U.S. Department
of Transportation

**Federal Aviation
Administration**

Advisory Circular

Subject: BUILDINGS FOR STORAGE AND MAINTENANCE OF AIRPORT SNOW AND ICE CONTROL EQUIPMENT AND MATERIALS

Date: 10/15/92 **AC No:** 150/5220-18
Initiated by: AAS-120 **Change:**

1. PURPOSE. This advisory circular (AC) provides guidance for the site selection, design, and construction of buildings used to store and maintain airport snow and ice control equipment and materials.

2. CANCELLATION. AC 150/5220-15, Building for Storage and Maintenance of Airport Snow Removal and Ice Control Equipment: A Guide, dated March 25, 1983, is canceled.

3. APPLICATION. The standards contained in this advisory circular are recommended by the Federal Aviation Administration (FAA) for the design of airport snow and ice control equipment and materials storage facilities at civil airports. For airport projects receiving Federal grant assistance, the use of the standards contained in paragraphs 4c, 10, 12, and 13 is mandatory.

CHAPTER 1. INTRODUCTION

1. BACKGROUND. Airport operators utilize numerous pieces of sophisticated equipment for snow and ice control on the Nation's airports. Adequate storage and maintenance buildings are needed to protect and service this equipment.

a. These buildings provide a warm, sheltered environment for equipment repair and service. In addition, they protect the airport's investment by shielding equipment and stored materials from moisture, contaminants, and composition change.

b. Airport authorities frequently find it advantageous to include space in the building to store field lighting and other airport maintenance equipment, friction measuring equipment, rubber removal devices, and inspection or bird patrol vehicles.

c. These buildings, when adequately sized and centrally located on an airport, can provide a center for dealing with snow and ice conditions as well as a convenient location for fueling airport equipment.

d. Buildings of this complexity normally require site-specific design. Any sizable building located in an airport environment should be designed by an architectural and/or engineering firm familiar with airport needs and construction constraints.

2. EXPLANATION OF TERMS.

a. Building. The word "building" refers to structures designed and constructed specifically for the storage and maintenance of snow and ice control equipment and materials.

b. Equipment. The word "equipment" refers to all devices used by airport operators to control and remove snow and ice from operational areas. It includes displacement and rotary snowplows, sweepers, spreaders, carrier vehicles used for snow and ice control, and accessory equipment, e.g., front- end loaders, scrapers, etc.

c. Materials. The word "materials" refers to all approved substances used by airport operators to control snow and ice on operational areas. It includes solid and liquid de/anti-icers as well as abrasives (sand) to enhance friction.

3. GENERAL CONSIDERATIONS.

Airports which have a need for snow and ice control equipment also need maintenance and storage facilities to house that equipment. In designing these facilities, planners and airport operators must consider the following:

a. Equipment Maintenance. Equipment deterioration accelerates under conditions of freezing temperature, snow, rain, dust, sun, and chemical contamination. Routine maintenance of this equipment can be optimized if it is performed under sheltered conditions that are worker friendly.

b. Storage of Snow and Ice Control Materials. Abrasives and chemicals, stored outdoors, are subject to deterioration or composition change which can make them ineffective or unavailable for use. If possible, they should be stored in a sheltered environment.

c. Personnel. Morale and efficiency are directly related to environmentally friendly working conditions. These conditions can be enhanced by including sufficient office space, lavatories, locker rooms, and training/lunch rooms in the building design.

4. PLANNING CONSIDERATIONS. Although the information contained in this AC is recommended for civil airports, not all of it may be appropriate because of airport characteristics or budget, site, and other limitations. Conditions and requirements at each airport are usually unique and must be clearly understood by the decision maker before building dimensions and interior space set-asides are determined.

CHAPTER 2. FUNCTIONAL REQUIREMENTS

5. GENERAL.

a. Location. The building should be located near the airport's operational area and be situated in such a manner that associated activities (such as automobile parking) will not inadvertently block any airport fire lane or infringe upon any aircraft operational area. To avoid the problems inherent in traveling circuitous routes during heavy snow storms, the building should be located to permit equipment to move directly to and from aircraft operational areas. Figure 1 suggests, in order of priority, several typical sites. Private or service vehicles should not be required to cross runways or taxiways to get to and from the building. Additionally, a building should not restrict airport surveillance from either the control tower or the fire station, but shall conform with AC 150/5300-13, Airport Design, and be compatible with airport operations including those involving navigational aids.

b. Expansion. The building site should be capable of accommodating future building expansion.

c. Regulations.

