SEATTLE-TACOMA
INTERNATIONAL AIRPORT
DESIGN GUIDELINES
1999

Port of Seattle

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1.1 INTRODUCTION

The Design Guidelines are issued by the Air Terminal Line of Business to provide guidance to all project teams involved in the design of facilities within the terminal complex. The Air Terminal Line of Business is responsible for the administration of the Design Guidelines, and it is the responsibility of each project team to coordinate with ATLOB to achieve compliance with this document.

The Design Guidelines are intended to be both inspiring and practical, articulating the comprehensive vision for Sea-Tac Airport, as well as providing clearly defined design criteria to be followed on all projects. The Design Guidelines provide direction to design teams to assure that designs are consistent with the Port of Seattle's vision and requirements for all projects at the Airport.

The Design Guidelines are intended to accomplish the following:

- Articulate the Design Vision of Sea-Tac as a Premier, World Class Airport, establishing a conceptual foundation for all design projects at the Airport.

- Outline the Design Strategies, providing fundamental principles to guide project teams in developing the design of each project.

- Illustrate Existing Challenges and Opportunities, demonstrating how the existing facility relates to the design vision and strategies.

- Provide a Clear Basis for Design Reviews by the Design Review Committee, which has responsibility for reviewing the design of all projects at Sea-Tac Airport to assure compliance with the Design Guidelines.

- Set the Tone for Unity and Consistency in appearance at the airport, making the link between existing and new.

- Consolidate Relevant Information, providing a summary of related documents, resources, authorities, or other entities that are applicable to design work at Sea-Tac.

The Design Guidelines are not Standards. Although specific criteria is included in many cases, the Design Guidelines are intended to provide a flexible framework, allowing for new discoveries and appropriate responses to each project's unique conditions.

Design teams are encouraged to bring fresh creative energy to each project, applying the comprehensive vision, strategies, and design criteria in the Design Guidelines to the unique opportunities presented by each project. To assist each project team in understanding and interpreting the Design Guidelines, a Design Review Committee will work interactively with project teams during the design process.

The Design Guidelines will be an evolving document to be updated as conditions and criteria change over time.

1.2 DESIGN VISION

1.2.1 Sea-Tac International Airport's Role in Our Region

Sea-Tac International Airport is a Premier, World Class Airport, serving as an International Gateway to Seattle and the Pacific Northwest.

Sea-Tac is an integral part of our regional community:

- A Safe, Efficient, and User-friendly Transportation Center, essential to our region's economic vitality.
- A Good Neighbor, responsive to the needs of surrounding communities.
- An Inspiring and Memorable Place, reflective of our region's extraordinary environment, vibrant business community, and rich diversity of cultures.

The design vision for Sea-Tac International Airport grows directly out of its essential role in our regional community.

1.2.2 Design Vision: Creating a Memorable Sense of Place

The Design Vision for Sea-Tac is focused on Creating a Memorable Sense of Place, one which *reflects the character and environment of the Northwest*. The key aspects of this Design Vision are:

- Progressive Modern Architecture: based on essential design principles which stand up well over time. The term "progressive modern architecture" is intended to convey two fundamental ideas. First, continuity with the existing "modern" architecture is critical to achieving a unified image for Sea-Tac. Second, each new design should also be progressive and forward-looking while being respectful of the "International Style" modernism of the main terminal.
- The Northwest Natural Environment: strong connection to and respect for the natural environment, through prominent exterior use of native landscaping; use of natural materials; sustainable design strategies; responsiveness to the unique character of Northwest natural light and views; and metaphoric reference to natural considerations where appropriate.
- The Northwest Cultural Environment: prominent integration of artwork and cultural elements representative of the region. The diverse range of cultural influences includes Native American and immigrant cultural heritage; trade and technology; Northwest landmarks; and outdoor recreation.

The Design Vision will enable Sea-Tac to become a truly great airport, recognized by travelers and neighbors alike for high quality service, sensitivity to our environment, and distinctive character uniquely emblematic of our region.

1.2.3 Progressive Modern Architecture

The primary aspect of the Design Vision is the commitment to "Progressive Modernism" as the fundamental design approach. This approach is based on the following timeless principles:

- Responsive to traveler needs: consistently enhancing the quality of the traveler experience, both functionally and aesthetically.
- Open and engaging: forming an inspiring and visually engaging environment for the vibrant activity occurring throughout the airport.
- Forward-looking: conveying a progressive image appropriate to the dynamic nature of air travel and to the innovative spirit of the Northwest.
- Appropriate to our region: evolved from an insightful response to the unique qualities of the Northwest environment and culture.
- Integrates innovative technology: enabling high quality service.
- Clear and elegant design approach, with honestly expressed structure and materials: achieving a design clarity that is easily understood and appreciated by travelers.
- Light Color Palette: enhancing the sense of openness and natural lighting, and assuring a sense of consistency and continuity within the airport.
- Develops a well integrated design expression: in relation to the immediate project's surroundings, and to the airport as a whole.

There are several key considerations which make "Progressive Modernism" the appropriate design approach at Sea-Tac:

- It is based on essential principles that stand up well over time.

  A critical concern at Sea-Tac is that the facilities endure and do not require updating simply because they seem "out of style". This is a problem now facing many commercial buildings that followed "post-modern" trends toward nostalgic and historical references to previous eras. The fundamental design principles summarized above will lead to essentially sound designs that will continue to inspire and serve travelers well into the future.

- It offers the best opportunity to create a unified architectural character at Sea-Tac.

  The predominant architectural character of the existing Airport is modernist, ranging from the early modernism of the original terminal, to the "International Style" of the Main Terminal and Satellites, to the more contemporary modernism of the recently renovated Concourses B, C, and D. Although the older existing facilities are now seen as outdated in material expression and are in need of functional improvements, and there are some aspects of the renovated concourses that are seen as unsuccessful, the predominant modernism provides a strong architectural continuity among the existing facilities. The proposed Concourse A project, the Hotel, and the Central Terminal all will continue this modernist

architectural approach, with an appropriate expression of progressive design strategies and values.

The outdated aspects of the existing facilities should not be grounds for abandoning their modern architectural character. Rather, all new and renovation projects should seek ways of enhancing the strengths of the existing building, while continuing to develop the palette of materials used in more recent projects to create a stronger cohesiveness throughout the facility.

- Progressive modern architecture embodies our region's forwarding-looking culture and visionary spirit.

  From our innovative businesses such as Boeing and Microsoft, to our leadership in environmental consciousness and integration of public art, we pride ourselves on our openness to new ideas and innovation.

- Modernist architecture relates well to the inspiring and dramatic nature of air travel.

  Air travel has always captured our imagination as one of the most engaging and dramatic experiences of modern life.

- Modernism at its best is regionally appropriate to our environment.

  The main terminal and satellites were designed in the "International Style" that is seen as having relatively little relationship to the Northwest, but this does not mean that modern architecture cannot be highly appropriate to our region.

  In fact, the Northwest has a strong history of modernism which is regionally appropriate, from Weyerhaeuser's Corporate Headquarters, recognized thirty years ago for blending modern architecture with an innovative relationship to the natural environment, to more recent modern buildings such as 2 Union Square and Benaroya Hall. These buildings all blend a progressive modernist expression with a sensitivity and connection to the unique environment and culture of the Northwest.

  The buildings themselves do not attempt to literally "represent" the Northwest, but they are clearly appropriate to the region and their more immediate context.

  Our temperate climate, extraordinary landscape and views, and the quality of Northwest light, all offer strong opportunities for developing a modern architectural character which is highly appropriate to the Northwest.

For all of these reasons, "Progressive Modern Architecture" is seen as the primary aspect of the design vision for Sea-Tac Airport.

1.2.4 The Northwest Natural Environment

A second essential aspect of the Design Vision is *achieving a strong relationship with the Northwest's natural environment.* The enduring images of Western Washington – recognized throughout the world -- are of extraordinary natural beauty: from Mount Rainier and the Olympics; to the dense evergreen forests; to Puget Sound and the Pacific Coastline. The intention at Sea-Tac is to respect and connect to our extraordinary environment, through:

- Prominent exterior use of native landscaping:

  The intention in exterior landscaped areas is to integrate landscaping native to the Northwest, to develop micro-environments that represent unique aspects of our regional environment. This approach must be evolved in a way that fully integrates the functional requirements of the airport with the desired aesthetic intent.

- Responsiveness to the unique character of Northwest natural light and views:

  The architectural design and siting of all facilities should optimize views to natural features, particularly Mt. Rainier and the Olympics, and should integrate natural lighting opportunities where appropriate.

- Use of natural materials:

  Natural materials should be well integrated within the interior spaces, as well as in exterior paving and landscaped areas. Natural materials add warmth and texture to the built environment, providing human scale and enhancing the connection to the natural environment. The use of natural materials should be carefully developed to integrate well with the modern design character at the airport. The intention is to maintain an overall light color and material palette at the airport, to enhance the sense of openness and natural light. The selection of wood veneers, stone, or other natural materials should be made with this in mind, although feature elements may be appropriate to be darker in tone if their use is relatively limited.

- Metaphoric reference to natural elements where appropriate:

  Metaphoric reference to natural elements can be a way of enriching the architecture in certain instances, but this approach is not recommended as a primary generator of architectural concepts, since this type of "theming" too often seems trite and quickly dated.

- Environmentally sustainable design:

  The Northwest region is recognized for leadership in environmental issues, and the airport acknowledges environmental sensitivity by emohasizing innovative and energy efficient designs.

1.2.5 The Northwest Cultural Environment

The third important component of the Design Vision is the expression of the Northwest Cultural Environment, achieved through *integration of artwork and cultural elements representative of the region.* Artwork and cultural elements offer significant opportunities to enhance the traveler's experience:

- Well integrated artwork which reflects our region:

  Seattle has long been a national leader in developing public art as a prominent approach to enriching our public spaces. Sea-Tac airport also has an extensive tradition of integrating public artwork within public spaces. The approach to artwork at Sea-Tac will build on these traditions, with a focus on developing a cohesive yet diverse artistic expression.

- Integration of cultural elements where appropriate:

  The culture of the Northwest encompasses a diverse range of influences including Native American and immigrant cultures; trade and technology; Northwest landmarks; and outdoor recreation. These elements may be represented in a variety of ways: through integration in artwork; as temporary exhibitions; or through displays or other activities sponsored by important regional institutions.

These three components of the Design Vision – Progressive Modern Architecture, Northwest Natural Environment, and Northwest Cultural Environment – are the fundamental basis for creating a memorable world class airport. The following sections of these guidelines outline the strategies, procedures, and design criteria that support these broad concepts.

1.2.6 Translating the Vision to Reality: Extraordinary Design Leadership

The creation of a Memorable Sense of Place is subjective and difficult to define in absolute terms, because it requires extraordinary creative interpretation. The Port of Seattle is committed to selecting highly qualified design professionals experienced in providing this superlative level of design leadership. The Port expects that these design leaders, while bringing fresh creative energy, also will join the Port and other designers in achieving a unified and cohesive character at Sea-Tac.

1.2.7 Purpose of the Design Guidelines: Implementing the Vision

Every design and construction project at Sea-Tac should be conceived, developed, and implemented with this comprehensive vision as the ultimate goal. Every aspect of every project must address the question: *"Does this support and strengthen the vision?"*

United Airlines Terminal One at O'Hare International Airport: is an excellent example of modern architecture cohesively developed to create a memorable sense of place. The structural steel frame is an honestly expressed feature that defines the architectural character of the terminal, creating a forward looking image and a visually engaging traveller sequence. Every aspect of the terminal is well considered and carefully integrated, creating a strong sense of clarity and unity within the public spaces.

Vancouver International Airport: Well developed landscaping creates a welcome transition zone between the garage and the terminal.

Washington National Airport: Artwork is prominently integrated throughout the terminal, creating strong areas of focus and significantly enriching the traveler

2.1 SUMMARY: DESIGN STRATEGIES

Section 1 articulated the Design Vision:

Creating a Memorable Sense of Place
- Progressive Modern Architecture
- Northwest Natural Environment: Connection to Landscape, Natural light, Views
- Northwest Cultural Environment: Integration of Artwork & Cultural Elements

Section 2 establishes the Design Strategies that support the vision. Following is a summary of these fundamental principles:

2.2 Enhancing the Quality of Traveler's Spatial Experience
- Visually Open and Engaging
- Appropriate Spatial Hierarchy
- Choreographed Experience: Approach / Decision / Arrival / Relaxation

2.3 Providing Clarity of Wayfinding
- Open and Clear Traveler Circulation
- Effective Message Systems

2.4 Achieving Continuity with Diversity
- Coherent Image: Holistic Experience
- Diversity of Creative Expression
- Enhancement of Existing Architecture
- Consistent Use of Materials

2.5 Maintaining High Quality of Services & Amenities
- Ease of Access and Use
- Well Organized and Efficient
- Clean and Well Maintained: Control of Clutter
- Appropriate Sizing for Current and Future Needs
- Functional and Maintainable Designs

2.6 Sustainable Design
(To be explored by design teams to the extent feasible within budget and other parameters)
- Conserve Energy
- Manage Material Use
- Enhance Environment
- Support Landscape
- Safeguard Water

These design strategies are interwoven and interdependent, and it is intended that design teams thoroughly integrate these strategies as a unified design approach. These strategies are not intended to be seen as independent of one another, however in the following pages it is useful to consider each strategy separately as a means of identifying critical issues that each design team needs to address.

2.2 ENHANCING THE QUALITY OF TRAVELER'S SPATIAL EXPERIENCE

Visually Open and Engaging:

Public spaces should be clearly organized, visually open and engaging, and generously scaled appropriate to the use of the space. Public circulation areas should be comfortably sized to allow for easy traveler movement during peak traffic periods. Vertical circulation between floor levels should be very open, enabling clear wayfinding and offering opportunities for spatial drama and visual connectivity.

Materials and finishes in public spaces should enhance the sense of openness and visual engagement. Glazing in lobby spaces should be as transparent as possible to maximize visibility and openness. Interior mezzanine rails should be glazed or otherwise detailed in a way to maximize visibility. Primary interior material palettes should be very light to enhance the sense of openness and natural lighting.

Public spaces should be free of physical impediments that would reduce ease of movement. Service elements should be consolidated and located in alcoves or otherwise well integrated to avoid congestion in public circulation paths. "Controlling clutter" is not just an operational issue; designers should develop clear zones for service elements, creating a framework that allows future evolution of service needs without compromising the image and coherence of the public spaces.

Natural daylighting and exterior views are an essential aspect of achieving open and engaging public spaces. Daylighting and views should be carefully integrated with artificial lighting and control of solar glare and heat gain, to achieve a strong connection to the natural environment without compromising energy efficiency and functional considerations.

The use of clerestory windows in lieu of skylights should be considered where possible, as clerestory windows are more easily maintained and are less prone to developing water infiltration problems. Where skylights are used, it is recommended to use kalwall or other translucent glazing. Clear skylighting should be used only if POS commits to regular maintenance and cleaning. Skylights should not be placed over areas where sensitive equipment such as security will be located.

Integration of landscaping, both in exterior locations and where appropriate as interior features, supports the design vision and enriches the traveler's spatial experience.

Appropriate Spatial Hierarchy

Public spaces should be organized in a hierarchy that creates a clear and comfortable traveler experience. Primary public circulation paths should have generous ceiling heights, while secondary and support spaces will typically have lower ceilings. Low ceilings in primary circulation paths such as those in the existing concourses B, C, and D, are to be avoided.

Materials, finishes, and artwork can also support and clarify the intended spatial hierarchy. Primary spaces can be given greater emphasis through use of featured materials or through

prominent integration of artwork. Lighting and signage should also be developed in ways that strengthen and support the spatial hierarchy.

Choreographed Experience: Approach / Decision / Arrival / Relaxation

The traveler's experience follows a sequential cycle while moving through the airport: approach, decision, arrival, relaxation. The design of the public spaces should be appropriate to the travelers' needs and emotional state at each step of these sequential experiences. Clarity and good visibility are essential throughout the sequence.

Approach: in approaching a new space or decision point, travelers seek reassurance and clues to assist with wayfinding. The spatial organization in these approach routes should be very clear to minimize traveler confusion and uncertainty. The space itself should naturally lead travelers toward their destination. Finishes, artwork, and lighting should enrich the experience without creating significant distractions to travelers.

Decision: at points where paths diverge or options are presented to travelers, spaces should be generously scaled to allow travelers to slow and make decisions. Primary paths should be emphasized spatially, while secondary paths should be clearly defined and legible without confusing the natural hierarchy with more important routes. Materials, lighting, and clear signage all can enhance the decision-making process.

Arrival: the creation of gateways, focal points, or other transitional elements can help travelers recognize and celebrate their arrival in a new space or intermediate destination. These transition points are ideal locations for dramatic artwork or specially designed architectural elements. Material transitions offer more subtle ways to enhance the arrival sequence.

Relaxation: after arriving at a destination such as hold rooms or concession areas, (and to a lesser extent ticketing and baggage claim), travelers have an opportunity to relax and enjoy their surroundings, as they await the next step in their journey. The character of these spaces should create a relaxing and enjoyable environment, offering exterior views and ample natural light. The design character and material expression should balance a sense of drama with comfort and reassurance to travelers.

Integration of Retail and Other Amenities

Integration of retail facilities enhances the traveler experience, and should be fully considered and integrated early in the design process.

2.3 PROVIDING CLARITY OF WAYFINDING

Open and Clear Traveler Circulation

Maintaining good visibility and clear circulation paths are essential. The design and layout of all public spaces must use this as a fundamental basis of design.

Effective Message Systems

The message systems: primary wayfinding signage, service signage, FID's, and advertising all must be effectively integrated into a coherent whole which enables travelers to easily find the information they need in a timely manner.

Signage systems must be designed so that each system is legible and given the appropriate level of emphasis. Primary wayfinding signage must be visually emphasized to avoid confusion and visual clutter.

Advertising should be integrated in clear zones that are highly visible but not in conflict with primary wayfinding.

2.4 ACHIEVING CONTINUITY WITH DIVERSITY

Coherent Image: Holistic Experience

Achieving unity and consistency throughout the airport is essential to creating a coherent image for the airport. The selection of materials and design expression should be developed to relate well with existing and other new designs. Details should support the design character of the specific project, and each project should be seen as an integral part of the entire traveler experience.

In addition to the coherence of the architectural details, it is also important that all services, commercial elements, landscaping, and movable furnishings support and strengthen the entire design character.

Diversity of Creative Expression

The airport is large enough to accommodate and benefit from diverse architectural and artistic expressions within different parts of the airport. This diversity can enrich the overall character of the airport, but it should be balanced with a commitment to maintaining continuity of material palette and general architectural principles.

Enhancement of Existing Architecture

Renovations and expansions of existing architecture should seek ways of maintaining existing high quality materials or elements, while creating stronger continuity with newer portions of the facility. For instance, in the main terminal, the introduction of lighter materials and finishes could be balanced with refurbishing rather than replacing the dark granite wall cladding.

Consistent Use of Materials: Clean Simple Materials, Honestly Expressed

Consistent material use is important to achieving continuity throughout the airport. The intent is to maximize consistency while still allowing appropriate variations and development of feature elements within specific areas. Specific material selections and recommendations are defined in Section 4.3.

2.5 MAINTAINING HIGH QUALITY OF SERVICES & AMENITIES

Ease of Access and Use

All services and amenities must be easy for travelers to find and use. Services should be grouped in zones that while easily accessible do not clutter or confuse the primary activities in public spaces.

Well Organized & Efficient

Services and amenities must be efficiently organized to meet traveler needs and expectations.

Clean & Well Maintained: Control of Clutter

Public spaces should be designed to be easily cleaned and maintained, and should integrate service elements in a way that reduces and controls clutter.

Appropriate Sizing for Current and Future Needs

Designs should be carefully developed to meet current demands. Designs should consider potential future changes or developments, and make provisions to allow for future growth or expansion. This is not a mandate to "over-design" the initial systems; rather, design teams should look ahead to future possibilities, and with the Port, make sound long-term decisions that provide appropriate levels of future flexibility.

