,750,000	$ 3,750,000
Owner Project Expenses	$ 8,399,783	$ 8,399,783	$ 5,386,527	$ 5,386,527	$ 13,786,310	$ 13,786,310
Permits and Fees	$ 284,598	$ 284,598	$ 159,078	$ 159,078	$ 443,676	$ 443,676
Testing & Inspections	$ 644,467	$ 644,467	$ 461,832	$ 461,832	$ 1,106,299	$ 1,106,299
Bidding, Advertising & Printing	$ 59,500	$ 59,500	$ 64,000	$ 64,000	$ 123,500	$ 123,500
Project Contingencies	$ 7,742,719	$ 8,249,335	$ 2,114,139	$ 2,462,560	$ 9,856,858	$ 10,711,895
Total	$ 83,687,770	$ 89,260,543	$ 17,981,414	$ 21,814,050	$101,669,185	$ 111,074,594