(1) Building heights should be kept beyond or below the airport imaginary surfaces defined in AC 150/5300-13. Construction or expansion of a building will require that advance notice be given to the FAA.

(2) On federally assisted airports, the building and associated support areas should be shown on the approved Airport Layout Plan (ALP). The construction of this building normally does not require an environmental impact analysis; however, Environmental Protection Agency (EPA) regulations known as the "Storm Water Application Rule" must be complied with relative to storm and surface water discharges (see 12d).

6. ORIENTATION.

a. Siting. In those instances where orientation options are available, the building's face containing the large vehicle entrance doors should be parallel to the prevailing winter winds to allow the wind to sweep snow or other debris away from those doors. Where this orientation option is not available, fences and other buildings or vegetation can be incorporated into the site design to help keep equipment entrance doors and ramps free from this debris.

b. Fueling Facilities. Fueling facilities should be located on the leeward side of the building to protect them from hazards resulting from wind borne vapors and fuel spills. Provisions should be made for dealing with these spills.

7. EXTERIOR APPEARANCE AND LANDSCAPING. The exterior finish, landscaping, and overall appearance of the building should blend with the rest of the airport. This is especially important if the building is located near the terminal complex.

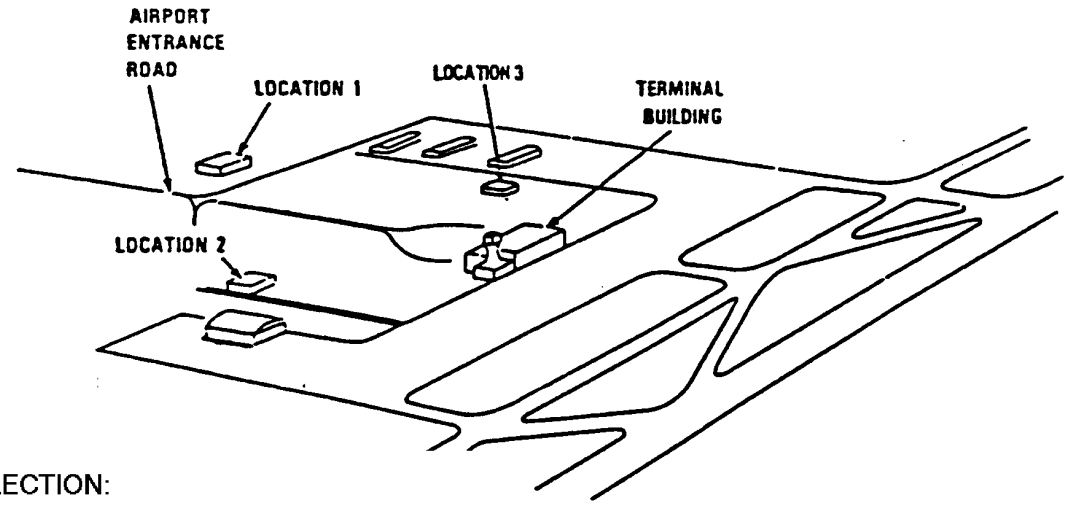
a. Exterior Finish. The building's exterior finish must be considered when selecting a site and orienting the building to the site. Metal frame buildings constructed with long-life siding are normally most economical. The exterior finish materials should be durable and require minimal maintenance. Metal siding, however, should not be used at locations where it could create interference with electronic navigational aids.

b. Landscaping. The landscape design should avoid trees, shrubs, and fences which could impede equipment movement, disrupt line of sight to the operational areas, obstruct the airport imaginary surfaces, or be difficult to maintain. Plantings and building exteriors should also avoid creating bird habitats.

c. Appearance. Consultation with a landscape architect, other design professionals, and a meeting with all interested parties during the early planning stages is desirable.