2.6 SUSTAINABLE DESIGN

Note: The Port of Seattle Aviation Division has not developed a detailed sustainable design approach, however design teams are encouraged to explore sustainable design strategies that are achievable within budget and other parameters. Following are broad goals related to sustainable design:

Conserve Energy

Energy is a finite resource that must be conserved if the region is to achieve a sustainable pattern of development. Each project must meet the Washington State Non-Residential Energy code, and should consider the following energy conserving strategies:

- Reduce energy consumption
- Harvest site resources
- Increase Efficiency

Manage Material Use

The construction of new facilities, as well as the renovation of existing spaces, increase our region's consumption of materials. To approach sustainable patterns of material use, the complete life cycle of a product should be considered. Improving the efficiency of use and lowering the overall resource consumption, can be achieved through four strategies:

- Minimize material use
- Select sustainable sources
- Use durable materials
- Close the loop

Enhance Environment

There is growing evidence of the negative impact from exposure to multiple environmental toxins present in building materials. The construction of new facilities can create new sources of pollution and environmental impact both inside and outside of buildings. Many building materials create pollutants and contamination during production and the negative impacts occur remotely from the site. Other building materials contain pollutants when they are installed in a building, and continue to emit them for long periods of time. The approach to enhancing the environment has three key components:

- Reduce pollution sources
- Eliminate contamination
- Dilute pollution strength

Support Landscape

Landscaping and the connection to the natural environment is summarized in other sections of the design guidelines as an essential aspect of the vision for Sea-Tac Airport. The key issues are restated here, since it is an essential aspect of the concept of sustainable design:

- Connect with nature
- Preserve native vegetation
- Work with natural systems

Safeguard Water

The beauty of the Pacific Northwest is closely linked to the quality of it's water resources. Three strategies are employed to conserve and improve the quality of water:

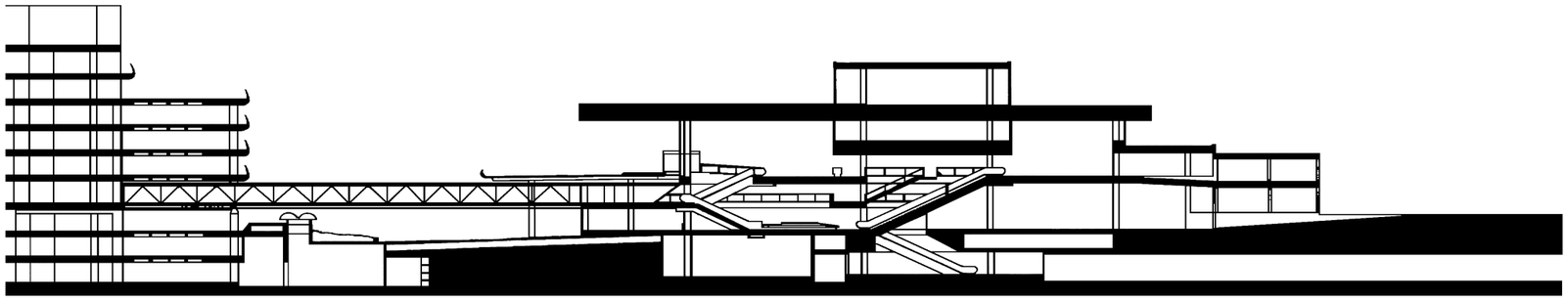
- Reduce potable water use
- Maintain natural waterflows
- Harvest on Site Flows

END OF SECTION SUMMARIZING DESIGN STRATEGIES

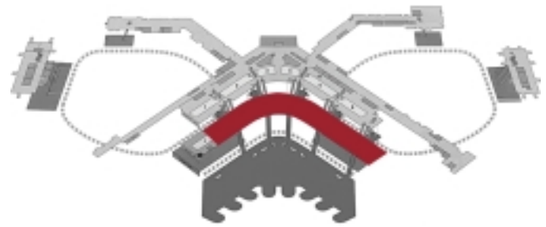
Quality of Service / Spatial Experience: Baggage counters crowd the curbs, impeding movement to entry doors. Future designs should integrate check-in functions more effectively to provide adequate queuing and circulation space.

Quality of Service: Curbside trashcans and ashtrays present cluttered image. Future designs should integrate all site furnishings to reduce clutter.

Quality of Spatial Experience / Wayfinding: The open sweep and extensive glazing at the main terminal could create an engaging entry sequence, but the dark glass and lack of clearly defined entry points presents an univiting first impression. Clearly expressed entry doors combined with some clear glazing at entries could enhance image and wayfinding. Addition of landscaping along the parking structure would provide welcome visual relief.



Section through airport showing garage, enplane and deplane drives, ticketing lobby, esplanade, baggage claim, and satellite transit system station.



Design Strategies

Quality of Spatial Experience:
Transparent glazing and improved articulation at entry doors would enhance image and orientation. Addition of landscaping along the parking structures would significantly enhance the image of the drive area.

Clarity of Wayfinding:
Introduction of more transparent glazing and clearly expressed entry doors would also enhance wayfinding. The current enplane drive lighting and signage overlap in the same ceiling zone, reducing the clarity of wayfinding. Future exterior signage replacement offers the opportunity to achieve more effective wayfinding by creating a more appropriate relationship of lighting to signage elements. It would be desirable to consider ways of defining the central axis of the terminal, to improve traveler orientation and to create a clear image at the center of the airport.

Continuity with Diversity:
Renovated concourses have introduced a lighter exterior color palette that contrasts with the Main Terminal. It is seen as appropriate to maintain this contrast, however in future renovations to the main terminal, it will be desirable to explore ways of enhancing continuity with the newer construction.

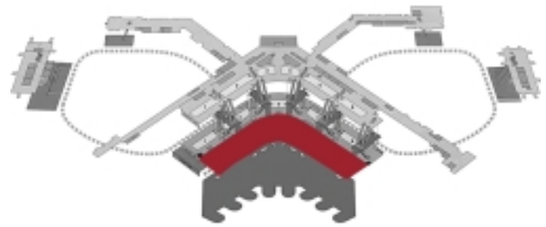
Quality of Services and Amenities:
Adequate space for both curbside baggage check-in and lateral circulation to entry doors is needed. Services, amentites and upgraded site furnishings should be well integrated and reside within well-defined zones.

Quality of Spatial Experience / Continuity with Diversity: Dark materials and dark curtainwall make the deplane drive seem uninviting and drab compared to concourses. The new lighting system improves light levels in curbside area, but future designs could significantly improve traveler experience through enhanced finishes and integration of artwork.

Wayfinding: Directional signage should be more clearly distinguished from airline idenfication signage to clarify wayfinding.

Quality of Services: Curbside area and site furnishings are not user-friendly. Future designs should more carefully integrate furnishings and amentities to enhance the traveler's experience.

Wayfinding: Signage should be more carefully integrated with architecture to avoid clutter and to clarify wayfinding.



Design Strategies

Quality of Spatial Experience:
Transparent glazing and improved articulation of doors from baggage claim would enhance image and orientation. Upgraded finishes and integration of artwork would significantly improve the traveler experience.

Clarity of Wayfinding:
Signage should reinforce the architecture and path of circulation but still be it's own clear, well-defined element. Directional and informational signage should be more clearly developed with appropriate hierarchy of emphasis.

Continuity with Diversity:
Materials at the deplane drive should incorporate lighter color and material palette to relate to renovated concourses and other new construction.

Quality of Services and Amenities:
Services and site furnishings should be more carefully integrated to improve traveler amenities and to create a more unified design image.

Quality of Spatial Experience / Continuity: Upgraded finishes and lighting at the third level significantly improve traveler experience. As this work proceeds on other levels, the third level upgrades should be evaluated to confirm what refinements should be made in future upgrades.

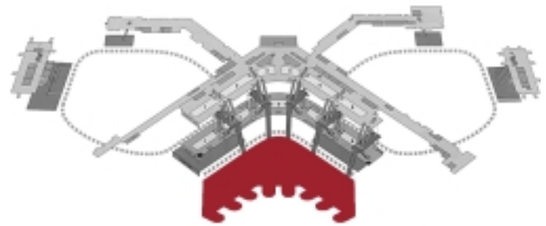
Quality of Spatial Experience / Continuity: Upgraded lighting and materials should be completed throughout the garage elevator lobbies. As noted above, these first phase work should be evaluated to confirm what refinements should be made in future upgrades.

Wayfinding / Quality of Spatial Experience: Poor lighting and lack of adequate signage on the fourth level plaza present unappealing image and make it difficult to locate elevator banks and skybridges. Undifferientiated concrete surfaces also make space unappealing and disorienting for travelers.

Quality of Spatial Experience / Continuity: Existing courtesy van shelters are unappealing and poorly lit. These elements should be well designed and lit to integrate with upgraded image of main facilitities.

Quality of Service: This service element is not well integrated with surroundings. Designers should consolidate service elements in locations that are easily accessible but do not clutter the space..

Quality of Service: Designers should integrate storage space for wheelchairs and other movable items near circulation cores, to avoid cluttered image.



Design Strategies

Quality of Spatial Experience:
For many travelers the garage is their first spatial experience at the airport. Given the low ceiling heights there are few spatial clues that enhance wayfinding. Lighting, signage, and finishes should be developed in a way that strenghtens traveler orientation and creates an appealing first impression.

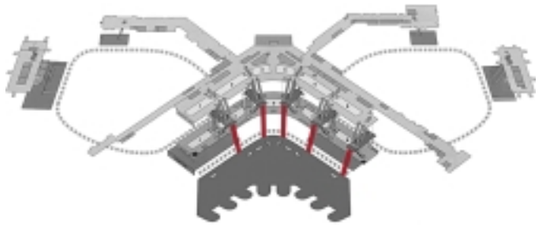
Clarity of Wayfinding:
Signage is a critical tool to define and clarify circulation paths, as well as an opportunity to enhance the image and visual delight within the garage.

Continuity with Diversity:
Areas within the garage for passenger waiting and circulation should be upgraded to create continuity with other primary public spaces.

Quality of Services and Amenities:
Service elements should be consolidated to provide excellent accessibility but do not clutter the space.

Quality of Spatial Experience / Wayfinding: Dark entrance is highlighted only by unevenly lit signage.

Quality of Spatial Experience / Wayfinding: As one of the primary front doors to the airport, skybridge entrances should present a strong appealing entry. Existing skybridge entries are not featured and are partially concealed by structural columns.



Design Strategies

Quality of Spatial Experience:
The spatial character of the skybridges is not commensurate with their functional importance and image. Raised ceilings or other spatial modifications may be difficult to achieve, but lighter finishes, integrated artwork, and improved lighting could significantly improve the quality of the space.

Clarity of Wayfinding:
Improved signage at skybridge entrances would significantly enhance wayfinding. Additional wayfinding improvements could include more distinct architectural expression of entries at each end of skybridges; and integration of artwork that visually engages and leads travelers.

Continuity with Diversity:
Skybridges should incorporate the lighter color and material palette from the renovated concourses and proposed new construction to improve image and establish continuity. Distinctive but related artwork elements could be a way of establishing strong identities for the individual skybridges.

Quality of Services and Amenities:
Consolidated and upgraded site furnishings would enhance image and facilitate circulation.

Quality of Spatial Experience / Continuity with Diversity: Skybridges benefit from natural sunlight, but materials and color palette are drab and do not relate to upgraded finishes in newer areas.

Quality of Spatial Experience / Wayfinding: Entrance to main terminal from skybridge is disorienting. Low ceiling does not provide spatial clue for circulation path. Signage is too small and not easily read.

Quality of Services: Designers should address maintenance considerations in original designs. Any modifications to solve maintainance problems should be designed to blend with existing architecture.

Quality of Services: Trashcan and suggestion box clutter skybridge entrance. Future designs should consistently integrate service elements to avoid clutter.

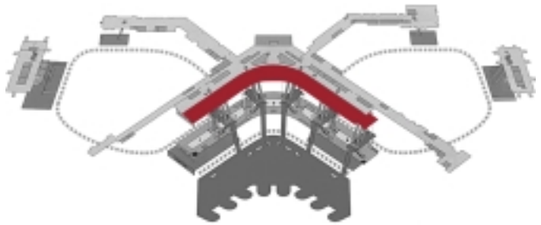
Quality of Spatial Experience: Recessed ticket counters increase passenger circulation space, but movable stanchions and queuing lines can still seem cluttered if not well located. Future designs should consider ways of assuring that the ticket line areas do not appear cluttered.

Quality of Services / Spatial Experience:
Ticketing lobby at Vancouver International Airport is well organized with consistent, high quality finishes. Modern technology is an integral aspect of customer service and image: airline identification on above-counter monitors maximizes flexibility and allows the wood rear wall to be continuous and uncluttered. Future ticketing designs at Sea-Tac should be developed to achieve a similar level of quality and consistent image.

Quality of Spatial Experience / Wayfinding: New pendant lighting elements help to define waiting area from circulation zone. New wood paneling conveys a sense of quality and warmth over ticketing areas. These improvements highlight the need to update, simplify, and consolidate signage, FID's and other elements within the space, to reduce clutter and improve wayfinding. **Continuity with Diversity:** the wood paneling establishes continuity throughout the ticketing lobby, and continues the use of wood as a featured material in public spaces.

Quality of Services / Wayfinding: FID's and elevator locations should be better coordinated for ease of access, to reduce clutter, and create a unified image.

Quality of Service: New curbside baggage shrouds, plantings and airline services should be integrated to create a cohesive image.



Design Strategies

Quality of Spatial Experience:
The narrow width of the public circulation and the sense of clutter detract from success of the ticketing lobby. Future renovations should recess the ticket areas to increase traveler circulation space and reduce the sense of clutter.

Clarity of Wayfinding:
Signage should develop a clear hierarchy to give greater emphasis to primary circulation paths. FID's and airline signage should be carefully integrated to be legible and easily accessible without competing with primary wayfinding signage, and without cluttering the space.

Continuity with Diversity:
Renovations of the ticketing lobby should integrate functional and aesthetic changes in a cohesive way that builds on the strengths of the existing architecture. Existing high quality materials should be maintained and enhanced, to develop a distinct character within the main terminal that relates to but does not replicate the material palette of the concourses.

Quality of Services and Amenities:
Future designs should organize services and amenities to reduce clutter and maximize traveler convenience. For example, the creation of consolidated service "kiosks" in the seating area of each ticketing bay would be one way of more effectively integrating the baggage shrouds, FID's, and other service elements.

Continuity with Diversity: Artwork placed in locations that are not highlighted seem peripheral and do not enhance the traveler's experience. Future designs should properly highlight art installations.

Quality of Spatial Experience: Freestanding kiosks and advertising clutter main circulation zone, while sidewalls are bland and could actually benefit from more carefully integrated advertising. Commercial activities should be integrated along the sides of the Esplanade. Advertising should also be removed from the center spaces to locations that are prominent but do not dominate space or detract from ease of traveler circulation.

Quality of Spatial Experience / Services: Existing walls appear cluttered with poorly integrated service elements. Future designs should integrate advertising and all service elements to create unified appearance.

Wayfinding: Existing advertising sometimes overwhelms wayfinding signage. Designs should define zones for advertising that do not conflict with wayfinding signage.

Wayfinding: Existing retail signage is often not easily readable even when duplicated by generic signage. Future retail signage should be distinctive and legible. Duplicated generic signage should be eliminated.

Design Strategies

Quality of Spatial Experience-
The esplanades can be appealing and functionally successful spaces if the clutter is controlled, and the functional activities are well integrated in relation to the space. The commercial activities within the esplanades should be more closely controlled and organized to reduce clutter and enhance the ease of traveler circulation.

Clarity of Wayfinding-
The removal of clutter and the creation of a clear message hierarchy are both critical to improving wayfinding within the Esplanade. Primary wayfinding signage should be given prominence within the circulation paths, while advertising should be integrated in locations that do not conflict with the primary wayfinding.

Continuity with Diversity-
The esplanade, as a component of the main terminal, should have design continuity with the ticketing lobby and the new central terminal, integrating materials and detailing used in those areas. The integration of retail activity should allow for interesting diversity within the framework of each retail storefront, while maintaining a clear continuity and consistency within the framing architecture.

Quality of Services and Amenities-
The new retail spaces and public restrooms within the esplanade will greatly enhance the quality of service and traveler experience. As part of these renovations, service alcoves should be included to better integrate telephone and other traveler amenities.

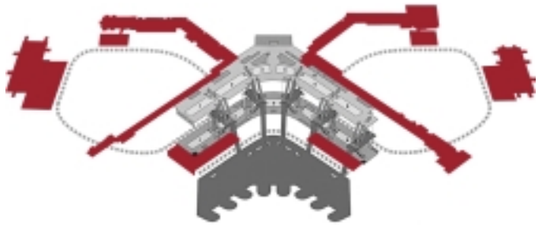
Quality of Spatial Experience: Although white columns and beams help to lighten space, the low ceilings, dark finishes on ceilings and floors, and limited daylight in concourses, result in drab and constricted public spaces. The terrazzo flooring replacement currently in progress, with lighter colors and integral artwork will significantly improve traveler experience.
Wayfinding: Although signage is relatively new and still functional in Concourse B, C, and D, the image is outdated, and some full width signage elements further constrict the already low ceiling heights. As new signage standards for entire airport are developed, it may be appropriate to modify or replace existing signage in concourses B, C, and D.

Quality of Spatial Experience: Light finishes, ample daylighting, and high ceilings create a sense of spaciousness in hold rooms. These areas are seen as the most successful portions of the renovated concourses, providing a good model for future holdroom development.

Continuity with Diversity: Satellite transit system stations will soon be renovated to improve continuity with concourses.

Quality of Services & Amenities: Wood and metal finishes effectively accent high-use amentites. In these prominent conditions, service doors that do not have similar finishes decrease the overall effect.

Quality of Spatial Experience / Wayfinding: Natural daylighting, high ceilings, and prominent artwork enhance quality of space. Spatial clarity and openness enhance wayfinding.



Design Strategies

Quality of Spatial Experience:
In concourses and satellites, the public spaces should be open and engaging, with light finishes and ample natural light. Dark finishes should be avoided except if appropriate in very limited areas.

Clarity of Wayfinding:
As new signage standards for entire airport are developed, it may be appropriate to modify or replace existing signage in concourses B, C, and D.

Continuity with Diversity:
Renovation of concourses has introduced a lighter color and material palette. Satellites and future concourses should incorporate this palette to enhance continuity. Diversity can be achieved through integration of artwork, through the spatial character of the architecture, and through subtle adjustments to materials and detailing. The dark ceilings in concourses B, C, and D should be avoided in future work.

Quality of Services and Amenities:
Service and amenity elements should be carefully integrated to reduce clutter while assuring that travelers can easily find and use these elements.

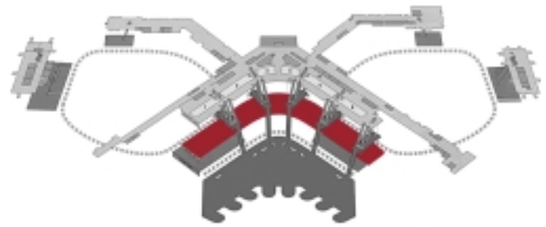
Quality of Spatial Experience: At Munich International Airport the baggage claim areais open and engaging, with lighter finishes, natural lighting, and well integrated advertising all contributing to a positive traveler experience.

Quality of Spatial Experience / Services: Mezzanine roof over baggage claim presents cluttered image to travelers using skybridges. Future designs should consider alternative uses of this space to improve image and functionality of space. One option is to convert to enclosed usable public space, possibly including rental car counters. This would tie directly to the bridge connection to rental car parking and shuttle vans, and could free up baggage claim level for other services or amenities.

Quality of Spatial Experience / Wayfinding: Advertising located throughout the baggage claim area creates clutter, especially at floor level. Advertising on upper wall is not well integrated. Future designs should create well integrated advertising zones to decrease clutter and improve wayfinding.
Continuity with Diversity: new stainless steel railings begin to establish updated image. Future designs should continue this material palette, replacing existing dark metal panel and railings.

Quality of Spatial Experience: Dark "skylight" does not increase natural light and actually is an intrusive presence in the baggage claim area.

Wayfinding: Advertising located in proximity to wayfinding signage creates confusion as well as a cluttered image.



Design Strategies

Quality of Spatial Experience:
The baggage claim area has a relatively high ceiling and could be an appealing space if certain key approaches are adopted: control of clutter, introduction of lighter finishes, improvements to lighting, and removal of the existing sloped dark glazing all would contribute to a higher quality space.

Clarity of Wayfinding:
Advertising should be well integrated and clearly separate from wayfinding signage.

Continuity with Diversity:
The introduction of artwork and creative advertising would be ideal opportunities for enriching these spaces. The replacement of the dark metal panels and railings would improve the continuity with other parts of the airport.

Quality of Services and Amenities: currently rental car counters at baggage claim level compete for space with passenger seating and other service elements. Future designs should consider alternative locations for rental counters to maintain quality of service and adequate space for all functions.

SECTION 3 DESIGN REVIEW COMMITTEE

3.1 INTRODUCTION

This section defines the design review process that will be applied by the Design Review Committee to all projects within the terminal complex at Sea-Tac Airport. The intent is to establish a consistent process that achieves a cooperative and timely exchange of information between the Design Review Committee and the design team.

The Design Review Committee's involvement in project reviews is intended to assure that each project complies with the Design Guidelines and that each project receives the appropriate level of attention and review, consistent with the project's importance and complexity.

Additional quality control and design review procedures are described in the AV/PMG Procedure Manual available to designers through their POS project manager.

3.2 DESIGN REVIEW COMMITTEE

The Design Review Committee will be composed of a core group of airport staff and consultants with comprehensive understanding of the Airport's overall goals and vision, as well as detailed knowledge of the Design Guidelines.