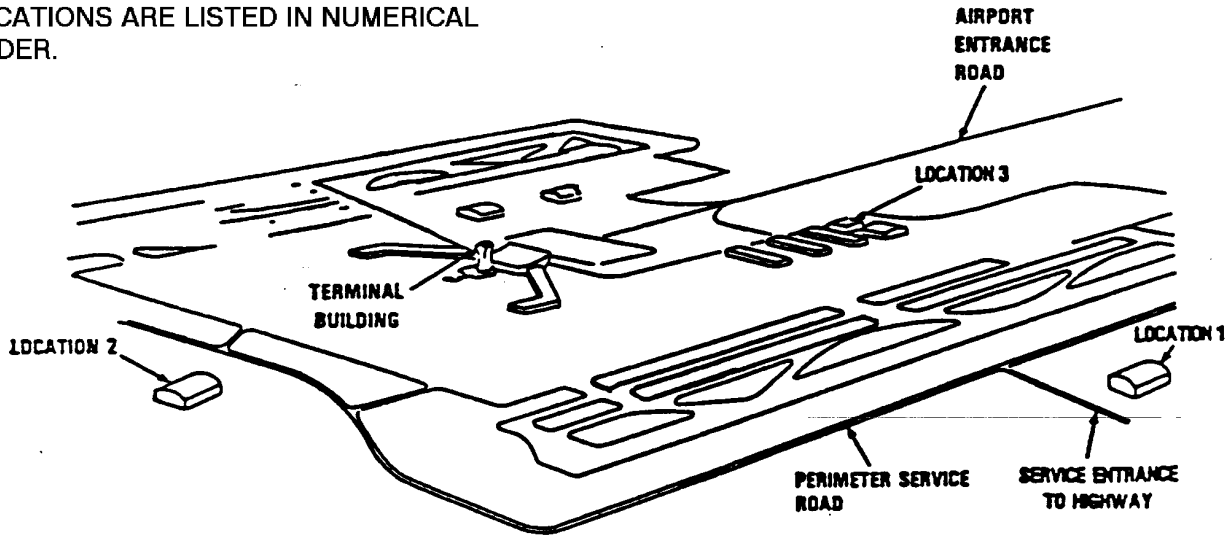
FIGURE 1.

AIRPORT EQUIPMENT MAINTENANCE & STORAGE BUILDING SITING



SITE SELECTION:

WHEN OPERATIONAL EFFICIENCY IS NOT IMPAIRED, PREFERRED LOCATIONS FOR MAINTENANCE/STORAGE BUILDINGS SHOULD AVOID REVENUE PRODUCING AREAS SUCH AS RAMPS AND HANGAR AREAS. PREFERRED LOCATIONS ARE LISTED IN NUMERICAL ORDER.



CHAPTER 3. BUILDING CONFIGURATION AND CONSTRUCTION REQUIREMENTS

8. GENERAL. The building should meet an airport's equipment and material storage demands and be economical to maintain.

a. Cost. Design choices should be based on building life-cycle cost.

b. Fire Protection. In most cases, the building will house mechanical equipment which use flammable fuels. Buildings should, therefore, be as fire resistant as possible and comply with local and national fire codes.

9. CONFIGURATION. The size, variety, and type of equipment needed to maintain winter operations at an airport, together with storage and personnel requirements, shall determine the geometrics of the building. The layout should expedite the movement of equipment and provide ready access to materials. Standard design configurations for equipment storage buildings are as follows:

a. Design Features.

(1) Central Aisle Design. An efficient design for large buildings is a central drive-through aisle, with back-in equipment stalls (see Figure 2). While providing central access to equipment parking spaces, this design requires fewer doors: usually one large door on each end of the building for equipment entrance and exit and one or more smaller access doors in the maintenance area for personnel. This type of design adapts well to modular-type additions.

(2) Drive-Through Design. A drive-through design features separate entrances for each piece of equipment to be parked (see Figure 3). Maneuvering of equipment preparatory to parking is done outside of the building; thereby, conserving interior floor space and reducing overall building costs. For larger buildings, however, the cost of the doors may outweigh the savings in building space.

(3) Back-in Design. Smaller buildings may be designed with a single door for each stall and back-in parking (similar to a one or two bay fire station).