The Design Guidelines are intended to be flexible, allowing for creative interpretation in response to individual project conditions. The Design Review Committee will facilitate the interpretation of the Design Guidelines in an interactive process with each design team.

The Design Review Committee has the responsibility for determining if individual designs comply with the Design Guidelines. The committee will provide review comments to project teams, as well as recommendations to Port administration concerning the consistency of project designs with the Design Guidelines.

3.3 DESIGN REVIEWS

The Design Review Committee will provide interactive comments to project teams in interim reviews. As a follow-up to each review, the Design Review Committee will provide written comments summarizing relevant issues for the design team's consideration. It is intended that this process will assist design teams in achieving consensus on design direction, as well as providing assurance to Port management that project designs are consistent with the Design Guidelines. If the Design Review Committee feels that a project is not meeting the intent of the Design Guidelines, whether due to design decisions or constraints outside the control of the project team, the Design Review Committee will communicate these concerns to the project team and to Port management for resolution.

On the following page is an outline of the recommended design review stages by the Design Review Committee for each project.

Recommended Reviews by the Design Review Committee:

Program Definition Phase:	Review draft
Schematic Design Phase:	Reviews at 20% and 100% of phase completion.
Design Development Phase:	Reviews at 20% and 100% of phase completion.
Construction Document Phase:	Reviews at 20% and 100% of phase completion.

Note: The actual extent and timing of reviews may vary depending on project complexity and schedule, and should be confirmed with the Design Review Committee at the start of each project.

END OF SECTION ON DESIGN REVIEW COMMITTEE

4.1 INTRODUCTION: DESIGN CRITERIA

This section establishes design criteria, defining performance criteria as well as requirements for specific materials and systems. In some cases, general criteria is summarized with reference to separate more detailed requirements.

NOTE: these sections are not intended as complete documentation of the design criteria. Rather, within the limitations of the initial Design Guidelines project, the following sections are a first step in establishing the framework on which, if the Port decides to proceed with development, more detailed standards can be prepared. Even if no further development occurs, the following sections will be of significant assistance to design teams to coordinating their work with Port expectations and with other design teams.

Following are the subsections covered:

4.2 Space Allocation
4.3 Materials & Finishes
4.4 Signage
4.5 Artwork
4.6 Accessibility
4.7 Lighting
4.8 Acoustical
4.9 Landscaping *(Summary plus Reference to separate document)*
4.10 Sustainable Design
4.11 Structural
4.12 Mechanical *(Summary plus Reference to other documents)*
4.13 Electrical *(Summary plus Reference to other documents)*
4.14 Concessions & Tenant Projects *(Summary plus Reference to other documents)*
4.15 Advertising
4.16 Remote Facilities
4.17 Port Offices & Other non-public spaces
4.18 Furnishings

4.2 SPACE ALLOCATION

Floor Area Space Allocation:

Space allocation typically is determined through a programming process at the outset of each project. Although no specific criteria have been established at this point, it would be desirable in the future to develop standards for space allocation for certain typical spaces.

This would ideally be done as a follow-up to projects such as the restroom improvement project, Concourse A, STS renovations, and the Central Terminal projects. For instance, the restroom project will establish certain criteria for space allocation and fixture counts that should be documented and included in a standard for future reference.

Wall and Ceiling Space Allocation:

Space allocation is not only an issue related to floor area. The allocation or "zoning" of ceiling, wall, and even subfloor spaces for services is also a critical consideration, and essential to achieving high quality service, ease of maintenance access, and control of clutter. Examples of standards that could be developed include:

- Ceiling Access: assuring that mechanical elements above ceilings are zoned in locations that are easily serviced with minimum disruption to public activity.

- Zoning of Services on Walls: typical locations or methods for integrating miscellaneous elements such as water fountains and electrical outlets, could be defined to maintain a consistent image.

- Space needs for routing of special systems: such as communications systems, could be defined.

- Zoning of Advertising: typical methods of locating and integrating advertising could be established.

Again, these detailed standards would ideally be developed as an outgrowth of the major projects currently in design.

4.3 MATERIALS & FINISHES

4.3.1 Introduction

This section summarizes material and finishes criteria and recommendations for all projects within the terminal complex. The recommendations are preliminary in some cases, reflecting the fact that the material and finish selections are evolving over time and will be further resolved through the design process on current major projects.

The intention in this section is to define materials and finishes in enough detail to assure continuity throughout the airport, without being so specific or exclusive that it would limit project teams in achieving the best possible solution on each project. Typically the material and finish selections on each project will be achieved through an interactive process between the project team and the Design Review Committee. Any decisions regarding new airport wide material selections should be reached through a collaborative process involving the primary architects on major projects and the Design Review Committee.

4.3.2 Guiding Principles

The following guiding principles should be applied to the selection of materials and finishes:

- Consistent use of materials, with diversity of expression appropriate to specific conditions.
- Primarily light colored materials and finishes with accented contrasts.
- Simple and elegant use of materials, honestly expressed.
- Minimize the total number of materials and colors, to maintain clarity and continuity. This is not intended to exclude the potential use of strong accent materials or colors in appropriate locations.
- Prominent use of natural materials, especially wood as an accent material.
- Sustainable design: use of ecologically appropriate materials & finishes.
- Materials and finishes should be durable, easily maintained, and appropriate for their intended use.

4.3.3 Exterior Materials and Finishes (Terminal & Related Buildings)

Exterior Walls:

The existing airport terminal complex presents a discontinuous image, with the white renovated concourses and existing white satellites standing apart from the main terminal, which appears drab and outdated by comparison. Future renovations and expansions of the terminal complex should seek to create stronger continuity and a more consistently updated image.

- White metal panels should be used as the primary wall cladding material for new concourse construction. The intention is to match Concourses B, C, D visually, but metal panels should be smooth surfaced and self-cleaning, not textured as on B, C, and D. The

B/C/D panels have been found to be difficult to keep clean, and will require regular cleaning to maintain the desired image. The Concourse A project team should research and select an appropriate panel material that will become the standard for future work.

- Concrete (cast-in-place or precast) is an acceptable secondary wall material in terminal buildings, and primary material on parking structures. Finishes used on the Hotel and/or Parking Garage are recommended as a basis of design, but other finishes may be appropriate in other conditions.

- Existing brown panels at Main Terminal and Skybridges: shall be maintained and refurbished where appropriate. New construction that extends the Main Terminal shall match the existing brown panels.

Exterior Glazing:

Exterior glazing is a critical element with major impacts on the appearance, daylighting, and energy efficiency of the airport. Design teams should explore innovative technologies, sunscreening, frit patterns on glazing, and other methods to maximize daylighting and energy efficiency, while maintaining continuity with other portions of the facility. Specific airport related concerns, such as FAA limits on use of low-E glazing in certain conditions, should be researched and confirmed by design teams for each project.

- Gray tinted insulated glass in white painted aluminum frames interior and exterior: at Concourses to relate to existing Concourses B, C, D. It may be appropriate for sills to be clear anodized or stainless steel at high traffic areas. Note: it would be preferable that new glazing be lighter than existing concourse: as light as possible within energy conservation goals, to increase natural daylight transmittance and enhance visibility.

- Clear low-E coated insulated glass in custom designed curtainwall: at International Arrivals Hall, and at the Central Terminal.

- Kalwall: secondary glazing material at Concourses B, C, D. It is anticipated that new concourses will also utilize Kalwall in a similar manner.

- Existing dark gray glass (single pane) in bronze anodized aluminum frames at Main Terminal: will remain in place until some future date, when replacement with insulated glazing is economically appropriate. Extension of main terminal should utilize gray glass that is lighter than existing glass, while still being compatible visually.

Exterior Roofing:

Roofs are highly visible from aircraft and shall be simply designed and constructed. New low slope roofing on terminal buildings shall match existing, or if research determines that a different system is preferable for Concourse A project, this system should be confirmed as standard for future applications.

4.3.4 Interior Materials and Finishes (Public Areas in Terminal Buildings)

Interior Flooring:

- Terrazzo: primary flooring in public circulation areas. Color to be in light range; zinc divider strips; significant opportunity for diverse expression. Note: Concourse B, C, D terrazzo project is currently in progress. On completion, this should be evaluated as precedent for all other terrazzo areas. Following this evaluation, criteria for construction method, color range, and pattern should be developed and included here. (Existing terrazzo is thick set cementious terrazzo, while concourse renovations are thin set epoxy resin terrazzo. It is expected that typical new construction will be thinset.

- Wood, stone, or other natural high quality materials: are appropriate to consider as featured flooring materials in focal areas within primary public spaces. The International Arrivals Hall and Central Terminal are the two primary projects where these feature flooring areas would be appropriate. If wood is proposed as a flooring material, maintenance and durability issues must be carefully addressed, and materials approved by the Design Review Committee.

- Carpeting: is the recommended flooring material in Hold Areas and other secondary public areas. The criteria for composition, density, color range, and pattern should be developed and refined by the Concourse A design team, and included here.

- Ceramic tile, other natural tile, or wood flooring are potentially acceptable for use in Tenant and Concession areas. Specific proposals should be developed and agreed with the Design Review Committee.

Interior Walls:

Following is a summary of existing interior wall surfaces, with recommendations for future applications.

- Wood Paneling as accent elements in appropriate locations: for example Ticketing backwall and Concourse B/C/D restroom entry walls are seen as appropriate locations for wood paneling. Current preference is to use Anigre or Maple in primary spaces, but other veneers may be appropriate. Design teams should develop proposals for review and approval by the Design Review Committee.

- Plastic Laminate (existing in Concourse B/C/D, Satellite and Main Terminal). This is seen as an acceptable material, however colors are outdated in Satellite and Main Terminal. Detailing of edges is critical to durability and appearance. Detailing which protects edges and allows for individual panel replacement is recommended.

- Fabric Panels (existing in Concourse B/C/D). Use of fabric panels should be limited to areas where they are necessary acoustically and where they are out of reach, to avoid damage. Fabric material should be easily cleaned and replaced in the event of damage.

- Brushed Aluminum (existing in Concourse B/C/D wall bases). Existing base has had some problems with delamination. This should be addressed in future applications to achieve improved durability and appearance.

- Painted Drywall (existing at upper level wall surfaces and other protected areas). Acceptable in out of reach or protected conditions.

Column Cladding:

Following is a summary of existing column cladding, with recommendations for future applications.

- Black Granite (at Main Terminal ticketing and Esplanades): Although existing quality and durability is good, current finish is drab and does not look like stone. It is recommended that refurbishment be considered to improve reflectance / luster. If stone is used in future column claddings, a lighter color palette is recommended.

- White Metal Panels (at Concourses B/C/D circular columns): light colored finish is desirable, but light gauge of metal and lack of protection at base has resulted in maintenance problems. Horizontal brushed stainless strips have also been a maintenance problem. This finish should be avoided in future column cladding.

- Plastic Laminate (at Satellites and STS stations): not seen as high enough durability or quality image. Should be replaced in future renovations with higher quality finish as noted above.

- Future Column Covers: Other finishes may be considered in future renovations or new construction. The intention should be to select finishes that are highly durable, compatible with the design character of the surrounding space, and supportive of continuity with other portions of the terminal complex. Recommended finishes include stainless steel, stone, or other highly durable material.

Ceilings:

Typically all ceilings should be white unless specifically approved by the Design Review Committee. Current mock-ups are being developed to confirm the approved ceiling types to be used throughout. Once approved, these types will be documented and included in a future edition of the Design Guidelines.

Following is a summary of existing ceiling finishes, with recommendations for future applications. Ceiling designs and finishes must take into account the need for access to services above ceilings. If the ceiling is “accessible”, the system must be designed for ease of removal of access tiles. If the ceiling is “fixed”, services must be carefully coordinated to eliminate any need for access. The intention should be to select finishes that are durable, provide appropriate access, are compatible with the design character of the surrounding space, and provide continuity with other portions of the terminal complex.

- White painted metal paraline (at Main Terminal, Satellites, and STS stations): existing paraline ceilings are functional and would be costly to replace, however they currently appear drab since they have significantly yellowed over the years. It is recommended that intensive cleaning, refurbishing, or potentially repainting be implemented to achieve a bright white finish. It is not recommended that this ceiling type be used in new construction.

- Painted drywall (in many areas): desirable aesthetically in certain conditions, but the use of drywall ceilings must be limited and carefully coordinated with mechanical and other service needs, to avoid problems with access to services, and to avoid the need to add access panels in drywall ceilings.

- Wood ceiling panels: not recommended. A vocabulary of wood wall paneling has been developed throughout the terminal buildings, and it is seen as undesirable to introduce wood in ceiling areas.

- Existing brown metal perforated panels at Concourse B/C/D are not seen as successful, and should eventually be considered for replacement with lighter finish. There have also been concerns with the difficulty of removing panels for access, as well as the cost of replacing damaged panels, since the supplier is overseas.

- White Metal Perforated Panels: size and construction to be confirmed following completion of mockups. Other finishes may be considered in future renovations or new construction.

Public Restrooms:

Refer to the Restroom Standards, being separately developed for documentation of finishes and spatial requirements for restrooms.

END OF MATERIAL & FINISHES SECTION

4.4 SIGNAGE

4.4.1 Introduction

Note: two current projects are underway that will affect the majority of the signage at Sea-Tac:
1) Design and Construction of new Exterior Signage.
2) Preparation of new Interior Signage Standards.

The following summary forms the basis for those projects, but design teams should refer to the standards that will be developed out of those projects for detailed criteria related to signage.

Navigating through an airport is an experience of sequential identification and wayfinding, beginning at the entrance to the site and continuing through the roadways, garage, terminal, concourse, and return. It consists of identifying and understanding the physical options throughout the entire facility. As such, signage is a unique architectural detail that literally interprets the built environment. It is also unique in that it is most often the singular element that successfully threads continuity through diverse facilities. Additionally, people equate a well-designed signage system with a well-managed, efficient organization—reflecting a critical position for a major regional transportation facility.

Signage has a significant responsibility to provide easy-to-understand "third-person guidance" to customers 365 days a year, 24 hours a day. The diversity of customers is notable—passengers vary from frequent local users most familiar with the facility, to first-time users with a high need for wayfinding and information, including international and non-English speaking travelers.

The requirements, expectations, and outcomes of signage are extensive. As Sea-Tac Airport expands in the future, adding proposed additional remote facilities, expanded services and options within the garage and curbside, expanded retail and central terminal facilities, expanded concourses and others, describing the site to wayfinding patrons increases dramatically in complexity. Accordingly, the effectiveness of signage throughout the entire Airport grows even more critical.

Achieving necessary effectiveness throughout this diversity requires a diligent degree of consistency in signage throughout the entire airport, yet with appropriate flexibility to address the diversity between facilities and activities, from parking to retail, ticketing and others. This need is most often successfully translated into a core group of *design standards* and can be further supported by a related group of *design guidelines*.

4.4.2 Signage Standards

Signage standards provide the basis for consistency in the delivery of wayfinding messages, forms and formats, and should be visualized as a well-planned, well-organized, forward-thinking *system* with an expected life span of approximately 20 years.

The components of signage standards should include graphic standards, standard sign types, and a system-wide plan to orchestrate and integrate signage between the diversity of ground access and terminal facilities.

Graphic Standards

Graphic standards need to address all content in signage. Specifically, this includes:

- Consistency in nomenclature, with a comprehensive set of approved terms, descriptions and instructions to be used system-wide. Succinct and consistent messages are important for successful wayfinding.
- A bank of international symbols and standards for their use.
- Standards for the relationships between graphic components, including symbols, words and colors.
- Standards for fonts, font sizes and message hierarchy.
- Colors for graphic content, as well as for forms and structures. This involves designating colors and reserving them for signage applications, as well as identifying specific colors for special categories, such as emergency.

Standard Sign Types

An integral part of signage standards is to establish a system-wide approach to presenting wayfinding messages through a definitive group of sign types. Through the process of establishing these sign types, a hierarchical and functional array will be developed to address:

- Vehicular applications for roadways, garages and curbside.
- Pedestrian applications for garage and curbside.
- Pedestrian applications throughout the terminal and concourses.

Each sign type should include definition as to purpose, function, form, typical location and frequency throughout the system, as well as details of standard dimensions, lighting, colors, typical layout and messages, materials, and relevant construction and attachment details.

System-Wide Integration

Establishing system-wide standards will also involve the process of establishing wayfinding schemes to be used throughout the airport, and will address the transitions of customers as they progress into and out of the airport and its many facilities as vehicular and pedestrian travelers. This integration should include:

- Interrelationships of various sign types and facilities.
- Identifying the organization and sequencing of messages throughout the system.
- Establishing the hierarchy of primary and subordinate information.
- Standards for the integration of international symbols.
- Standards for the incorporation of other languages.

- Definition of a core set of forms and styles to articulate Sea-Tac's individual character.
- Identify how and where a Northwest theme may be integrated.
- Solutions to how signage can work in harmony with the existing and future architecture.
- Identifying what amenities and features of the airport are to be signed.
- Transparent integration of ADA and FAA requirements.
- Identification of opportunities to establish and integrate an electronic information system for MFID's, variable message signs and other new technology applications.

4.4.3 Design Guidelines

It is important to recognize that the diversity of function and architecture between facilities dictates that system-wide signage will require an appropriate degree of flexibility that can be described through establishing a companion set of design guidelines. Successful guidelines should detail areas for allowable variations in form from the standard sign types. Variations should not include changes to graphic content standards, but rather provide an appropriate degree of flexibility to allow the signage to further integrate with its adjacent environment.

- Variations can include modulating subtle variations in accent colors, trim, lighting, or modifying attachment and installation details. It should not entail drastic variations from the standards, such as redefining a sign type.
- For example, wayfinding signage within the central terminal retail area may benefit from brighter accent colors, brighter lighting (such as neon), or the addition of artistic detailing to the supporting framework for it to better compete within that visually competitive environment.

4.4.4 Relationship to Overall Design Vision

The Design Guidelines articulate a vision for Sea-Tac that focuses on "creating a memorable sense of place," reflects the unique character and environment of the Northwest, and describes the Sea-Tac architectural design approach as progressive modernism. Signage can be used to reinforce this architectural approach and incorporate opportunities for Northwest character as appropriate. Additionally, signage can significantly contribute to a memorable sense of place by creating a unique graphic character for Sea-Tac. The signage should:

- Be visualized as an architectural highlight, interesting and pleasing in form and graphics.
- Portray a "worldly" style in its graphics, incorporating a graphic character that is interesting, timeless and unique.
- Incorporate dynamic uses of lighting, both direct and indirect.
- Eliminate visual clutter by focusing and organizing messages into concentrated and deliberate signage statements.
- Utilize limited, succinct and consistent nomenclature supported by international symbols.
- Incorporate a design details that enhance the progressive modern style, while avoiding treatments or overly thematic devices that mask the modern style.
- Be honest in expression of detailing with exposed supports and mountings, yet with concealed electrical, mechanical and inner workings.

- Utilize elegant, graceful, deliberate, controlled and geometric forms for sign faces.
- Allow opportunities for limited variations within varying architectural spaces.
- Incorporate a limited and controlled use of color, with an identified and reserved color palette exclusive for signage.
- Establish a distinct graphic identity for the airport.
- Incorporate an interesting font and set of international symbols exclusive to Sea-Tac to articulate a unique character, as well as through the use of an interesting graphic layout.
- Control the diversity of signage materials.
- Streamline ADA and FAA requirements efficiently and transparently.
- Utilize a discreet family of sign types, maximize their use and minimize use of non-standard sign types, with significant differences in size and format between types.
- Enhance ease of wayfinding system-wide.
- Work well within crowded public spaces.
- Include a comprehensive electronic information system to elevate Sea-Tac to a truly world-class and progressive level.

4.4.5 Specific Guidelines

Site Identification

- The arrival experience for vehicular customers should begin with large "spectacular" landmark signage at the current north entrance and at the future south entrance to truly identify that one has arrived, and to make an impressionable statement that Sea-Tac is a world leading airport.
- This statement should be a dynamic orchestration of signage, art, lighting and landscaping.
- It should be a visual statement of a gateway, reflecting the excitement of entering the first stage of a trip.
- It is beneficial to include time of day messages at these entrances.

Roadway Signs

- Overall, the roadway signs should be much more distinctive, and far less "highway" style.
- They are perhaps the most sensitive to the use of very clear and concise nomenclature.
- They require handsome, modernist layouts, structures and detailing to harmonize with and accentuate diversity of architectural character of various facilities.
- Very strict attention to hierarchy and logical, sequential dissemination of messages should be developed, including the future distinction between unit terminals.
- Strong use of illumination, potentially including non-graphic areas of sign, should be included.
- Dynamic signage elements for VMS applications should be architecturally integrated, rather than mechanical-looking designs.
- Traffic signs should be appropriately controlled to avoid visual clutter.