(4) Modified Design. A design may combine features from the above designs.

b. Specific Features.

(1) General Storage. Areas will be required for storage of oil, grease, tires, antifreeze, hand tools, etc. To reduce the space needed for storage, some items which are used less frequently may be stored between roof trusses or over office ceilings.

(2) Material and Salt Storage. The best storage for abrasives, solid deicers, and salt is inside the building. Storage areas require adequate space to allow for the loading of materials onto spreader trucks. While it is desirable to have enough space to permit interior loading, the building design should, as a minimum, provide for material loading through exterior doors. Designers should allocate space for storage within the building in accordance with the guidelines presented in paragraphs 10 and 11.

(3) Machine Room. Sufficient space should be allotted for major power tools required to service equipment stored in the building. This room may also contain a limited parts storage facility, the mechanical equipment for heating, ventilating, and cooling the building, and the compressed air and hydraulic equipment needed to support the maintenance operation. Since most fire and safety codes do not permit storage of combustible materials in an equipment room, combustible parts or packaging will need a separate storage area.

(4) Combined Facilities. Some airport sponsors find it cost effective to house aircraft rescue and firefighting vehicles and equipment (ARFF) in one section of the building. This arrangement is satisfactory if the necessary personnel and facilities are available and if the choice of the site also follows the conditions as outlined in AC 150/5210-15, Airport Rescue and Firefighting Station Building Design. The space for housing ARFF vehicles should be partitioned to safeguard against tampering with the vehicles and unauthorized use of rescue tools and equipment.