Garage Signs

- Incorporate a wayfinding theme within garage to facilitate identification of stall, area and nearest elevator core, utilizing a theme that works in harmony with modernist style.
- Increase the use of color, graphics and particularly lighting in signage.
- Include both vehicular and pedestrian wayfinding.
- Evaluate the effectiveness of organizing arriving traffic by airlines—garage capacity greatly reduces the ability of customer to park near their desired airline
- Facilitate pedestrian wayfinding at fourth floor plaza by signage and by improved architectural design.
- Clearly identify and describe the pay-on-foot system throughout the garage.
- Define and delineate between parking options.
- Provide clear definition and identification along plaza curbsides for purpose and amenities, including load/unload zones and airline locations.

Enplane and Deplane Drives

- Update the airline directory signs to further the identifiable Sea-Tac character.
- Employ dynamic signage that can be programmed to reflect daily operational changes along the curb, in concert with future ticketing operations.
- Separate the vehicular and pedestrian level signage.
- Provide curbside identification for dedicated zones for wheelchair, taxi, etc., for both vehicular and pedestrian traffic.
- Incorporate a literal or metaphoric means to identify and differentiate the existing terminal from the north terminal. Names for terminals must be logical and meaningful to the customer.
- Sign the third and fourth floors of the garage as amenities or extensions of Deplane and Enplane, rather than as specific destinations.
- Recognize audible messages as an integral component of a signage system.

Terminal Building—General

- Create major wayfinding nodes at the intersections of escalators, ticketing lobby and transition zones, with suspended signage "statements"—complementary in architectural form, with clear and consistent nomenclature, identified as primary wayfinding messages.
- Secondary signage should be within defined overhead linear zones on walls, perpendicular to pedestrian traffic.
- The linear terminal layout requires lateral wayfinding to identify the desired airline. Given the length of the terminal, it is most beneficial to enhance this wayfinding in the garage and at curbside, rather than within the ticketing area.
- Increased attention should be placed on the signage for the automated people mover (APM) system, as it will become more important as customers use it to reach the future remote facilities. It will need to describe the access and amenities of these facilities.
- Implement new technologies to transform detailed information sources into an enhanced and progressive *electronic information system* throughout all areas of the terminal and other facilities. Technology is a reflection of our region, and an opportunity to achieve Sea-Tac's world-class goal.

- Utilize appropriate designs for interactive (touch screen, closed circuit phones) versus read-only displays (MFIDs, motion video), and distinguish between hospitality displays, ground access displays, MFID displays, directories, etc., their functions and audiences.
- Integrate the displays into the terminal and locate them according to user need, and design them to be truly meaningful, accurate and as an integrated Sea-Tac airport information system rather than as independent vendor or airline displays.
- Address the appropriate locations and uses of foreign languages on signs, realizing the airport's goals and actual travel demographics.
- Sizes of signs and messages should be designed for specified viewing distances and legibility.

Ticketing Lobby

- Constrict airline identification to the linear horizontal band, and integrate dynamic electronic signage in this area. These electronic signs can replace "visiontrons," and can delineate various ticketing activities under the proposed flexible operation scenario.
- Create new design guidelines for back wall signage, addressing flexible operations. Consider new technologies such as projected images, video walls or electronic displays.

Esplanade

- Allow retail signage to be a visual highlight and to captivate attention at storefronts by encouraging shopping mall style signage with dramatic lighting, color and graphics.
- Constrain retail signage within prescribed zones via tenant signage guidelines, and don't allow it to penetrate the linear architectural band.
- Avoid redundant international symbols at retail storefronts—customers can see through the storefront windows, further elimination of visual clutter
- Control visual clutter of signage created by kiosks, advertising and vendor carts/booths by applying tenant signage guidelines in these areas as well.

Baggage Claim

- Keep signage at all carousels uniform.
- Hospitality displays should be integrated, consistent in design, easy to read and easy to access. Materials of exceptional durability should be used. Electronic interactive and read-only displays are encouraged.

Concourses

- Create major wayfinding nodes periodically in concourses, with suspended signage "statements"—complementary in architectural form, with clear and consistent nomenclature, identified as primary wayfinding messages.
- Secondary signage should be within defined overhead linear zones on walls, perpendicular to pedestrian traffic.
- Allow retail signage to be a visual highlight and to captivate attention at storefronts by encouraging shopping mall style signage with dramatic lighting, color and graphics.
- Constrain retail signage within prescribed zones via tenant signage guidelines, and don't allow it to penetrate architectural areas.
- Avoid redundant international symbols at retail storefronts—customers can see through the storefront windows, further elimination of visual clutter
- Control visual clutter of signage created by kiosks, advertising and vendor carts/booths by applying tenant signage guidelines in these areas as well.

Temporary/Construction Signage

- Temporary construction identification signage should be included in design standards and guidelines to describe improvements underway behind barricades.
- Additional construction phase "detour" or temporary closure signage should also be included.

END OF SECTION ON SIGNAGE

4.5 ARTWORK

4.5.1 Introduction

The Art Guidelines provide airport staff, design professionals and artists with aesthetic and procedural guidance for the creation and integration of art at Sea-Tac. They are intended to be both inspiring and practical to ensure that art commissioned, acquired or displayed at Sea-Tac reinforces the overall design vision for the airport. While they provide a general framework for aesthetic direction, the guidelines are not intended to be proscriptive in terms of artistic expression. The Art Guidelines, like the design guidelines themselves, recognize that it is essential that artists be encouraged to bring fresh creative energy to their work at Sea-Tac.

The Art Guidelines are intended to accomplish the following:

- Articulate a broadly defined aesthetic approach which supports the creation of a memorable sense of place.
- Provide artists insight into particular issues unique to working in the airport environment.
- Provide definitions of artwork types in the context of Sea-Tac
- Outline technical guidelines for artwork.
- Provide general direction with respect to the existing collection.
- Provide direction regarding the provision for temporary exhibitions.
- Outline the process for integrating art in the airport and artists in the design process.

4.5.2 Relationship To Overall Design Vision

The Design Guidelines articulate a Design Vision for Sea-Tac that is focused on "creating a memorable sense of place," which reflects the unique character and environment of the Northwest. The Art Guidelines support this design vision and identify these key aspects:

- Excellence in Contemporary Art: the work should be of the highest quality, created by recognized professional artists and reflect contemporary artistic concerns as appropriate within the context of a dynamic and often changing environment.
- The Northwest Natural and Cultural Environments: the content of the artwork should embrace or express qualities that are significant to the Northwest natural or cultural environments. Artists will have wide latitude for exploring the method and aesthetic approach to these ideas. Northwest natural and cultural aspects may be integrated abstractly or narratively, or through materials and methods that are relevant to the Northwest.

4.5.3 Conceptual Guidelines

The following conceptual guidelines apply to artwork at Sea-Tac:

- Northwest Natural Environment

  Artworks can help travelers understand the nature of the Northwest and to become more aware of the environment in which we live. Because the Northwest has such diverse geography and because the role and character of the land, water and light are so central to our experience, they provide a rich palette for inspiration. In addition to the romantic ideals associated with land, water and light, there are many contemporary issues relevant to the natural environment (water use, conservation, recycling, restoration of the indigenous landscape, and diversity of plant and animal species) that are all appropriate artistic concerns. The Northwest Natural Environment provides rich source materials from which artworks may be generated.

- Northwest Cultural Environment

  The Northwest Cultural Environment is meant to be interpreted broadly, to include not only artwork which represents diverse cultural expressions but also works which may explore or utilize certain aspects of our region's activities in technology, manufacturing, trade, or recreation. Artworks may also deal with the history of the region, the airport itself, or the role and history of aviation in the region.

- Enhancing The Quality Of Travelers' Experience

  Artwork can contribute significantly to enhancing the quality of the travelers' experience by providing engaging things to look at or interact with, and by enriching the overall design environment. At the same time, artists should be mindful of the fact that the airport is used by a wide range of people and that its primary purpose is to provide an safe and efficient transportation environment. It is imperative that artwork contribute to rather than compete with the function of the airport. While some locations may seem ideal artwork sites to artists, other uses or considerations may have a higher priority. There is also a need for the airport to have the flexibility to modify the use and design of spaces as needs change. This may limit the placement or integration of artwork in certain locations.

- Artistic Diversity

  Diverse artistic expressions are encouraged in works sited at Sea-Tac. No single artistic approach or particular artist's work should so dominate the airport that other artistic expressions are excluded or rendered ineffectual.

- Exterior Sites

  The exterior facilities and grounds represent significant areas for artwork inclusion and lend themselves well to the exploration of the Northwest Natural Environment.

4.5.4 Technical Guidelines

Artworks for permanent siting at Sea-Tac should address the following technical issues:

- Durability And Maintenance

  Materials should be durable in nature and should be able to withstand high pedestrian traffic volumes and the "wear and tear" that is to be expected in this environment. Outdoor works should be able to withstand normal Puget Sound weather conditions. Routine maintenance of artworks should be simple enough that the airport is able to provide it without extraordinary training or expense. Maintenance requirements should be determined, to the extent possible, prior to artwork installation. Artist should provide a written directive for routine maintenance for airport use upon artwork installation.

- Vandalism

  While no artwork can be guaranteed "vandal proof," artists and Sea-Tac should attempt to anticipate the types of problems that could arise and address these concerns in the design of the work. For example, attempts should be made to discourage graffiti or facilitate its removal.

- Safety

  Material selection and fabrication methods should consider the general safety of airport users. For example, dangerously sharp edges and toxic paint or other toxic finishes should be avoided.

- Accessibility

  Artists should be sensitive to issues of accessibility including the safety of people approaching or touching the artwork. Artworks must comply with Americans With Disabilities Act (ADA) legislation and other relevant accessibility standards. This includes but is not limited to floor surfaces, seating elements, water fountains, and some visual displays.

- Pedestrian And General Circulation

  Pedestrian access, vehicular circulation, and service access requirements need to be considered in the evaluation of potential artwork sites. In some cases, art may be effectively integrated so as to enhance these requirements. In others, depending upon the nature of the artwork proposed, it should not be included as it may compromise efficient use.

- Utility And Infrastructure Requirements

  Artworks which have significant utility or infrastructure requirements are not desirable unless they are included in the design of a major renovation or addition to the airport. In

these cases, it will be possible to "piggy back" artwork installations along with other infrastructure work, potentially resulting in an overall cost savings. Early and coordinated planning for artwork and capital project development can anticipate these needs and minimize duplicative expenses.

- Ecological Issues

  In undertaking exterior projects, it is important to be mindful of not creating works that attract wildlife which are undesirable in the airport environment. Exterior artworks should also reflect a sensitivity to conservation.

4.5.5 Types Of Projects

- Design Team Projects

  These are projects in which artist(s) serves as a member of the team to incorporate materials or features into a project which create a seamless whole. Artists working on these projects are involved at the outset of project to identify locations and methods for incorporating art within the project. Design Team Projects can also include "integrated art" and provide a venue for "commissioned works" (see definitions below) which may or may not be created by the Design Team Artist. The Metro Bus Tunnel is an example of a design team project.

- Integrated and Functional Works

  These works are defined as ones which are immovable and fully incorporated into a functional aspect of the architecture. They therefore are not intended to be relocated to make way for alteration of the space without destroying the work. For example, flooring which is specified to be terrazzo could be installed in a pattern or design created by an artist. A security fence or railing could be designed by an artist to create a more harmonious or attractive design rather than a more standard solution. Other examples of functional works of art are unique information kiosks, lighting elements, or built-in seating. These have the ability to shift the experience of place from "generic" to "specific".

  The terrazzo floor at Harborview Medical Center, the lobby railing in the King County Justice Center, and the Dick Weiss glass wall at the south end of the Sea-Tac main terminal are three examples of Integrated and Functional Works.

- Large Scale Commissioned Works

  Independent large scale works may be site specific in nature or works which are placed in a particular location but not specifically tied to the site. Site specific works are either designed in harmony with their surroundings, contributing to a sense of a seamless whole, or create a unique identifiable and contained experience in that location. Examples of large scale commissioned works are "Hammering Man" at the Seattle Art Museum and

the artworks at NOAA. An example of a large scale commissioned work which is not site specific is the Robert Mackie sculpture in Sea-Tac's main terminal.

- Portable Works

  These are small scale works which may be relocated with relative ease and are either exhibited on walls or in display cases. An example is the photography by Robert Lyons in the airport's collection.

- Temporary Works And Exhibitions

  Temporary works refer to works which are are not intended to have a continued presence in the airport. Typically, temporary works are made of more fragile or impermanent materials than permanent works. They may be created as part of a festival or special event, intended to last only as long as the event. For example, Sea-Tac might commission a temporary work to celebrate the grand opening of new terminal or concourse of for a major international event such as the Olympics, hosted by Seattle. Temporary artworks may also take the form of duratran photographic installations or other elements incorporated in an information kiosk which change seasonally, banners, or other temporary markers. There is great variation in the size and scale of potential temporary work.

  Temporary exhibitions are those which are organized by Sea-Tac or another entity for a limited time of display. To date, Sea-Tac's temporary exhibition program has been to fill the display cases in the main terminal with artworks relating either to northwest themes or sister city programs. Temporary exhibitions are particularly interesting to the repeat airport user who has the opportunity to enrich the airport experience by periodically seeing something new.

4.5.6 Artwork Types

Three key types of artwork are particularly important in enhancing the traveler’s experience. A balanced integration of these approaches will be central to achieving the design vision for Sea-Tac:

- Unifying Treatment

  Unifying treatments are defined as "continuous applications of decor or consistently designed elements intended to knit together the overall fabric of the place." These elements either through repetition or continuous application contribute to a coherent design character within individual spaces and the airport as a whole. Art may be effectively used to achieve a unifying treatment in a variety of ways. Using integrated and functional art to create a unifying treatment helps both enrich the airport environment and assist the traveling public in wayfinding.

- Gateways and Portals

  Gateways/portals are defined here as "sensory experiences using visual, aural or other elements to heighten the visitor's awareness of important transition points and entryway." Places where art might be used for gateways and portals include the treatment of the sky bridges between the garage and the central terminal or the subterranean lobbies of the STS system. Gateways and Portals often take the form of site specific works. The underground tunnel containing the moving sidewalk between United Airlines' Concourse B and C at Chicago's O'Hare Airport is an excellent example of a multimedia artwork, combining sound, light and sculptural forms to make a breath-taking transition statement. Lorna Jordan and Paul Sorey's art landscape at the King County Justice Center is an excellent example of art functioning as a gateway.

- Focal Points

  Focal points are defined as "unique features that create interior or exterior landmarks
  - to frame a view
  - to draw special attention to a particular location
  - to provide orientation and identifiable meeting places.

  Art may be used as focal points at informal meeting places, locations at the end of concourses or at particularly important sites (e.g. International arrival hall). These are often large scale independent work. Examples of art used in this way include the "The Spirit of Haida Gwaii" by Bill Reid at Vancouver' Airport's International Terminal, "Hammering Man" by Jonathan Borofsky at the entrance of Seattle Art Museum, the "Foliated Trellis" by Kent Bloomer at the new National Airport.

In some cases the same work of art might serve multiple purposes. For example, Buster Simpson and Sherry Wiggin's “Fence Line Artifact” at the Denver International Airport functions both as a gateway and a focal point since it is at the major transition point along the airport access road and an isolated work within the landscape.
An example of art functioning both as a unifying treatment and a focal point are the terrazzo floor medallions by such artists as Frank Stella and Joyce Scott at National Airport which fit seamlessly within the overall floor design.

4.5.7 Use Of Existing Collection

Sea-Tac's permanent collection includes works by international, national and regional artists and has been acquired since the early 1970s. There is no overarching theme to the collection nor was it amassed with a strong curatorial point of view. Nonetheless, it represents a considerable artistic and financial asset to the airport and it should be used to its best advantage as the airport is redeveloped and expanded.

The fact that the airport will now pursue a more cohesive approach to art collection and commissioning does not invalidate previous acquisitions. Analogous to this situation is when a museum decides to refine its curatorial direction. It does not routinely deaccession its previous holdings in favor of its new direction. Many of the existing works in the Sea-Tac

collection will fit comfortably within the overall design vision. Others should continue to be displayed in the airport because of their artistic or historical importance. As redevelopment goes forward, careful consideration should be given to their care and placement. Prudent evaluation of the collection should be undertaken to determine which works will require temporary relocation during construction or be permanently sited elsewhere within the airport property. Moving of fragile artworks requires experienced art handlers. The design of new sites to house works should consider factors such as proper display, lighting, and security.

There may be some works, due to their appreciated value, fragility or incompatibility with future airport designs, which will may no longer be suitable at the airport. ***(Note: evaluate whether the following portion should be edited or deleted from Guidelines).*** The Port of Seattle should consider creating an overall policy which facilitates the rotation of works from one Port property to another. This would accomplish several things: (1) provide more opportunities for effective placement of works; (2) create a dynamic exhibition-like quality to portable works; and (3) afford diverse audiences the opportunity to see works. This type of policy would demand a certain level of project management. But the advantages could be well worth this minor expenditure of funds.

There may be some works in the permanent collection which may be candidates for deaccessioning. Sea-Tac should adopt formal policies and procedures for deaccessioning artwork.

4.5.8 Temporary Artwork Exhibitions

Sea-Tac has a strong temporary exhibition program which showcases not only art of the region (e.g. Pilchuck Glass School exhibitions) but also cultural, historical and scientific contributions to the region (e.g. displays of artifacts from the Museum of Flight or the Burke Museum). These are consistent with the design vision for Sea-Tac as uniquely emblematic of the Northwest region. In addition, temporary displays of art or artifacts from Sister Cities showcase our region's relationship to the world. It enables the airport to create a dynamic environment, particularly for regular users of the facility. In addition, through partnerships with regionally significant institutions, the airport can play an important role in educating visitors about the region's resources.

To assure that temporary exhibitions are properly accommodated, every significant renovation or expansion of public space should endeavor to make provision for temporary artwork exhibitions. The design team should work with the Port's Art Program Manager to determine the extent of exhibition provision that may be appropriate. At a minimum, renovation projects should maintain the existing level of temporary exhibition capability within the affected area.

The following types of temporary exhibition provisions should be considered:

- Flexible Floor Space: within public areas for the temporary art installations (sculpture, multi-media, or temporary display cases). Appropriate lighting provisions should also be integrated.

- Flexible Wall Space: designated for changing exhibits of wall mounted two dimensional artwork. Appropriate lighting and suspension methods should be integrated.

- Flexible Ceiling Space: to allow for temporary suspension of artwork. Appropriate lighting and suspension methods should be integrated.

- Integral Display Cases: to accommodate rotating displays. The built-in display cases should integrate well with the surrounding design character, and should fully incorporate lighting and security provisions.

4.5.9 Artwork Integration

The Art Guidelines envision the integration of art into the architecture, landscape architecture, and wayfinding systems, as well as the placement of independent works of art in selected locations either within the terminals and concourses or on the grounds. They are intended to provide a general framework for decision making with respect to the selection and placement of art. Sea-Tac should exercise discretion and judgment in applying the Guidelines, recognizing that it is not possible to foresee all the various possibilities that may present themselves in the future. In evaluating proposals which digress from the guidelines, the articulated vision should be considered and special attention be given as to how such a proposal fits within the overall context of the airport.

The success of arts inclusion lies in the hands of the various Sea-Tac design teams and staff to ensure that art is included as an essential part of achieving the overall design vision for the facility. This will be accomplished through the inclusion of artists on design teams as well as the direct commissioning of independent works and integrated works and functional art. It will also include temporary works or exhibitions. As a rule, artworks should be located in publicly accessible places with high visibility and use. Specific locations for art will be determined in the context of the Project Definition Phase for individual projects

4.5.10 Project Definition

The Project Definition begins with the Capital Planning Process. When it is decided that the airport will undertake a capital project, it will make a determination as to whether art should be a part of it, how it will be included and determine a preliminary allocation of resources. In general, capital projects which are publicly accessible will include a budget allocation for artwork. The project team, working with the Port's art program manager, will evaluate the nature of the project and recommend how art should be included, i.e. whether an artist should be included in the capacity of a Design Team member, or whether a commission for an independent or functional artwork would be more appropriate.

(This needs some editing / clarification) When it is determined that the project should include an artist as a member of the design team, the potential scope and budget allocation will be determined by the project team working closely with the Art Program Manager. During the Project Definition Phase (3.7), the Art Program Manager should be involved in the Project Start-up Workshop. During the Schematic Design Phase (3.8), the artist will identify opportunities for art and a general conceptual approach to the project. At the approval of the

Schematic Design Phase, the priorities for the allocation of funds for art will be determined. When it is determined that an independent work should be commissioned, the priority location(s) will be identified and an artist selection process initiated.

4.5.11 Art Advisory Committee
(this section needs review / editing)

Sea-Tac currently has an Art Advisory Committee which facilitates coordination and management of the art program. It is composed of airport personnel from the various lines of business. The Committee could be expanded to include a practicing professional artist, curator or contemporary art historian, and a public art administrator who serve for rotating 2-year terms. It also may be desirable to include a member of the Design Review Committee to facilitate integration of artwork into the overall design process. This committee forms the policy making body for the program. In some cases, it will serve as the selection panel for artists projects, augmented by the project architect, except in the cases where RFPs are written to include artists as a member of pre-formed design teams (see Artist Selection Procedures).

The Art Advisory Committee will have the discretion to create Proposal Review Panels composed of arts professionals who will review applications and make recommendations to the Committee for approval. All Proposal Review Panels would include a member of the Art Advisory Committee as Chair. The Committee is charged with conducting periodic design reviews of projects after contract award in coordination with the Design Review Committee, consistent with Project Review Type outlined in 3.3. Finally, it is responsible for implementing de-accessioning and gift policies established by Sea-Tac. The members of the committee who are airport personnel shall deal with issues of coordination and management while the whole committee will provide a broad perspective for the implementation and refinement of policies.

4.5.12 Design Reviews

The Art Advisory Committee will constitute the review body for independent works of art and may be asked to designate a representative to serve on the Design Review Committee for projects involving artists on design teams or involved in creating functional works which are subject to Full Review Project and Expedited Review Project procedures. Artists will be expected to participate in the appropriate reviews of the project, including the Project Definition, Schematic Design, Design Development, Construction Document, and Project Completion. In projects managed by the Art Advisory Committee, a similar review process will be established with emphasis on Schematic (Conceptual) Design and Design Development phase reviews.

The Art Advisory Committee will provide comments to the artist and the design team at interim reviews. If the Committee feels that a project is not meeting the intent of the design vision of the airport, it will communicate this to the artist and design team in writing at the Schematic (Conceptual) Design phase and a determination will be made whether to go forward with the project. If substantial changes are made between Schematic (Conceptual) Design and Design Development, the Committee will consider this redesign subject to review and approval.

It is the Port's intent to support the vision of the artist and to provide for freedom of artistic expression. The goal of the review process is to facilitate the artist's work, to provide feedback on approach, to provide assistance in navigating the airport administrative process, and, in general, to insure the airport art program is of consistently high quality.

4.5.13 Artist Selection

(Note: this subsection probably not to be included in the Design Guidelines)

Artists will be selected through a wide variety of methods. In general, artist selection will be an open competitive process, ensuring ample opportunity for the airport to choose from a wide variety of artists. However, there will be times when a limited solicitation process will be the appropriate approach. The selection process for each project will be determined during the Project Definition Phase. There will also be projects in which the airport will specify in its Design Team RFPs that an artist should be included on proposing teams. In the first two cases, the Art Advisory Committee (or a designated Proposal Review Panel), augmented by the project architect in a nonvoting capacity, will act as the selection panel. In the last case, an arts professional member from the Committee will participate in the interview panel constituted for that particular project.

The Port's priorities in artist selection shall be:

- the quality of the artist's work
- the artist's ability to complete the scope of work outlined for a particular project
- the artist’s sensitivity to and understanding of the overall design vision of the airport.
- In certain cases, where considerable local contact is necessary for regular interface with a design team or airport personnel, it may be desirable to limit artist selection to those from the region.

All works of art acquired by the Port, either as gifts or as a commissioned or site- integrated work, will be subject to a formal review process.

<u>"Open Call"</u>

When it is determined that a project should utilize and "Open Call" to select an artist(s), the following procedure is used:

A prospectus including the following information is published:
1. Description of the project (may include such things as background, history, current status, goals, etc.)
2. Visual and written description of the site(s), its limitations and opportunities
3. Application guidelines specifying materials to be submitted, including such things as cover letter, 10-15 slides, annotated slide sheet, resume and self addressed stamped envelope for the return of the application materials
4. Selection process (Sometimes the names of jurors are included here. It will also include whether finalists will be selected for interviews and whether concept proposals will be required.) Indication whether the Port of Seattle will pay expenses for artist interviews or finalist proposals.

5. Proposed project timetable from application deadline date through construction.
6. Total funds available and whether additional funds might become available through the construction budget for the overall project. Indication of whether this is a phased project.
7. Who to contact for additional information.
8. Application deadline and whether it is a postmark or receipt deadline.
The availability of the open call may be published in art publications such as Sculpture Magazine, Public Art Review, Artist Trust's Possibilities, etc.
Artists selected through the "Open Call" process may (1) be added as a member to a pre-existing design team and be expected to work collaboratively on the project, or (2) be invited to create a large scale independent work or artwork environment.

Direct Selection and Limited Solicitations

There will be situations when the Port may wish to make a direct selection or utilize a limited solicitation process for identifying an artist. In either case, the Port would dispense with the Open Call process and either identify a particular artist or short list of artists which it is interested in considering for commissioning for a particular work. Direct Selection and Limited Solicitations most frequently occur when there is either (a) a short time frame for the project that would prohibit an Open Call process; (b) Sea-Tac is seeking artists to create functional works such as artist design railings, light fixtures, seating elements, etc. ; or (c) when the project budget is of such a small level that it would not justify an Open Call. In utilizing this format of artist selection, Sea-Tac should take advantage of rosters of artists maintained by such agencies as the King County Public Arts Commission, Sound Transit, and the Seattle Arts Commission. These rosters include pre-qualified artists selected through an open competitive review and are available as a regional resource.

Design Team Roster

To facilitate the inclusion of artists on design teams, the Port should consider establishing an artist design team roster through a pre-qualifying selection process. This roster would serve as a resource to design teams formed in response to RFPs which require the inclusion of an artist(s). Those using the roster would not be required to submit additional information on the artists' qualifications but would include a letter from the artist indicating his/her interest in serving on this team. Those teams choosing to go outside the roster would be required to submit artist qualification materials including samples of past work and the artist's resume with their proposals. All competing teams would be expected to include a description of the artist's role on the project.

Artists included on the roster would be required to resubmit qualification materials periodically (every two to three years) and the roster would be updated periodically through an open call for qualifications. Artists would be expected to have design team experience or be able to demonstrate their ability and interest in working in a collaborative situation.

Interview Procedures

In cases where an artist is part of an overall design team proposing on a particular project, the interview committee should be enhanced by an arts professional member of the Arts Advisory

Committee. In selecting artists through open calls, direct selection or limited solicitations, the Art Advisory Committee (or a subcommittee of the Art Advisory Committee or its designated Proposal Review Panel) would serve as the interview panel. The committee should also include a representative from the respective line of business, the project manager, the project architect or landscape architect. Sea-Tac should expect to compensate artists for any unusual costs associated with the interview such as travel or finalist fees for concept designs.

4.5.14 Artists On Design Teams

Determining exactly how art should be incorporated in a particular project is often developed through the design process itself. Artists serving as members of design teams are included in the design process beginning with the Project Definition Phase and continues through Construction Supervision.

Artists will often collaborate with the other design professionals on a wide range of project elements or may identify priority area(s) for artistic intervention and focus his/her efforts in this location(s). In either case, coordination with other design professionals will be necessary throughout the process. The structural engineer may be called upon to assist the artist with engineering drawings, if they are to be part of a general bid package. In other cases, the artist will coordinate with the architect on specifying artwork locations, footings or other features to be included in the construction documents. In these cases, the artwork is often fabricated through a separate process either by the artist him/herself or by a professional art fabricator under the artist's direction.

As a standard practice, the airport should include financing for artist design services in the professional fees budget for the project. The Port should expect to pay artists at a comparable rate as architects or landscape architects for design services.

The allocation for the construction and installation of art will be made separately as part of the overall construction budget.

4.6 ACCESSIBILITY

4.6.1 Introduction

Seattle-Tacoma International Airport is committed to providing appropriate facilities and services for all travelers, including those with disabilities. This section summarizes the relevant codes and resources to be used by design teams for projects at Sea-Tac.

All projects at Sea-Tac Airport should be concerned with providing accessibility for travelers and staff. Accessibility design is most successful when well considered early in the design process. Considering accessible routes will affect siting decisions and circulation design. Considering accessible spaces and fixtures will affect the area allotted to restrooms and other specific use spaces. Waiting to add accessible features to a completed design increases cost, complexity and creates less accessible facilities.

For projects with significant accessibility issues, it is suggested that designers seek the guidance of reputable groups that represent people with disabilities and understand their environmental needs. Local groups, such as the Washington Governor's Committee on Disability and Employment, Easter Seal Society of Washington, and the Washington Coalition for Citizens with Disabilities have all participated in past reviews of facility accessibility for The Port of Seattle. These and many others may act as resources to assist in understanding accessibility issues.

4.6.2 What is an Accessible Facility?

In theory, an accessible facility is a built environment that has no barriers to people with disabilities. In practice, it is one that has been designed to comply with specific laws or codes. The Port of Seattle's design goals for Seattle Tacoma International Airport go beyond accessibility as defined in the laws and codes to the overarching principal of Universal Design.

Universal Design is the idea of designing for the widest range of ability with as few barriers as possible. It encourages designers to realize that guidelines and codes are minimum dimensions that allow only a narrow range of users to experience ease of use. By considering a wider range of users, even those with temporary physical limitations will be accommodated.

4.6.3 Accessibility Regulations in Washington State

Washington State has been a leader in the area of accessibility design regulations. As of March 29, 1995, Washington was the first state to have its current regulations certified by the U.S. Department of Justice as equivalent to the Americans with Disabilities Act Accessibility Guidelines (ADAAG). Provisions for accessibility design have been a part of the State Building Code for publicly and privately funded buildings of "public accommodation" since 1971. The state Barrier-Free Regulations reside under WAC 51-40, Washington State Amendments to the Uniform Building Code, Chapter 11. Enforcement for accessibility issues

within the state is the responsibility of the local building official. If followed to the letter of the code, this now signifies a good faith effort of the designer to comply with the ADAAG.

The Port of Seattle requires that current versions of all codes and laws be followed during the design and construction process. Copies of the laws and codes for accessibility design in Washington State include:

- Chapter 51-40 WAC: Uniform Building Code and Uniform Building Code Standards (contains Chapter 11 ACCESSIBILITY amendments) is available through:
  Community Trade and Economic Development
  Washington State Building Code Council
  Post Office Box 48300
  Olympia, Washington 98504-8300
  (360) 753-1184

- Americans with Disabilities Act Accessibility Guidelines is available through:
  Calling the ADA information Line of the U.S. Department of Justice at (800) 514-0301 (voice) or (800) 514-0383 (TDD).

A recognized resource for the background on accessibility design in Washington State with illustrations of design suggestions is:

- Accessibility design for all: an illustrated handbook is available through:
  Easter Seal Society of Washington
  521 2nd Avenue, West
  Seattle, Washington 98119
  (206)281-5700
  (800)678-5708

4.6.4 Design Considerations: What to consider when designing for accessibility:

- Consider access when dropping off, parking or picking up travelers and staff at the airport. People with disabilities may be drivers or passengers. They may need to drop off a bag and then park a car. The driver may need to drop off a person with limited mobility and then park a car. Where can people wait safely and conveniently?

- Consider accessible routes within the airport. Is there an accessible path from the curb to the plane, with accessible features along the way, such as ticket counters, waiting areas, security check points. Consider the route all the way to the jetway.

- Consider exiting for people with disabilities in case of emergency. Consider areas of evacuation assistance and two-way communication with both visible and audible signals. Do all alarms systems have both visual and audible components?

- Consider access to restrooms, drinking fountains, telephones, and signage. People with disabilities may be traveling alone, with a companion, or with family. People with

disabilities may be parents with small children or parents may have a child with a disability.

- Consider the disabled business traveler. Are business traveler services available equally to persons with disabilities?

- Consider the entertainment, dining and shopping desires of people with disabilities.

- Consider equally the needs of all disabled people including mobility impairments, sight, hearing, and cognitive impairments.

To help understand the needs of people with disabilities, the President's Committee on Employment of Persons with Disabilities has fact sheets available on their website for review or to order at www.pcepd.gov.

4.7 LIGHTING

4.7.1 Introduction

The lighting design guidelines establish guiding principles and criteria that will enable lighting designers to help achieve the design vision for Sea-Tac International Airport. While this section provides general direction as well as specific criteria, these guidelines are not intended to provide specific lighting solutions. Rather, the guidelines provide a framework within which lighting designers can work creatively to achieve successful lighting at Sea-Tac. The intent is to establish continuity and consistency where appropriate, while enabling design teams to bring fresh creativity and insight to each project.

In a well lighted place, people are the highest priority. Good lighting is not simply an application of abstract principles. Good lighting practice holds visual comfort, visual delight and energy efficiency as the three primary encompassing design objectives. Successful lighting systems will achieve these goals through the rigorous consideration of the building's formal architecture hierarchy of space and form and through close collaboration with airport and user constituencies.

These guidelines do not replace the need for interpretation and response to each project's unique conditions. Any project with unique or significant lighting issues should include the design input of a qualified lighting designer.

The guidelines address both the broad lighting design principles as well as the specific measurable design criteria applicable to projects at Sea-Tac:

- Guiding Principles outline the strategies for integrating the lighting design successfully with the design vision for Sea-Tac.

- Measurable Light Level Goals (Illuminance) define specific criteria such as light levels, energy usage, and lamp life.

Both the general principles and the measurable lighting goals are essential to achieving a successful lighting environment.

4.7.2 Guiding Principles

The design vision at Sea-Tac is to achieve an inspiring and comfortable traveler experience, through creation of a memorable sense of place, clear wayfinding, and high quality service. The lighting design at Sea-Tac should consistently support these goals.

The key guiding principles for lighting are:

- Create appropriate luminous relationships that support and compliment the architectural character and functional activities of the airport, promoting perception of place, visual clarity, and visual reassurance to travelers.

- Enhance wayfinding through lighting strategies that clarify traveler orientation and circulation.

- Enhance the connection to the natural environment through daylighting and views, as well as appropriate exterior lighting of landscape areas.

- Reduce glare through use of demonstrable glare reduction strategies, and through use of low glare fixtures.

- Achieve energy and maintenance efficiency by utilizing high quality fixtures and high efficiency long-life lamps and components.

- Utilize high color rendering lamps for visual comfort and enhanced visual acuity.

- Incorporate light level prescription guidelines based on those described in IESNA RP-29-95 (Recommended Practice) Illuminance Categories & Recommended Illumination Levels.

The following subsections expand on these guiding principles and provide more detailed design criteria.

4.7.3 Creating Appropriate Luminous Relationships

Guiding Principle: create appropriate luminous relationships that support and compliment the architectural character and functional activities of the airport, promoting perception of place, visual clarity, and visual reassurance to travelers.

Perception of Place: In a prominent public facility such as Sea-Tac International Airport, lighting that promotes perception of place, both from within and from without, holds highest priority for the designer. This perception of place is fundamental to the user's orientation and navigation. A good lighting system reveals the important architectural and informational cues by applying a variety of lighting techniques and standards. Highlighting calls the viewer's attention to important visual cues, such as signage, crossing traffic pathways, decision points, changes of function and important service and retail areas.

Visual Clarity: Sea-Tac is a complex public facility, with varied and complex tasks and functions. As in any significant public space, the lighting scheme ought to work in such a fashion that the things that people want or need to see are emphasized and clearly visible, while those things which are distracting or unpleasant are de-emphasized or hidden. While this ideal is sought in all buildings, it is most critical in public spaces where we are more subject to chance encounters with the unfamiliar.

Travelers depend on clear visual organization for orientation and navigation. The lighting design approach should consistently achieve visual clarity through enhancing the ability to distinguish important details and to detect brightness differences.

Lighting for architectural spaces can be thought of in two components: Ambient lighting and Task lighting, distinguishing background "field" and foreground "figure". Balancing these two elements helps to guide us through complex public spaces, which assists us with the necessary tasks of travelling and enhances our experience while doing so.

Visual Reassurance: This facility serves a transient and vulnerable population. Whether their concerns are about personal safety and security, the exigencies of business and schedule, or separation from familiar surroundings, travelers have a heightened need for confirmation of spatial and directional information. Airline surveys continually indicate that travelers need visual assistance and refreshment when they are in transit. Thoughtful lighting can provide this visual reassurance and can help Sea-Tac become an enjoyable and comfortable experience for travelers.

4.7.4 Wayfinding

Guiding Principle: Enhance wayfinding through lighting strategies that clarify traveler orientation and circulation.

Clear, easily perceptible visual cues are critical to our ability to orient and to find our way. Sea-Tac International Airport is a complex place with a complex program, a layered urban-like environment captured under one roof. Enhanced way-finding cues are vital to the efficient functioning of the facility. Way-finding is supported by lighting that reveals a simple, clear and uncluttered building form. Clear building form provides obvious, unencumbered pathways, informs intuitively with changes of materials and volumes, and provides a proper setting for its activities. Good way-finding lighting marks the path, reveals signage, highlights a destination and promotes efficient and personable transactions.

Essential elements of wayfinding include building form, light and view. When these elements come together as mutually reinforcing architectural elements they create a spatial organization that informs the user. Building form and light become important informational visual cues that not only reinforce the basic plan organization, but also establish a memorable identity for a particular place and direct us to specific locations within that place.

The foundation to understanding an interior space is shaped by the geometry of the building as revealed in light, allowing the built relationships to be emphasized and easily understood. Light, electric or natural, thoughtfully placed, articulates building form, highlights surface materials and brings order to the environment.

Where interior circulation paths transition, the visual cues can help slow traffic flows, to increase decision time. Brighter light levels heighten attention and reinforce decision making. Surface materials that are thoughtfully designed and lighted reduce distracting visual clutter. Design of suitable lighting systems will take all these factors into consideration.

4.7.5 Enhancing the Connection to the Natural Environment

Guiding Principle: enhance the connection to the natural environment through daylighting and views, as well as appropriate exterior lighting of landscape areas.

An essential aspect of the design vision for Sea-Tac is the creation of a strong connection to the natural environment. Appropriate lighting design is an essential component in achieving this connection.

Wherever possible, the approach to lighting design within the interior spaces should emphasize natural daylighting and orientation to exterior views. Important connection and orientation to the exterior world can be gained through views to the sky and the surrounding natural environment. Natural light is associated with the thermal characteristics of a space. People expect their surroundings to be warmed and cooled with the changing rhythms of the sun and sky. For many, their emotional well being is linking closely to sunlight. Our natural light and "sky show" is a Northwest asset which can be a memorable aspect of the traveler's experience.

In the exterior areas of the airport, lighting design should enhance the appreciation of the natural landscape while not compromising functional requirements, including aviation and vehicular wayfinding needs.

4.7.6 Controlling Glare

Guiding Principle: Demonstrable glare reduction strategies and inherently low glare fixturing should be utilized for all lighting systems at Sea-Tac to enhance visual comfort and acuity.

The lighting design challenge is to effectively direct light to where it is needed without visual noise. Glare from unshielded source brightness can cause discomfort, actually impair good vision and can inhibit people from gathering important information. The control of this glare is critical to attaining high visibility without sacrificing visual comfort. Distinction should be made here between glare and sparkle.

There are four types of glare which reduce lighting quality and should be avoided:

1. Direct Glare is caused by bright light sources in the field of view, a bright sun lit window, a glarey plastic lens or direct light from an unshielded lamp.

2. Veiling Glare is the reflected image of a lighted object that "veils" or obscures the view, typically in a VDT screen.
3. Disability Glare reduces visual performance and visibility by placing overly bright objects within the task field of view.

4. Discomfort Glare is an annoying and uncomfortable light source directly in the field of view.

Each of these types of glare should be consciously addressed and controlled through appropriate lighting design.

4.7.7 Lighting Technology

Guiding Principles: two key principles apply to lighting technology:

- Achieve energy and maintenance efficiency by utilizing high quality fixtures and high efficiency long-life lamps and components.

- Utilize high color rendering lamps for visual comfort and enhanced visual acuity.

The efficiency of the lighting system is the result of the thoughtful use of lighting design techniques coupled with the careful application of recent advances in lighting technology. Energy efficacy is concerned with the cost of energy, and the careful application of efficient lighting technology to meet the desired visual program. We are specifically concerned here with lamps, ballasts, total light fitting efficiency, controls and maintenance programs.

High efficiency lamps

Light sources for interior spaces and exterior pedestrian areas should consider a minimum efficiency of 70 lumens per watt (LPW), except as noted below, and a color rendering index (CRI) of not less than 80. Color Rendering Index (CRI) is a scale from 0-100 that describes the color rendering characteristics of a light source. The higher the number, the more true the color rendering. Exterior areas would have the same efficiency criteria with a minimum CRI of 60 in vehicular areas only. These criteria would include the use of fluorescent, metal halide, and QL sources and exclude high pressure sodium, mercury vapor, and incandescent sources. Tungsten halogen (a form of incandescent) should be used only for special cases such as artwork lighting.

Standardize components used in the lighting system.

This simple, seemingly obvious tactic will lower initial costs and subsequent replacement costs for lamps, ballasts, dimmers and other associated equipment by permitting stocking of fewer types of replacement components.