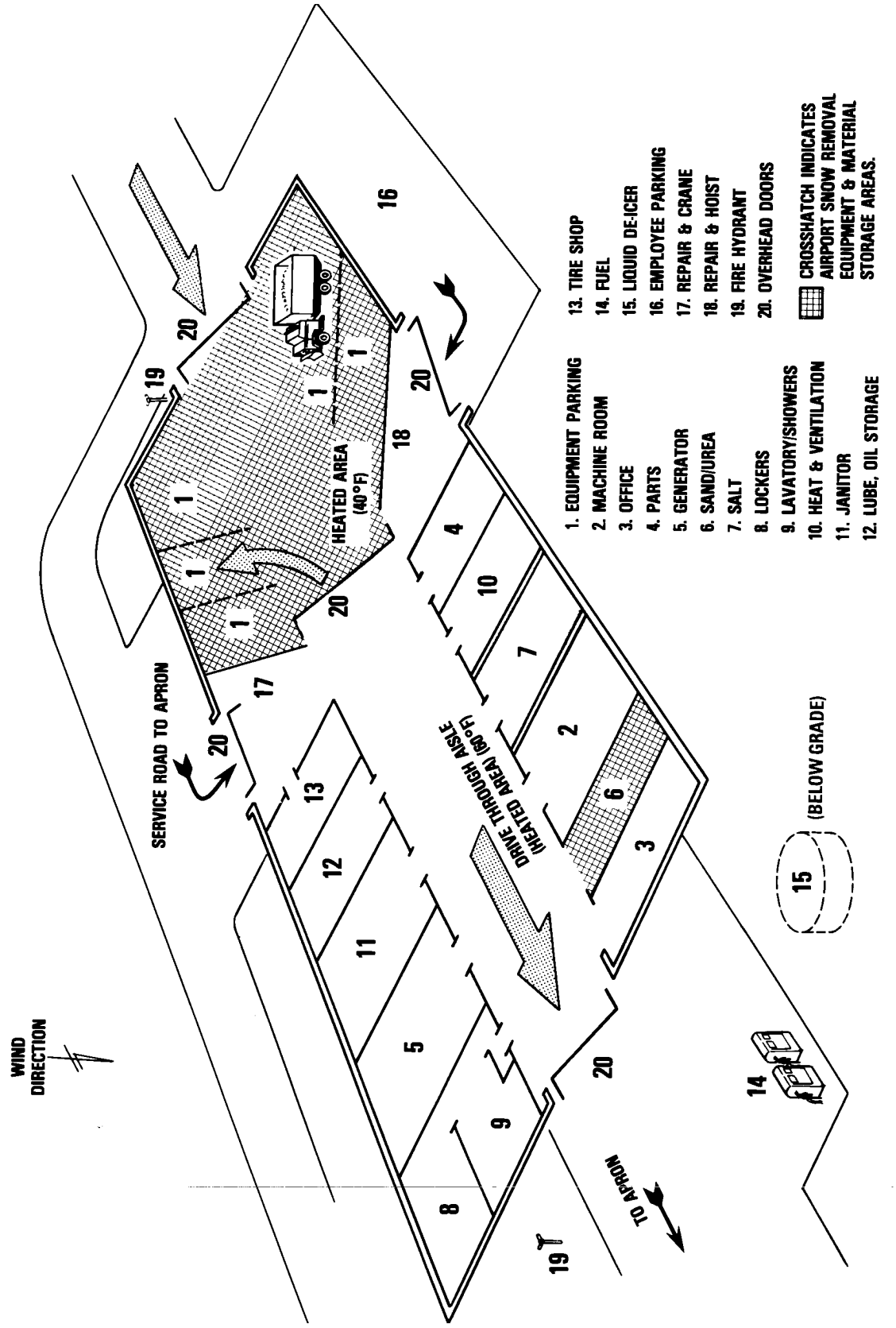


Figure 2. Typical Building Layout (Central Aisle Design)