Sea-Tac Airport has embarked on a lamp standardization program to minimize the number of discrete types which must be stocked and handled. In addition to helping to reduce costs associated with maintaining the lighting systems, it also adds visual consistency and control over energy use. Designers should consult with Sea-Tac Operations for a list of active lamp types.

On a specific project, all lamps of one type should be from a single manufacturer. It is the responsibility of the design team to ensure that specific lamps selected meet the general criteria below.

Lamp types

Summary of light source characteristics:

- Fluorescent (Linear and Compact)
  3000K, 80+ CRI lamps should be used for all applications. A variety of shapes, from single-ended compact lamps to double-ended T8 lamps are available. Fluorescent lamps are temperature-sensitive. Their output is reduced if the lamp is operating in an environment that is too hot or too cold. The degree of reduction varies with the lamp, and each lamp must be evaluated in its proposed use condition. Lumens per watt should be a minimum of 65 for compact lamps and 85 for full size (T8) lamps. No T12 lamps should be used.

- Metal halide
  Both single- and double-ended lamps are available; however, single-ended screw base lamps are most common. Ceramic metal halide lamps have a more stable color, longer life and higher CRI than quartz arc tube lamps and should be used in the sizes and wattage for which they are available (typically 35-150 watts). Lumens per Watt, (LPW) rating for this lamp is above 95.

  Ceramic metal halide lamps should be used for interior and exterior applications at 150 watts and lower. Should these lamps become available in wattage greater than 150, their use should supersede the recommendations that follow. For roadway lighting greater than 150 watts, use clear lamps. For interior applications greater than 150 watts, use phosphor coated 3000K lamps.

- QL Lamps
  QL is an induction source available in 65 and 85 watt sizes. The CRI is 85 and color temperature is 3000K with a LPW rating of 65. Advantages include an extremely long life (100,000+ hours), instant "on" characteristic, and high color rendering ability. It is ideally suited for situations where diffuse, high color quality light is desirable, and access for relamping is difficult. Fixture availability is limited at the time of this writing but is expected to increase in the upcoming years.

- High Pressure Sodium
  These lamps have a long life and low CRI (21), and are available in wattage from 35-1000 watts, with LPW rating of 105. This source has extremely poor color quality, and is not recommended.

- Mercury Vapor
  This source has been almost entirely replaced by metal halide and should not be used.

- Incandescent (Tungsten Halogen)
  Tungsten halogen is the most efficient version of incandescent. These lamps have shorter life and lower efficiency than any of the other sources listed above, but have the highest CRI. Their use should be restricted to special applications only. When used, voltage to all incandescent fixture runs should be reduced, by means of dimmers, to extend lamp life, lengthening replacement schedules. Dimming to 80% of full output extends lamp life by four times. Dimmers or transformers are the most common methods for voltage control.

- Other light sources

Light sources continue to evolve. New sources that develop subsequent to this document should be considered if they fit into the goals of the lighting system for color quality, life, and efficiency.

Lighting Fixtures

As is true in most public places, light fixtures are subject to normal wear, some abuse, and general deterioration over time and should be selected from high quality manufacturers who produce products expected to last 20 years or more. Exterior fixtures should be cast aluminum or heavy gauge steel with factory-finished painted surfaces. All lenses should be fully gasketed. Parts that are likely to need replacement over the life of the installation, (most commonly ballasts and lamps) should be accessible without tools, unless they are located within public reach or where vandalism is a concern. These fixtures should have closure devices of a tamper-proof nature. Ballasts should have plug-in connections. Fixture samples should be reviewed to verify quality of construction.

Ballasts

As part of the entire "Lumen Package", ballasts are critical to a successful lighting system. These electronic devices provide proper starting voltages and regulation of the lamp. This includes maintenance of the appropriate operating voltage, thermal environment, sound rating and inhibition of EMI. All fluorescent lamps at Sea-Tac should utilize rapid start, electronic ballasts with Class A sound rating, as determined by the Certified Ballast Manufacturers (CBM).

Lighting Controls

Designing the most efficient lighting system will not result in lower energy use if the system is allowed to operate longer hours than is necessary. Centralized automatic controls are recommended, including occupancy sensors to shut off unneeded light fixtures, schedulers to adjust for time of day in unused areas. These controls reduce superfluous electric light contribution during daylight hours, and include photo sensors which monitor and compensate for incoming daylight and adjust the electric lighting accordingly. Some systems offer "talk back" features which enable a PC to monitor and control the operation of lighting equipment throughout the facility from a single central location. A comprehensive lighting control system is essential to the most energy efficient and cost effective functioning of the electric lighting system. Further, the lighting control system allows the designers the opportunity to fine tune the look and visual feel of the completed project. Effective controls can have a dramatic impact on the perception of the finished space and on reducing the actual dollars spent on the electric lighting system operation.

4.7.8 Energy Efficiency and System Maintenance

All lighting systems degrade as they age, and overall light level outputs can drop by fifty percent in a relatively short time. With a comprehensive strategy and planned maintenance schedule, some of the contributing factors can be reduced or eliminated. Principle considerations for long term system maintenance are:

- The selection of quality system components,
- Group re-lamping,
- Regularly scheduled cleaning of the light fixtures and components.

Lamps and ballasts work most efficiently when installed in light fittings that maintain the appropriate electrical and thermal operating environment. Installation of luminaires that have been engineered for specific lamp/ballast combinations will add considerably to the long term maintainability of the light system and lighted environment.

The most common method of changing lamps is called spot relamping...waiting for lamps to burn out completely and replacing them individually as they fail. By contrast, group relamping is a regularly scheduled 18-24 month cycle, based on the anticipated life of the selected lamp source, which replaces all lamps in a group at the same time, at the end of useful life but before actual failure. In addition to being much more cost effective from a staging and labor point of view, this practice also allows for the regular cleaning and maintenance of all luminaires in a particular operating area, regardless of their apparent brightness. As a further point, lamps continue to consume electricity as if they were new, even as their light output depreciates over time. The result is lowered efficiency, as less light is generated at a fixed cost. Scheduled group relamping protects the designed look of the facility, maintains designed light levels, is cost effective, and supports energy efficient operation of the designed lighting system.

4.7.9 Light Level Criteria

An essential step in improving continuity and coherence within the airport is to establish consistently appropriate light level guidelines for each activity at Sea-Tac. Following these guidelines is critical to supporting the functional activities at Sea-Tac.

Guiding Principle: Incorporate light level prescription guidelines based on those described in IESNA RP-29-95 (Recommended Practice) Illuminance Categories & Recommended Illumination Levels.

The following table summarizes the prescription guidelines compared to actual levels as measured in in January 1997.

Recommended and Existing Light Levels

Lighting was measured on Thursday 23 January 1997, during the night hours, between 6:00 PM and 8:30 PM.

Area	Height	*(existing)* Horizontal	*(existing)* Vertical	Recommended
Bridge from Parking				
Under Fixture	0'-0"	26.0	–	15-20
Between Fixtures	0'-0"	12.0	–	15
Vertical Circulation	3'-0"	6.9	1.4	20
Elevator Lobby				
Under Fixtures	3'-0"	44.0	–	15-20
Between Fixtures	3'-0"	30.0	–	15
Between Fixtures	5'-6"	–	4.5	15
Escalator Lobby @ Table Top	3'-0"	10.0	–	15-20
Escalator Lobby @ Eye Level	5'-6"	–	1.1	15-20
Bottom of Up Escalator	0'-0"	13.0	–	15-20
Top of Down Escalator	0'-0"	7.5	–	15-20
Ticket Lobby				
Under Fixtures	3'-0"	11.0	–	15
Between Fixtures	3'-0"	12.0	6.0	15
At Ticket Counter	–	39.0	–	50
On Baggage Belt	–	34.5	–	20
Transition to Esplanade				
Center	0'-0"	6.8	2.2	15-20
at Wall	5'-0"	–	3.2	15-20
at Top of Stair	0'-0"	5.7	–	15-20
Esplanade				
Art Lighting	5'-0"	–	27.0	20
Children Play Area	2'-0"	4.0	–	20
Seating between A & B	–	12.0	–	15
Esplanade Circulation @ A	3'-0"	12.0	2.4	15-20
Security Checkpoint @ A	3'-0"	8.3	5.2	50
Sculpture Plaza	5'-0"	14.5	7.0	20
Plaza, on Table	–	11.5	4.7	20
Retail Corridor				
Between Fixtures	3'-0"	6.3	2.8	15-20
Under Fixtures	3'-0"	9.3	2.5	15
Esplanade Circulation @ B	3'-0"	13.7	–	15-20
Security Checkpoint @ B	3'-0"	4.8	.9	50

Area	Height	*(existing)* Horizontal	*(existing)* Vertical	Recommended
Concourse B Circulation				
Under Fixtures	3'-0"	13.1	4.1	15-20
Between Fixtures	3'-0"	10.9	2.2	15
Seating Low Ceiling	–	27.0	9.0	15
Seating at Window	–	18.0	3.5	15
Knuckle	3'-0"	12.0	3.9	15
Gate Lounge	5'-0"	13.5	24.8	15
Terminus	5'-0"	10.6	9.5	15
Ticket Counter @ B				
Low Ceiling, Under D/L	–	28.0	11.0	50
High Ceiling, No D/L	–	9.5	6.6	50
At Keyboard, No D/L	–	6.5	6.0	50
Security Checkpoint @ C	3'-0"	5.1	1.1	50
Concourse C Circulation				
Under Fixtures	3'-0"	14.3	4.3	15-20
Between Fixtures	3'-0"	11.1	2.3	15
Seating Low Ceiling	–	26.2	8.8	15
Seating at Window	–	18.2	3.6	15
Knuckle	3'-0"	12.3	4.0	15
Gate Lounge	5'-0"	13.2	24.7	15
Terminus	5'-0"	13.5	10.8	15
Security Checkpoint @ D	3'-0"	5.1	1.1	50
Concourse D Circulation				
Under Fixtures	3'-0"	15.7	4.8	15-20
Between Fixtures	3'-0"	11.9	3.1	15
Seating Low Ceiling	–	23.6	8.1	15
Gate Lounge	5'-0"	14.3	18.8	15
Terminus	5'-0"	12.8	9.7	15
Main Terminal Shuttle Station				
At Train Door	0'-0"	12.2	–	15-20
Between Doors	0'-0"	7.4	–	15
On Car	2'-6"	40.0	–	15
North Satellite Shuttle Station				
At Train Door	0'-0"	14.0	–	15-20
Between Doors	0'-0"	8.5	–	15
Under Fixtures	3'-0"	21.0	–	20
Escalator to North Satellite				
At Bottom	0'-0"	1.3	.6	15-20

Area	Height	*(existing)* Horizontal	*(existing)* Vertical	Recommended
North Satellite				
At Bottom of Escalator	0'-0"	12.3	–	15-20
On Escalator, Low Clg	3'-0"	28.0	–	15-20
On Escalator, High Clg	3'-0"	4.1	–	15-20
At Top of Escalator	0'-0"	7.7	–	15-20
North Satellite Concourse				
Between Fixtures	3'-0"	5.8	1.8	15
Under Fixtures	3'-0"	11.1	5.0	20
At Ticket Counter	4'-0"	49.0	14.3	50
North Security Plaza	3'-0"	13.1	5.5	15-20
Baggage Claim				
At Circulation, Between	3'-0"	9.0	2.9	15-20
Low Ceiling @ Belt #14	3'-0"	3.0	1.7	20-50
On Belt at Low Ceiling	1'-6"	5.1	2.1	50
On Belt at High Ceiling	1'-6"	11.5	4.9	50
Info Kiosk Phone Pad	3'-0"	2.0	–	50
Pay Phone Keypad	4'-0"	0.5	–	50
Pay Phone Desk	4'-0"	0.2	–	50
Ramp to Deplane Drive	0'-0"	2.3	–	20
Deplane Drive				
General	0'-0"	5.7	2.3	20
At Curb	0'-0"	4.0	1.7	20

END OF LIGHTING DESIGN GUIDELINES

Potential Reference Document: "Lighting Improvements Project", completed February 1997.

The lighting design guidelines were developed from the "Lighting Improvements Project", an intensive lighting survey and study completed in February 1997. This document is extensively illustrated and includes specific recommendations and proposed application of lighting strategies that are outside the scope of this guideline. Some of the recommendations have been implemented; others were not adopted and may not be applicable.

However, it is recommended that lighting designers for significant public projects refer to this document to be aware of previous lighting proposals, and to see specific examples of concerns with existing conditions. The "Lighting Improvements Project" document is noted here only as a potential reference document and is not intended to be seen as an integral part of the Design Guidelines.

4.8 ACOUSTICAL

4.8.1 Introduction

The intent of this section is to provide acoustical guidelines for the design of all projects at the Airport. It is not intended that this guide provide solutions regarding sound and vibration, but rather to identify issues requiring consideration and to define acoustical criteria for architectural components, mechanical systems, and audio/video systems.

These guidelines do not replace the need for interpretation and response to each project's unique conditions by a qualified acoustical consultant. Any project with significant acoustical issues should include the design input of a qualified acoustician.

4.8.2 Regulatory Criteria

The City of SeaTac Plans Examiner has determined that "any new construction at the Airport itself would be required to meet criteria outlined" in the City of SeaTac Sound Transmission Control Code, Sections 3551-3559 to achieve a minimum Noise Level Reduction (NLR) of 35 decibels.

The Mechanical Standards and Regulations for Airport Construction also include information regarding acoustical requirements for projects at Sea-Tac Airport. Design teams should review these documents and coordinate with their POS project manager if there are issues requiring clarification or interpretation.

4.8.3 Nomenclature

Noise levels are characterized by the magnitude of pressure fluctuations. Decibel, dB, levels are a form of shorthand that characterize the auditory response to the broad range of intensities that are perceptible with a convenient numerical scale. The decibel scale is logarithmic. A doubling or halving of energy causes the sound level to change by 3dB; it does not double or halve the original level.

The human ear has a unique response to sound pressure fluctuations. It is less sensitive to those sounds falling outside the speech frequency range; the higher and lower frequencies. Sound levels meters and monitors utilize a weighting system to approximate human perception of sound. Measurements made utilizing this weighting system are referred to as "A weighted" and are called "dBA".

Several mathematical descriptors have been developed to provide better assessment of human response to sounds. The following descriptors provide useful criteria for assessing projects at the Airport:

Equivalent Sound Level (Leq)

Leq is a single-value description of average noise exposure over various specified periods of time intervals. The Leq is used to characterize complex, fluctuating sound levels with a single number.

Day-Night Sound Level (DNL)

DNL is the Leq measured over an interval of 24 hours, with sound levels occurring between 10 p.m. and 7 a.m. penalized by 10 dB to reflect greater potential for disturbance. The nighttime penalty is imposed where sleep interference is a consideration. The DNL has been found to have a close correlation with community response to noise. DNL values reported for the Airport are based on a yearly sample file.

Sound Transmission Class (STC)

STC is a single-number laboratory rating of the amount of airborne sound isolation provided by a particular building component. The STC is determined by a curve fitting process defined by ASTM E-413. The larger the STC, the greater amount of isolation provided.

Noise Level Reduction (NLR)

NLR is the measure of actual reduction in sound pressure level, in dBA, between the exterior environment and an interior space. This measurement does not discriminate as to the path of the sound infiltration.

Noise Reduction Coefficient (NRC)

NRC is the arithmetic average of the amount of absorption of a material at speech frequencies. (250, 500, 1000, and 2000 Hz.) This number is reported to the nearest 0.05, as defined by ASTM C 423.

Noise Criteria (NC)

NC is method for determining allowable maximum background noise levels generated by a mechanical system developed by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) The method consists of comparing octave band sound pressure levels of a noise source with a prescribed series of curves to determine the corresponding NC rating.

Room Criteria (RC)

RC differs from NC only in that the curves are slightly more restrictive in the lowest and highest frequencies.

4.8.5 Architectural Components

The airport environment is, by its very nature, a highly charged, active area. Diverse crowds constantly move through the spaces. Some of the patrons find themselves with excess time allowing them the luxury to browse the retail facilities and leisurely enjoy the surroundings. Others are hurrying to meet a scheduled flight and need only be pointed in the right direction. The airport facilities need to respond to both of these user groups; providing a stimulating environment for exploration, while controlling the potential confusion associated with the combined sounds of aircraft arrivals and departures, paging and flight information announcements, general crowd activity and music, etc. from the retail spaces.

Building Shell

By code, the exterior envelope of the facility must meet the Noise Level Reduction, NLR, of 35 dBA. The following STC ratings are defined by the code to meet this rating:

Building Element	***STC (minimum)***
Walls	40
Windows	38
Exterior Doors	33
Roof/Ceiling Composite	49

Interior Spaces

Typical STC criteria are provided in the Table below only as a guideline. An acoustical consultant should be retained to develop the construction appropriate for specialty areas such as conference/auditoria spaces, administrative offices, FAA and Immigration areas or mechanical rooms. Spaces located along the perimeter of the facility should also be carefully evaluated to ensure that adequate protection from the sounds associated with the aircraft is provided to maintain good speech intelligibility within these spaces.

Space	***STC (minimum)***
Auditorium	60
Video/Teleconference Rooms	60
General Conference Rooms	50
Operable Partitions @ Conference	52
Toilet rooms to occupied spaces	50
General Classrooms	45
General Administrative	45

Construction techniques are critical to the amount of sound isolation actually achieved in the field.

Providing an acoustically compatible system of partitions, ceiling, doors and relights, etc. is also essential to the performance. The sound isolation will only be as good as the weakest element.

Operable partitions must be designed and specified carefully to provide optimal acoustical performance in the field. The following should be considered: Installation of all operable partitions must comply with all requirements of ASTM Designation E557.

Surface Finishes

Reflected sound can increase normal background noise levels through reverberant build-up. Absorptive finishes are necessary to provide adequate noise control throughout the facility. Ceilings are generally the most effective surface to treat with an absorbent material. In order to be effective, the ceiling finish specified shall have a minimum Noise Reduction Coefficient (NRC) 0.60. Not less than 60% of the ceiling shall be absorptive.

Absorptive wall panels with a minimum NRC 0.80 are desirable in areas of high volume spaces or in long corridors. Typically these panels should be placed low on the walls, between a few inches from the floor and door height.

An acoustical consultant should be retained to specify appropriate finishes for auditoria, video teleconferencing spaces or any other specialty area.

4.8.6 Water Features

Water features may be incorporated into the design of interior spaces within the Airport, provided that the noise levels of the feature does not exceed 50 dBA at 5 feet from the feature. Note: this limits water features to smooth water flow. If more drammatic water features are desired, mockups should be prepared to confirm that noise levels will be acceptable to the Port.

4.8.7 Mechanical Systems

Mechanical noise issues at the Airport are twofold: controlling the noise and vibration generated by the system itself, and minimizing the amount of aircraft sounds that are translated through the system back into the building through rooftop equipment or louvers. A qualified Acoustical Consultant should be retained to review any mechanical system design.

Criteria

The following table shows maximum permissible noise levels caused by building mechanical:

Space	***NC***	***RC***	***dBA***
General circulation, lavatories	45	45	52
Multipurpose, cafeteria	30	30	36-38
Classrooms, general offices	35	35	40-42
Private offices, conference rooms	30	30	36-38
Video/Teleconference, Auditorium	25	25	32-34

NC and RC criteria shall be defined and measured in conformance with the requirements of the ASHRAE 1987 HVAC and Systems Guidebook and the National Environmental Balancing Bureau.

Mechanical Rooms

The location of mechanical rooms is critical to isolating the mechanical noise from surrounding spaces. Mechanical rooms shall preferably be located on grade and be isolated from adjacent occupied spaces.

Where mechanical equipment is situated above grade or on a roof, construction under the equipment must be sufficient to adequately reduce the sound and vibration.

HVAC Equipment Selection

Maximum sound power levels for various mechanical equipment shall be included in the specification. Mechanical equipment suppliers shall be required to submit sound ratings for their equipment.

Terminal units (VAV, CV, etc.) generate more noise as the total pressure drop across the device is increased. In order to reduce noise generation, units shall be selected with a low operating pressure drop.

Fans shall be selected for and operated at maximum efficiency, which usually results with quietest operations. Plenum or plug style fans often are quietist and most compact.

Installation of Mechanical Equipment

Rotating or reciprocating machinery shall be mounted on vibration isolators which provide at least 95% isolation efficiency. Isolators shall be selected on the basis of machine speed and type of structure supporting the equipment. Isolators shall be specified to have seismic ratings. Additional seismic restraints are not needed, and shall not be installed, as they short circuit the vibration isolation properties of the spring.

Electrical connections must be made resilient with flexible conduit. Pipe connections must be made through neoprene pipe connectors.

Locate sound traps in a section of duct where a uniform velocity profile across the duct prevails, typically three duct widths from the nearest transition. The velocity at the face of the trap shall not exceed 1000 ft./min.