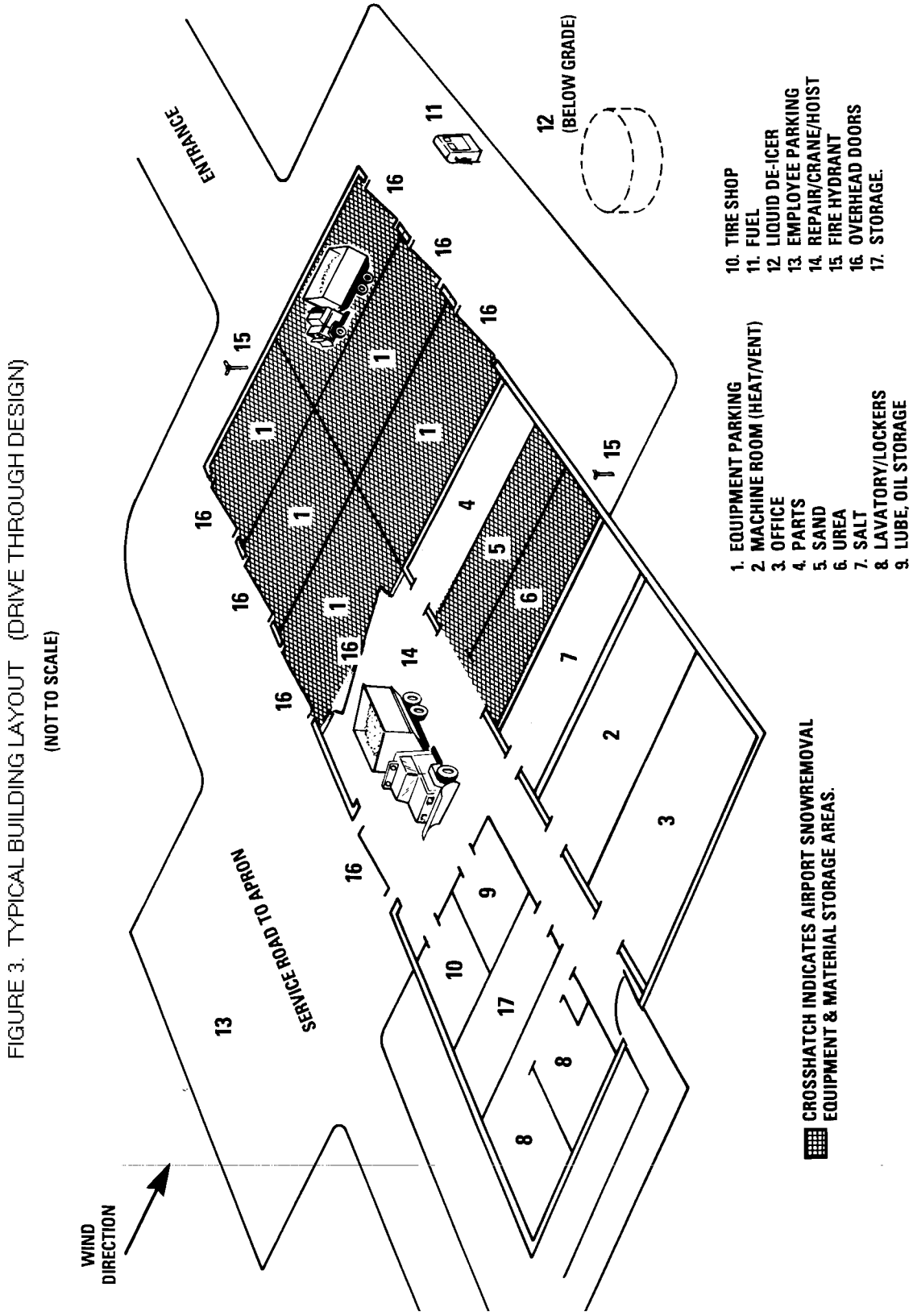


Figure 3. Typical Building Layout (Drive Through Design)

10. EQUIPMENT STORAGE. The following procedure, which is further discussed in Appendix 1, is recommended in planning floor area and space arrangements for equipment storage:

a. Rotary Snowplows. AC 150/5220-20, Airport Snow and Ice Control Equipment, recommends the number of rotary snowplows that will be needed at an airport. There should be one parking space of sufficient size to accommodate each rotary snowplow.

b. Displacement Snowplows. AC 150/5220-20 provides guidance when determining the number of displacement plows needed. There should be one parking space to accommodate each displacement plow and its carrier vehicle.

c. Spreaders and Sweepers. AC 150/5220-20 and AC 150/5220-12, Airport Snowsweeper Specification Guide, define the number of spreaders and sweepers needed to clear an operational area. There should be one parking space for each spreader and/or sweeper.

d. Floor Area Recommendations. Generally, the recommended area for a typical parking space is 25 feet by 40 feet (7.6 m x 12.2 m). Exceptions are the parking spaces for dry spreaders without plows and rotary snowplows with capacities under 600 tons/hr. These can normally be parked in a space 20 feet by 30 feet (6.1m x 9.2m). Smaller runway sweepers can normally be parked in a space 20 feet by 40 feet (6.1m x 12.2m). Appendix 2 provides general dimensions for various pieces of support equipment.

11. MATERIALS STORAGE.

a. Storage Methods.

(1) Abrasives and Solid Deicers. Abrasives and solid deicers including salt should be stored separately and kept dry to maintain the materials in a friable (loose) condition. Separation walls, particularly for salt, should be constructed of concrete and be located on the leeward side of the building, away from prevailing winter winds. They should have sufficient strength to contain the bulk materials being stored and the occasional rough treatment by loading equipment. In order to control moisture and improve interior illumination, walls should be parged, waterproofed, and painted. A drain in the abrasive storage area to remove water that may have collected in the material prior to delivery is recommended.

(2) Liquid Deicing Fluid. Bulk liquid deicing fluid may be stored in either above or under ground storage tanks outside of the building (see Figures 2 and 3). Inside storage may be considered for small quantities of deicer fluid in drums. Locations that normally experience severe weather conditions should consider insulation of above ground tanks to prevent the fluid from turning slushy. All underground storage tanks, together with their service lines, shall conform to EPA's underground storage tank requirements. All above ground tanks should be located in such a manner as to provide clear ramp areas for the movement of equipment.