Grilles, registers and diffusers shall be selected 8 NC points below the room criterion to allow for generous room absorption effects usually applied to catalogue ratings sound ratings for their equipment. This applies especially to equipment such as heat pumps or terminal units, which may be situated above ceilings in spaces where levels below NC-40 are desired.

Dampers shall preferably be located approximately five feet upstream of diffusers and be followed by lined ductwork or a plenum to absorb aerodynamic noise.
Locate rooftop equipment over acoustically non-sensitive spaces, i.e.: toilet rooms, circulation, storage, janitor, or similar spaces.

Ductwork

All ductwork shall be galvanized steel throughout, no exceptions. Fiberglass ductboard does not provide sufficient attenuation for sound transmission through the duct walls to contain fan noise. Final connections to diffusers may be made through short (less than 6 feet) lengths of insulated flexible ductwork.

Noise regenerated at fittings and vibration induced by airflow can be controlled by limiting air speeds in the ductwork. Air velocities in ductwork shall not exceed the following values:

Duct	***Velocity, fpm***
Main Trunks	2000-2500
Branches	900-1200
Connection to Diffuser or Grille	400- 600

These velocities shall be reduced by approximately 20 % for Video/Teleconferencing and auditoria.

Ductwork within mechanical rooms shall be suspended on combination spring and neoprene hangers with 1 inch static deflection. Unistrut and rod type hangers shall be satisfactory downstream from the mechanical rooms, for most low pressure, low velocity systems.

Suspend ductwork on spring and neoprene isolators with 1" static deflection for 25 feet upstream and downstream from a connection to a fan or other rotating device. Neoprene hangers shall be satisfactory further downstream from the air handling units.

Ductwork shall be designed for smooth aerodynamic flow. Turbulent air flow can produce noise and may cause ducts to vibrate. In order to reduce duct generated noise the following procedures shall be observed:

- A duct attached to the discharge of a fan shall be straight for at least three fan diameters, before incorporating an elbow.

- Elbows following a scroll centrifugal fan shall turn in the same direction as the fan scroll.

Use flexible connections to connect motor driven equipment to ductwork.

Ductwork which is common between two adjacent spaces where acoustical privacy is desired shall be internally lined for a sufficient length or contain sound traps to minimize crosstalk.

Return air plenums, must incorporate sound traps, lined elbows, etc., attached directly to ceiling grilles in order to reduce sound transfer between adjacent spaces. The effectiveness of this treatment will, however, depend on the sound transmission characteristics of the ceilings used in the installation.

Transfer grilles located in acoustically private rooms, such as offices, will short circuit the structure's attenuation of sound. We recommend the use of transfer grilles to be limited to acoustically non-sensitive spaces such as lobbies and general circulation areas. Transfer grilles in these locations shall include internal acoustical lining for their entire length.

Piping and Circulation Systems

Piping shall be routed over areas with a lower sensitivity to noise.

Flow velocities shall generally not exceed seven feet per second to insure quiet operation.

Pumps shall be base-mounted and located on concrete inertial bases. In-line pumps are difficult to isolate. Isolate all pump pipe connections with twin-sphere neoprene flexible connections, Mason MFTNC or approved equal. Electrical connections shall be made through a generous length of flex.

Base-mounted pumps shall be located on seismic type steel spring isolators with 1 inch loaded static deflection, Mason SSLFH or approved equal.

Piping within 25 feet of pumps shall be suspended on combination spring and neoprene hangers with 1 inch static deflection, Mason DNHS or approved equal. Saddle type hangers with insulation shields shall provide sufficient isolation downstream from this point.

4.8.8 Plumbing

Toilet rooms shall be located away from sensitive acoustical areas.

Siphon jet fixtures are quieter in operation than blow-out fixtures.

Domestic water pressure shall be reduced to the minimum pressure that will permit the flush valves to operate to reduce water hammer and subsequent pipe vibrations.
Provide gas charged type shock arrestors at the termination of risers serving flush and solenoid valves, Zurn, Wade, Josam, or approved equal.

4.8.9 Audio/Video Systems

Audio and video systems are used to convey information to a recipient. Successful audio reinforcement systems provide adequate levels of amplified speech to the listener to ensure intelligibility. This is achieved by ensuring that levels from the audio system are greater than

the anticipated background noise levels, and also greater than levels associated with the most frequent activities anticipated for a space. Intelligibility of the sound is also dependent on the reverberant condition of the space. An overly reverberant space will cause the sound to appear muddy and difficult to understand.

A qualified acoustician should be retained to ensure that the acoustical environment of the spaces is conducive with the design of the audio system.

Systems Requirements:

General:
Enclosed in metallic conduit
Single point grounding system
Powered by backup emergency generator circuit
ADA compliant

Terminal Areas:
Good speech reinforcement system with modest background music capabilities.
Paging Zones: All call, all terminal, gate, rest facilities
Visual display of audio.
Minimum Level: 68 dBA. Maximum Level: 78 dBA.
RF cable feed from main trunk.

Concourse Areas:
Good speech reinforcement and background music system.
Paging Zones: All call, all concourse, rest facilities
Minimum Level: 70 dBA. Maximum Level: 80 dBA.
RF cable feed from main trunk to vendors.
Audio levels from vendors no greater than 60 dBA at 10 feet from opening to vendor.

Auditoria:
Central control panel.
Podium with high resolution video inputs, audio inputs, mic inputs.
Recessed floor microphone boxes.
Remote operated projection screen.
Ceiling mounted video projector.
Full range audio, minimum program level of 95 dBA.

4.9 LANDSCAPE

Exterior Landscaping:

Refer to the interim Landscape Design Standards for information regarding exterior landscaping.

Interior Landscaping:

Interior landscaping would be desirable in key locations within the terminals if adequate natural light is available to assure healthy and sustainable plantings that do not incur excessive maintenance costs. The decision regarding integration of interior planting is a difficult issue that requires involvement of expert landscape consultants who understand the specific environmental and maintenance issues involved the specific space being considered.

It is recommended that an interior landscape standard be developed as an outgrowth of the interior landscaping conclusions reached by the project teams on the Central Terminal and Concourse A projects. Likewise, the existing ticketing lobby area should be evaluated regarding the potential viability of interior landscaping. Given the current condition of the Ticketing Lobby, it does not appear to be likely that interior landscaping would be viable or visually successful, without related renovations to clean up clutter in the planter areas, and potentially to replace the exterior dark glazing to increase the level of natural light in the space.

4.10 SUSTAINABLE DESIGN

4.10.1 Introduction

(NOTE: The Port of Seattle Aviation Division has not developed a detailed sustainable design approach, however design teams are encouraged to explore sustainable design strategies that are achievable within budget and other parameters. Following are broad goals for sustainable design.)

Sustainable design is the idea of creating buildings and landscapes that enhance our quality of life with the least negative impact to our environment.

This section of the Guidelines outlines the approach to sustainable design, describing the environmental impacts of conventional construction, and suggesting a proactive approach that minimizes those impacts. This section defines sustainable design goals for consultants, describes the basic strategies that can be employed to reach them. It does not stipulate specific design criteria as these have not yet been determined, beyond existing codes.

Design Goals: Sustainable building projects strive to reach five simple goals:

- Conserve Energy
- Manage Material Use
- Enhance Environment
- Support Landscape, and
- Safeguard Water.

4.10.2 Conserve Energy

Energy is a finite resource that must be conserved if the region is to achieve a sustainable pattern of development. Production of electricity from fossil fuels in the Centralia Power Plant creates pollution in such quantities that Mount Rainier is now often obscured by the plant's exhaust plume. These pollutants eventually end up in our region's watersheds, degrading the ecosystems that depend on clean water, and in the air where it effects people's health.

For many years hydroelectric has been viewed as a clean power source, but now there are many indicators that the anadromous fish species in our rivers are under stress. Given the prediction of continued growth of our population, the most effective way to reduce demand is to lower our per capita consumption of electricity. Each project should meet performance targets of reduced energy consumption through one or more of the following energy conserving strategies:

- Reduce energy consumption:
  The first step towards energy conservation is to eliminate unnecessary demand. This can be accomplished through strategies such as relaxation of design criteria where appropriate to allow wider temperature ranges; reduction of solar loads by shading windows, and occupancy sensing so equipment is turned off when people are not present.

- Harvest site resources:
  The second step in conserving energy is to meet as much of the load as possible by harvesting free energy available on site. This can be accomplished by strategies such as turning off lights when daylight is available, using cool nighttime air for ventilation cooling, and geothermal exchange to extract heat from the ground.

- Increase Efficiency
  The final step towards energy conservation is to increase efficiency of the technology that meets the minimized load. Example strategies include using T-5 and sulfur lamps, variable speed motor drives, and high efficiency modular chillers that increase part load efficiency.

4.10.3 Manage Material Use

The construction of new facilities, as well as the renovation of existing spaces, increase our region's consumption of materials. Increased material use depletes natural stocks if it is consumed faster than it can renew. The use of products that are created from abundant raw materials can minimize the depletion concern, but still may not address the disposal issues once the products life is over. To approach sustainable patterns of material use, the complete life cycle of a product must be considered. The best material selections will actually transform the life cycle from 'cradle to grave' to 'cradle to cradle'. Improving the efficiency of use and lowering the overall resource consumption, can be achieved through four strategies:

- Minimize material use:
  Reduction of material use in a project is the first step in material management. This strategy can be implemented by more efficient space planning, use of advanced engineering materials, or modular design that reduces waste from trimming of materials. Examples include high strength steel for structure, floor tiles that are increments of the design module, and designing bay sizes and office layouts to fit with window modules and furnishing systems.

- Select sustainable sources:
  Some materials are benign to extract and convert to building products, while others are less so. Once the material demand has been minimized, try and select actual products that minimize environmental impact. Examples of this strategy include certified wood products and recycled content building materials such as drywall, carpeting, and ceiling tiles.

- Use durable materials:
  Maximizing a material's useful life allows for any negative impacts to be spread out over a longer period of time. This reduces the incremental impact at any moment in time. Design strategies include planning for adaptability, detailing for durability, and considering maintenance needs. Selection of materials can also extend life cycles. Linoleum for example, has a life span twice that of PVC flooring.

- Close the loop:
  Once a material has been extracted and manufactured into a product, it should be kept in use for as long as possible. While it may be possible to extend the duty cycle through thoughtful selection of materials, eventually the product will be replaced. At this time, look for ways to recycle the material, selecting the highest possible use for the downcycled material. The first step is to look for reuse potential in a project. Strategy examples are the reuse of concrete crushed on site for structural fill, or substituting salvaged wood flooring for virgin wood flooring. If salvage and reuse cannot be accomplished, downcycle the material to the next lowest use. An example of downcycling is the re-sawing of glu-laminated timbers into wood flooring. Finally if downcycling is not possible, look for recycling opportunities. In the Seattle area there are material recovery facilities for aggregates, metals, drywall, cardboard, wood, and asphalt. These facilities charge significantly less per ton of delivered material than the local transfer stations.

4.10.4 Enhance Environment

The hidden costs of degraded environmental quality can be reduced with a sustainable pattern of development. As these costs are identified, the generator of the polluting processes or products can then be motivated to improve economic performance by eliminating the pollution.

For building owners, there is growing evidence of the negative impact from exposure to multiple environmental toxins present in building materials. The construction of new facilities can create new sources of pollution and environmental impact both inside and outside of buildings. Many building materials create pollutants and contamination during production and the negative impacts occur remotely from the site. Other building materials contain pollutants when they are installed in a building, and continue to emit them for long periods of time.

These approaches can be applied to non-traditional forms of pollution such as noise, light pollution, and odors. For example, reducing glare from uncontrolled sun penetration into a space can make a ticket salesperson more productive. Good sound control in an entry hall could improve the ability of passengers to hear and respond to the PA system.

Strategies in this category expand the notion of what constitutes pollution and how to eliminate it. Reduction of pollution sources is the first step. If pollutants cannot be eliminated, they can be filtered or neutralized to eliminate contamination, or they can be diluted to reduce pollution strength.

- Reduce pollution sources:
  The first step towards enhancing the environment is to eliminate the pollution at the source. Examples of this strategy are the use of non-toxic paints and adhesives. Another example is the development of an Integrated Pest Management (IPM) program for the exterior landscapes. This approach uses a series of increasing strong steps to control pests, which results in fewer instances of actually administering pesticides.

- Eliminate contamination:
  In some cases the pollutant source cannot be eliminated. In that case, it must be actively removed from the occupied space. A simple example is the use of high efficiency filters in the HVAC system to clean smoking areas. These principles can be applied to natural systems as well. There are increasing uses of bioswales to treat surface water runoff. In this approach, stormwater is channeled to a depression in the land that contains plants that actually digest road oil. The water is not only channeled, it is cleaned before recharging the local aquifer.

- Dilute pollution strength:
  If a pollution source cannot be eliminated at the source, or removed from the area, it should be diluted to reduce negative effects. For example, if it necessary for smoking to be allowed in restaurant, then providing additional levels of fresh air can dilute the levels of smoke in the space. If there is a cleaning material that must be used that has strong off gassing odors, then it should be used in non-occupied hours when doors and windows can be opened for ventilation.

4.10.5 Support Landscape

Landscaping and the connection to the natural environment is summarized in other sections of the design guidelines as an essential aspect of the vision for Sea-Tac. The key issues are restated here, since it is integral to the concept of sustainable design. Three strategies that support landscape are:

- Connect with nature:
  The strongest way to support landscape is to actively engage Port visitors with a strong connection to nature. A place of respite for travelers can often be created through a connection with the outdoor environment. If actual outdoor space is not possible, then a strong visual connection can provide the same the calming effect. Indoor plantings that are based on local species can evoke the Pacific Northwest forests to travelers as well.

- Preserve native vegetation:
  When selecting the plant materials to create landscapes, use species that are local and adapted to our climate conditions. This will reduce watering and maintenance requirements and operating costs. Select species with growth and propagation patterns consistent with the use of the space. This can reduce problems with volunteers and invasive species migrating to areas where plants are not desired for security or safety.

- Work with natural systems:
  The interaction of soils, weather, plant materials, and buildings is a complex system. Minimizing disturbances to natural systems will ensure robust and healthy existence over time. Keeping plant material on site for composting, using landforms to protect waterflows, clustering plants in larger groups are all ways benefit from strong natural systems.

4.10.6 Safeguard Water

The beauty of the Pacific Northwest is closely linked to the quality of it's water resources. Yet as quickly as water falls, it is out of sight and out of mind. The infrastructure that carries it away is present to protect the quality of health and life of the people who live there. These are still important goals, but a sustainable approach also considers the impacts of water flows to the natural environment as well.

While many visitors to the Pacific Northwest think they are coming to the Rain City, we are currently reaching limits on some of our local aquifers. Water rights in some parts of King County under so much demand from growth that development moratoriums have been instituted. By using less water in its facilities, the Port can help reduce the increasing demand we place on this limited resource. Additionally, there are opportunities at the building, site and neighborhood scale to use, reuse and improve both storm and drinking water so that we can reduce the amount of imported water we need

Three strategies are employed to conserve and improve the quality of water:

- Reduce potable water use:
  The first step in safeguarding water is to use it wisely. Carefully examination of the need for increased water supplies often reveals that additional capacity is oversized. In a food service area for example, there are a number of advanced dishwashing machines that can cut water use by one third.

- Maintain natural waterflows:
  Development often changes the ways water moves through a building site, redirecting flows and changing the volume of surface water runoff. Rain that normally flows through a watershed is diverted and the natural recharge that happens in the receiving water bodies is significantly lessened. These changes often produce undesired results such as erosion of soils or contamination of streams, that in turn have a negative impact on the local ecosystem. Allowing waterflows to continue historic patterns can mean fish spawning areas are preserved and wetlands continue their cleaning function. Preserving the features that attract so many visitors each year will ensure their return as well.

- Harvest on Site Flows:
  Sometimes there are waterflows that cannot be maintained exactly in their historical pattern. In this case, using that flow prior to discharging it to the ultimate receiving body can reduce demand for treated potable water. There are several reclamation water projects now in the Seattle area. Graywater, roof runoff, and groundwater are being used for processes that historically relied on potable water supplies. By avoiding demand increases on the existing supply system, costly upgrades in capacity, as well as charges at the water meter can be avoided.

~~**A Conserve Energy**~~
~~**B Manage Materials**~~
~~**C Enhance Environment**~~
~~**D Support Landscape & Site**~~

END OF SECTION ON SUSTAINABLE DESIGN

4.11 STRUCTURAL

4.11.1 Introduction

The structural engineering design criteria presented here are to serve as a guideline for design of structures at Seattle Tacoma International Airport (SeaTac). Designers of individual projects must verify the appropriateness of the recommendations for each project. It is intended that this document continue to develop and be updated periodically through use and feedback.

4.11.2 General Design Considerations

Structural design at airports does not usually entail overly complex analysis methods. There are, however, numerous constraints from other systems and uses that directly affect the structural design. The building systems (baggage, HVAC, plumbing, communications, electrical, etc.) can be quite complex, requiring great coordination and integration with the structure.

The interface between the airside operations and the building structures place significant limitations on both the floor elevations as well as the available structural depth. Ground support equipment must be accommodated at ramp level. Airplane parking and loading bridge lengths are both directly affected by the elevation of the floor(s) above the ramp level.

Things are constantly in motion at an airport. The vibrations caused by baggage systems, carts, people movers, pedestrians, etc. can produce highly perceptible vibrations within the structure. The large expanses of most concourses and lobby areas often have minimal inherent damping and offer few opportunities to modify the vibrational characteristics of the floor system once constructed. Therefore, the design of the floors must control these dynamic characteristics. Floor vibrations are discussed further in Section 4.11.11.

Airport facilities are often renovated. Changes in retail spaces or back-of-house operations for tenants occur frequently. To accommodate this flexibility, the layout of columns, the lateral resisting systems, and the floor systems must be selected with care so that future modifications are not excessively expensive, disruptive, or difficult to achieve.

4.11.3 Recommended Approach

Maintaining the flexibility necessary for future uses while providing an economical and functional solution to the immediate design issues is a delicate balance. Experience at this and other airport facilities indicates several general recommendations.

- Most construction at the airport uses spread footings. The soil is generally very capable glacial till. Bearing pressures used in past designs range from 4,000 pounds per square foot (psf) to 10,000 psf. Occasionally areas of unsuitable materials are encountered where over-excavation and importing structural fill is needed. A few projects have used drilled

piers in areas of less suitable soils, near utilities, or near the transit tunnels. The recommended preliminary seismic response is given in Section 4.11.10.4.

- The preferred construction material is structural steel. Structural steel is easily modified as needed for future renovations.

- The preferred structural system is a moment resisting frame with steel beams and girders.

- If braced frames or shearwalls are used, try to locate them adjacent to functions that are not likely to be moved in the future. Elevator and stair cores or restrooms are possible locations. Be sure that the drawings clearly indicate the presence of the bracing and particularly any shearwalls. Boldly label these items as part of the lateral force resisting system. Renovation work often adds a few holes here and then a few there. After a number of such minor adjustments, the shearwalls may not function as intended. Everything done to highlight the structural need for these elements will be worth it.

- The floor beams and girders should be designed compositely with the floor slab. However, consider the potential for an opening on at least one side of the beams, especially near baggage routes and in concourses.

- In large open areas such as ticketing, concourses and esplanades, vary the floor framing direction and/or beam stiffness. This helps keep vibrations from propagating throughout the area.

4.11.4 Existing Drawings

The Port of Seattle maintains a library of drawings from past projects. The designer must research all construction completed in the area of his project, paying particular attention to adjoining structures and utilities.

For future reference, it is critical that as-built documents of all projects be filed with the Port.

4.11.5 Schematic Design Phase

The Schematic Design Phase establishes the conceptual design, scale, and relationships among the components of the project. All constraints to the design should be identified during this phase. The engineer must research all past construction documents and soils investigations relevant to the construction area.

At the completion of this phase of the design, all critical design issues should be identified. The design criteria and critical design issues shall be described in a Basis of Design document submitted to the Port for review. The Basis of Design will be updated as appropriate at each phase of design.

The Basis of Design shall include:

- A listing of reference documents from previous relevant construction projects.
- The design criteria and critical design issues.
- Identify all design loads and codes to be used.
- Describe the structural system used for vertical and lateral loads.
- Describe the soils at the site and soils design information.
- Identify materials proposed and why they were chosen.
- Identify key decisions yet to be made which could effect the structural systems.

The Schematic Design submittal shall include:

- Basis of Design
- Drawings:
  - Framing Plans (foundation, ramp level, typical floor, roof)
  - Significant Structural Elevations
  - Preliminary details of special conditions
  - Preliminary Soils Report
  - Preliminary assessment of hazardous material remediation necessary (soil and building materials)

4.11.6 Design Development Phase

The Design Development Phase involves further definition and resolution of all important aspects of the project. No significant design issues should be left unresolved at the end of this phase. The Basis of Design shall note the disposition of items identified as potential problems at the Schematic Design phase.

The Design Development submittal shall include:

- Updated Basis of Design
- Outline Specifications
- Drawings:
  - General Structural Notes
  - Load Maps
  - Framing Plans (foundation, ramp level, typical floor, roof)
  - Significant Structural Elevations
  - Typical Details anticipated
  - Details of special conditions
- Preliminary Soils Report

- Preliminary assessment of hazardous material remediation necessary (soil and building materials)

4.11.7 Construction Documents Phase

This phase completes the design and produces documents necessary for the successful completion of the construction project. The Contractor's scope of work is clearly defined. At the completion of this phase of the design, the drawings and project manual are ready to be issued to bidders by the Port.

The Construction Documents submittal shall include:

- Final Basis of Design
- Technical Specifications
- Drawings:
  - Stamped and signed by a structural engineer licensed in the State of Washington.
  - General Structural Notes
  - Load Maps
  - Framing Plans
  - Structural Elevations
  - Typical Details
  - Details of special conditions
- Final Soils Report
- Final assessment of hazardous material remediation necessary (soil and building materials)

4.11.8 Design Checklist

The following is a "Design Checklist" that may be used to identify some of the issues inherent to the design of airport structures.

- ❑ Structural Design Loads
- ❑ Foundation Design Recommendations
- ❑ Future Expansion Requirements
- ❑ Flexibility for Future Occupancy Changes (gate lobby to retail, etc.)
- ❑ Control of Floor Vibrations
- ❑ Structural Clearances for Airside Vehicles
- ❑ Special Loads from Airside Vehicles
- ❑ Vehicle Collision Protection
- ❑ Baggage Handling Support Systems
- ❑ People Moving Systems, Escalators, Moving Walkways, Automated Transit
- ❑ Noise Control (What are the mass requirements that will effect the structure? etc.)
- ❑ Jet Blast Design
- ❑ Aircraft Loading Bridge Structural Requirements
- ❑ Mechanical Systems (HVAC, plumbing, preconditioned air, etc.)
- ❑ Electrical Systems (building power, 400 Hertz, communications, etc.)
- ❑ Airfield Lighting
- ❑ Antenna Farm Structural Design

4.11.9 Design Codes

All drawings, specifications and construction must meet the requirements of the State Building Code Act of 1985 and subsequent amendments. As a minimum, conform to the following:

- Port of Seattle Regulations for Airport Construction, 1996 edition.
- International Conference of Building Officials Uniform Building Code (UBC) 1997 edition.
- American Society of Civil Engineers (ASCE) Minimum Design Loads for Buildings and Other Structures ASCE 7-95, 1995.
- Structural Engineers Association of Washington (SEAW) Snow Load Design for Washington, Second Edition, July 1995.
- American Concrete Institute (ACI) Building Code Requirements for Structural Concrete (ACI 318-95), 1995
- American Institute of Steel Construction (AISC) Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design, June 1, 1989.
- American Institute of Steel Construction (AISC) Manual of Steel Construction Allowable Stress Design, Ninth Edition, Second Revision November 1995.
- American Institute of Steel Construction (AISC) Load and Resistance Factor Design Specification for Structural Steel Buildings, December 1, 1993.
- American Institute of Steel Construction (AISC) Manual of Steel Construction Load and Resistance Factor Design, Second Edition, December 1993.
- Research Council on Structural Connections (RCSC) Specification for Structural Joints Using ASTM A325 or A490 Bolts, Allowable Stress Design, November 13, 1985.
- Research Council on Structural Connections (RCSC) Specification for Structural Joints Using ASTM A325 or A490 Bolts, Load and Resistance Factor Design, June 8, 1988.
- American Welding Society (AWS), AWS D1.1 Structural Welding Code—Steel, 1998.
- American Welding Society (AWS), AWS D1.3 Structural Welding Code—Sheet Steel, 1989.
- American Welding Society (AWS), AWS D1.4 Structural Welding Code—Reinforcing Steel, 1998.

4.11.10 Design Loads

The structures shall be designed for at least the Code minimum design loads. In many cases, the Code does not clearly address functions within the airport structures. The building codes also do not address the need to allow for future modifications, which may increase the floor or ceiling loads beyond the original design. Following are recommendations for various loads, which may be encountered in the design.

4.11.10.1 Load Maps

Load maps are needed to clearly document the design loading. These illustrated plans identify the different loading conditions and the extent of each loading. Both live loads and superimposed dead loads (for finishes, mechanical, electrical, etc added to the basic structures self weight) shall be identified.

4.11.10.2 Live Loads

Live loads are those loads produced by the use and occupancy of the building or other structure and do not include environmental loads such as wind load, snow load, rain load, earthquake load, or dead load.

Live loads on a roof are produced:

- By workers during maintenance, equipment, and materials
- During the life of the structure by movable objects such as planters and by people.

The source of live loads can vary significantly during the life of an airport structure. It is very common for renovations to modify the usage of spaces. For example, gate lobbies may become retail shops or VIP lounges.

To accommodate this variation, all areas that have the potential to be used by the general public should be designed for a minimum live load of 100 pounds per square foot (psf). The building codes generally allow a reduction of live loads for structural members which support a large area. The rational is that the live load is transient and is not likely to occur over a large area. Live load reductions are not allowed for loads over 100 psf nor in areas of public assembly. Because the common areas within the airport may become assembly or exit areas the 100 psf design live load should not be reduced.

Mechanical rooms should be designed for a minimum of 125 psf in addition to the weight of any house keeping pads. The weight of all equipment should be checked as the mechanical design progresses to be sure that the assumed allowance is adequate. Attention should also be given to isolating any machinery-induced vibration and noise. The use of floating slabs is not uncommon and can add a significant load to the structure.

Airside ramp activities can include significant loadings to below grade structures. All ramp level floors need special consideration for loads, which may be imposed by vehicles. In particular, the tugs used for the airplanes commonly are used on both sides of a concourse. If the tug will fit in the drive aisle crossing the concourse, the driver will likely use that route. Unless the structure is designed for this very large load, barriers and/or very clear signage are required to protect the structure. Consider also access routes and loads for fire fighting equipment.

4.11.10.3 Superimposed Dead Loads

In offices, or other areas where partitions might be subject to erection or rearrangement, provisions for partition weight shall be made, whether or not partitions are shown on the plans. A minimum uniformly distributed dead load of 20 psf shall be included, in addition to all other dead loads, to account for the partitions. If office areas are designed for a live load of 70 psf or higher, this additional 20 psf need not be added. Areas where heavy storage files (drawing flat files, modular filing systems, filing rooms, etc.) are expected need to be identified and accounted for.

In mechanical rooms, account for the weight of house keeping pads and floating slabs in addition to the equipment weight live load.

Concourses, ticketing, lobbies, restrooms, and retail spaces may use topping slabs or other heavy finishes (terrazzo, ceramic tile, etc.). Most of the existing floors at the airport use 2-½" of terrazzo topping. Consider designing for an additional 50 psf to accommodate future finishes even if these loads are not part of the initial design.

Occasionally, exhibits and signage are hung from the structure. Therefore, these loads need to be identified and accounted for in the design. Consider an allowance for such uses in the future.

It is fairly common for ceilings above the baggage and ramp levels to be designed to allow maintenance access. These ceilings allow workers to access and work on equipment such as baggage systems and communication runs. Such ceilings shall be designed for a minimum live load of 30 psf.

4.11.10.4 Seismic

Seismic design shall follow UBC Chapter 16 Division IV.

The seismic importance factor shall be I = 1.0. However, I = 1.25 shall be used for ramp and aircraft control towers.

Seismic Zone 3; Z = 0.3.. For preliminary design, use a soil type of S_c; C_a = 0.33; C_v = 0.45.

Most areas of the airport complex rest on dense glacial till. A soils investigation of the particular site and review of past investigations should be performed on all projects of significant size. See Figure 1 for a preliminary response spectrum based upon soil type S_c.

Determine with the Port of Seattle whether or not the building being designed is intended to be used as an "essential facility." There may be occasions where it is appropriate to use an importance factor greater than 1.0 even if the structure will not be officially classified as an essential facility.

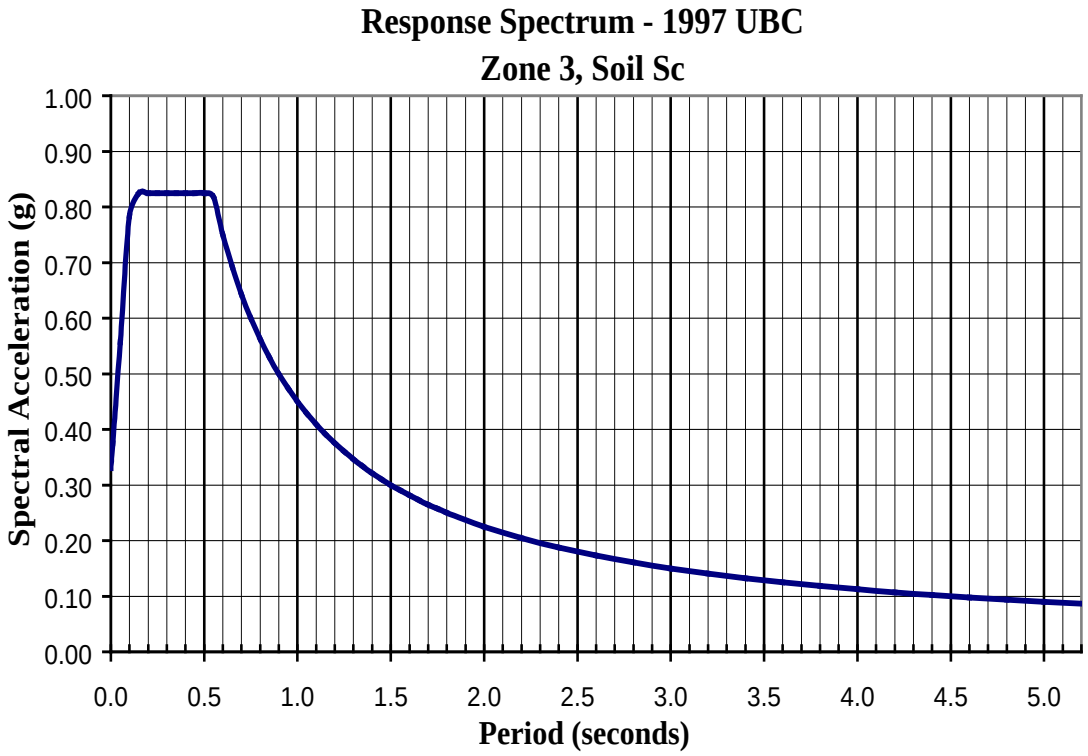


Figure 1

4.11.10.5 Wind

Wind load design shall follow UBC Chapter 16 Division III.

The basic wind speed shall be 80 mph.

The wind importance factor shall be $I_w = 1.0$. However, $I_w = 1.15$ shall be used for ramp and aircraft control towers. Determine with the Port of Seattle whether or not the building being designed is intended to be used as an "essential facility." There may be occasions where it is appropriate to use an importance factor greater than 1.0 even if the structure will not be officially classified as an essential facility.

Exposure category C shall be used unless it can be shown that a lower category is appropriate. Although a building site may appear to have different exposure categories in different directions, the most severe exposure is to used for all wind load calculations, regardless of wind direction or building orientation. A common mistake is to assign different exposure categories to different sides of a building. Since cladding design is often governed by suction pressures, which are caused by flow separation at corners, the side and back faces actually require the higher design values.

4.11.10.6 Snow

Snow load design shall follow the procedures in the SEAW snow load manual and UBC Appendix Chapter 16 Division I.

The basic ground snow load shall be $P_g = 25$ psf.

The occupancy importance factor shall be $I_s = 1.0$. Determine with the Port of Seattle whether or not the building being designed is intended to be used as an "essential facility." There may be occasions where it is appropriate to use an importance factor greater than 1.0 even if the structure will not be officially classified as an essential facility.

4.11.11 Floor Vibrations

One of the most persistent floor serviceability problems facing designers is annoying floor motion induced by building occupants or other transient sources such as trucks or buses. Tredgold[1] in 1828 wrote that girders over long spans should be "*made deep to avoid the inconvenience of not being able to move on the floor without shaking everything in the room.*" It has been common practice for soldiers to break step when marching across bridges to avoid large and potentially dangerous resonance vibrations.

Humans have an amazing ability to perceive motion in a floor system and have a widely varying opinion of the acceptability of such movement. If the floor systems' vibrational response from normal activities causes occupants to be uneasy or annoyed, the intended use of the building can be greatly affected. This can be especially true at an airport where some people are already uncomfortable with the idea of flying or have strained patience because of delays or just the rigors of travel.

In the last twenty five years there have been more than ten studies, and subsequent design guidelines, which have attempted to define a process that engineers could use to design floors that are both economical and free from vibration complaints by users of the facility. Studies have shown that the use of the facility has a major influence on the perception of acceptability. In other words, the vibration that would be acceptable in a gymnasium is significantly different from what would be acceptable in a restaurant.

Generally, the source of the floor vibration is from the occupants of the building. The most common source is from people walking and those who notice the movement are people sitting or standing still. Long spans and open areas tend to be the most prone to complaints from occupants.

Both stiffness and resonance are important considerations in the design of floor systems. Stiffness has been accounted for in the design using criterion dating from Tredgold's time. Traditionally the live load deflection is limited to less than $\frac{floor\_span}{360}$. Allen and Murray[2] suggest that a better stiffness criterion is to limit the deflection due to a 225 pound (1kN) concentrated load to less than approximately 0.04 inches (1 mm).

Resonance has been ignored in floor design for walking vibrations until recently. In studies of floors that satisfy code stiffness criteria but still had problems with walking vibrations, damping and mass, not stiffness, were the most important factors in preventing unacceptable walking vibrations. To take damping and mass into account, dynamic design criterion based upon heel-impact response have been developed and refined by several studies[3].

The loading function due to walking is approximately 2 Hz. Resonance can occur at harmonic multiples of this step frequency. Review of past cases of vibration problems showed a correspondence to the second (4 Hz) and third (6 Hz) harmonic resonance.

As noted above, walking forces produce motions, which are related to resonance, impulse response, and static stiffness. Resonance controls the design of floors with natural frequencies less than approximately 9 Hz. Static stiffness controls the design when the frequency is greater than 18 Hz. Impulse response controls the design for floors with frequencies between 9 and 18 Hz.

Allen and Murray (1993) present a fairly simple design criterion for walking vibration based upon harmonic resonance. The criterion is extended to floor frequencies beyond 9 Hz to control impluse vibration from footsteps.

The studies mentioned here, and several others, form the basis for a design guide from the American Institute of Steel Construction (AISC). This design guide book[4] presents the recommended procedures for the design of floor systems at SeaTac.

Measurements of the existing floors at SeaTac show that the ticketing level floors have a frequency between 4.5 and 7 Hz. The concourse floors have a frequency above 10 Hz. New designs should strive to design floors which will exceed 9 Hz.

[1] Tredgold, T., Elementary Principles of Carpentry, 2nd Edition, Publisher unknown, 1828.

[2] Allen, D. E., and Murray, T. M., "Design Criterion for Vibrations Due to Walking," Engineering Journal, American Institute of Steel Construction, Fourth Quarter, 1993, pp. 117-129.

[3] Lenzen, K. H., "Vibration of Steel Joists," Engineering Journal, American Institute of Steel Construction, 3(3), 1966, pp. 133-136.

Allen, D. E., and Rainer, J. H., "Vibration Criteria for Long-Span Floors," Canadian Journal of Civil Engineering, 3(2), June, 1976, pp. 165-171.

Murray, T. M., "Acceptability Criterion for Occupant-Induced Floor Vibrations," Engineering Journal, American Institute of Steel Construction, 18(2), 1981, pp. 62-70.

[4]Murray, T. M., Allen, D. E., and Ungar, E. E., "Floor Vibrations Due to Human Activity," Steel Design Guide Series 11, Publication No. D811, American Institute of Steel Construction, 1997.

4.12 MECHANICAL

Mechanical requirements are documented separately. Design teams should coordinate with the Port in acquiring the most current mechanical standards.

Acoustical considerations are an important aspect of mechanical systems. Refer to section 4.8 for acoustical criteria relating to mechanical systems,

Note: although the "Sustainable Design" sections 2.6 and 4.10 present broad concepts rather than specific criteria, design teams are encouraged to explore these concepts as they relate to mechanical issues, to the extent feasible within the project budget and other parameters.

4.13 ELECTRICAL

Electrical requirements are documented separately. Design teams should coordinate with the Port in acquiring the most current electrical standards.

Note: although the "Sustainable Design" sections 2.6 and 4.10 present broad concepts rather than specific criteria, design teams are encouraged to explore these concepts as they relate to electrical issues, to the extent feasible within the project budget and other parameters.

4.14 CONCESSIONS AND TENANT PROJECTS

Concessions Projects are covered by the Retail Concession Tenant Guidelines. These guidelines apply to all retail tenant projects. As current major terminal construction and renovation projects are completed, tenant guidelines will be expanded to cover specific requirements related to the architectural design approach in each major portion of the airport.

4.15 ADVERTISING

Advertising can offer many benefits, however the current conditions at Sea-Tac suggest the need for the development of standards for more careful integration of advertising.

Section 2.7 illustrates existing concerns relative to advertising, and suggests some general strategies for the integration of advertising to achieve a more successful integration with the desired image for Sea-Tac. Following is a summary of the potential benefits and strategies for achieving well integrated advertising:

Benefits of well integrated advertising:

- Important source of income for the Port, enabling services to be provided to travelers at lower cost.

- Enhancement of the traveler experience with visually stimulating displays. Well integrated advertising achieves strong visual interest without creating clutter or confusing wayfinding.

- Representation of regional culture through presentation of local businesses and civic activities.

Primary strategies for successful integration of advertising:

Every project team for new and renovation projects shall develop a clear approach for advertising integration, in concert with an airport-wide program to implement the following strategies:

- Establish clear zones for advertising that are highly visible but do not create clutter or conflict with primary wayfinding signage.

- Integrate the advertising display detailing with the architectural details of the surrounding architecture. For instance, the framework and details for advertising displays could match the detailing for FID's in adjacent areas.

It is recommended that the current major projects (Central Terminal, Concourse A, STS) develop a coordinated approach to advertising integration, which will then become the basis for more consistent standards throughout the airport.

4.16 REMOTE FACILITIES

The design guidelines are focused on the primary airport terminal and related facilities. Remote facilities are an important though secondary consideration in achieving a coherent and successful airport environment.

The intention in the design of remote facilities should be to achieve a relationship to the main facility that maintains continuity without necessarily replicating the architectural approach of the main facility. The variety of remote facilities makes it difficult to develop design criteria that are appropriate to all conditions. However, following are general recommendations:

Remote Facilities used by Public: should follow material recommendations outlined in section 4.3, "Materials & Finishes". It is recognized that given the separation from the main terminal facilities, there is greater flexibility in interpretation of the material and finishes recommendations, however it is still important to maintain consistency and continuity of the material and design character of the facilities, both externally, and internally.

Remote Facilities not used by Public: should maintain a neutral palette of materials consistent with the main terminal, with exterior colors being white and off-white. The use of other colors are subject to approval by the Design Review Committee. Interior finishes in remote facilities not used by the public are not subject to restriction by these guidelines.

SECTION 5 RESOURCES AND RELEVANT INFORMATION

This section provides a summary of related documents, resources, authorities, and other entities that are applicable to design work at Sea-Tac.

5.1 Review Authorities

For non-airfield projects, the City of Sea-Tac is the primary permitting authority. The airport's fire department is the reviewer for fire protection permitting.

For detailed and updated information regarding the City of SeaTac review and permitting process, refer to "The City of SeaTac Development Handbook", available from the city of SeaTac at no charge.

5.2 Port of Seattle Points of Contact

Design teams should verify points of contact with their project manager.

5.3 Regulations for Airport Construction

The Regulations for Airport Construction will become partially outdated by this Design Guideline documents. Other portions (mechanical and electrical) are currently being updated. It is anticipated that the Regulations for Airport Construction will be thoroughly revised and updated as part of the next phase of developing more detailed and comprehensive standards for the airport.

5.4 Master Specification

The Port of Seattle maintains a master specification which is used by both the aviation and the maritime divisions. The master specification is intended as a foundation from which design teams can build their project specifications. The master specification is not intended to cover specific projects. Each design team is required to review and modify the specification to suit the specific project requirements.

Note: the master specification is currently being reviewed, and is anticipated to be revised and updated in concert with the development of design standards.

5.5 AFUS CADD Standards

The Port has strict CADD standards, which are summarized in a separate document. Design teams should acquire the latest version of the AFUS standards from their project manager.

5.6 Drafting Standards

The Port has strict drafting standards, which are summarized in a separate document. Design teams should acquire the latest version of the AFUS standards from their project manager.