(3) Salt. Salt must be used only on non-airside areas such as roadways, sidewalks, parking lots, etc. Because of its corrosiveness, it must be separated from abrasives and solid de/anti-icing materials approved for use on the airport's operational areas. Salt storage areas should also be designed to discourage or prevent personnel from inadvertently mixing the salt with airside deicing materials.

b. Space Needs. The area needed for storage of materials depends on the quantity of abrasives and deicing chemicals to be stockpiled for winter operations. Typical ranges for material storage areas are:

	Range Sq Ft	Range Sq M
Abrasives Storage (sand)	100-400	9.3-37.2
Bagged or Bulk Storage (deicers)	100-400	9.3-37.2
Salt Storage	100-300	9.3-27.9
Lubrication, Oil, & Grease Storage	100-150	9.3-14.0

12. SUPPORT AREAS.

a. Administrative and Maintenance Support Areas. Typical support areas are:

	Range Sq Ft	Range Sq M
Supervisor's Office	100-150	9.3-14.0
Mechanic's Office	100-150	9.3-14.0
Locker Room	50-200	4.7-18.6
Emergency First Aid Room	50-300	4.7-27.9
Lunch/Training Room	100-300	9.3-27.9
Lavatory	100-150	9.3-14.0
Parts Storage Area	100-150	9.3-14.0
Welding Area	100-200	9.3-18.6
Bench Area (along walls)	100-200	9.3-18.6
Tire Change and Tire Chain Installation Area	50-100	4.7-9.3
Repair Bay (30 to 40 feet by 20 to 25 feet)	600-1000	55.8-93.0
Steam Cleaning Bay (30 to 40 feet by 20 to 25 feet)	600-1000	55.8-93.0

b. Special Equipment Areas. Typical areas for special equipment are:

	Range Sq Ft	Range Sq M
Major Power Tools	50-100	4.7- 9.3
Machine Room (Heat/Vent etc.)	200-600	18.6-55.8
Hydraulic Lift, Vacuum Pump, and Air Compressor	50-100	4.7- 9.3
Steam Generator	100-150	9.3-14.0
Emergency Power Generator	100-300	9.3-27.9
Galley or Kitchen	100-420	9.3-39.1

c. Sample calculations. Sample calculations for an equipment and storage building at a hypothetical airport are shown in Appendix 1.

13. DESIGN AND CONSTRUCTION STANDARDS.

a. Local, State, and National Codes. All applicable local and national codes and ordinances must be followed in the design, construction or modifications of a building. Special attention should be given to buildings that are situated in areas that experience severe weather conditions or natural phenomena such as earthquakes or tornadoes.

b. Floors. The building should have a reinforced concrete floor slab of sufficient bearing capacity to support both dead and live loads exerted by equipment and materials.

c. Drainage. Floor drains with slotted cast steel covers should be provided in all areas of the building where melting snow may drop from equipment. The floor should be gently sloped to these drains to ensure against puddling and should be finished in a manner that would allow safe movement by personnel servicing the equipment. Threshold drains are recommended to handle the drainage from melting snow, to aid in the routine cleaning of the building, and to prevent water from collecting at the thresholds or in front of door openings where it may turn to ice. Floor drains should connect to a separate drainage system designed to collect, separate, or treat materials and industrial waste.

d. Clean Water Act. Airports are subject to the requirements of the Clean Water Act. The EPA's "Storm Water Application Rule" sets limits on the amount of pollutants that can be discharged directly into the surface waters of the United States. Drains and other building conduits must comply with the airport's overall discharge plan to ensure that the limits established under the rule or by the State are not exceeded. Guidance on handling potential surface water contamination may be found in AC 150/5320-15, Management of Airport Industrial Waste.

e. Ceiling Height or Vertical Clearance. Vertical clearances must accommodate the maximum height of any piece of equipment that is either budgeted for or currently in use at the airport. These clearances should maximize at 22 feet (6.7 m) floor to ceiling in the service area. This height will permit high profile vehicles to negotiate within the building as well as allow material spreader trucks to elevate their beds for maintenance.

f. Doors. Equipment shall access the building via overhead industrial- type doors that are of either roller or counterweight design. They should be made of heavy-duty, weather-resistant material that is easily repaired in the event of minor accidents.

(1) Clearance. Airport sweepers, displacement snowplows, and rotary snowplows are normally much wider than highway type vehicles and often have bulky projections not visible from the operator's position. For this reason, it is recommended that extra clearance be provided in door sizes. Minimum door size requirements are as follows:

(a) Large Equipment. Large displacement plows, rotary plows, and sweepers require doors 18 feet high by 25 feet wide (5.5 m x 7.6 m).

(b) Medium and Intermediate Equipment. Medium and intermediate size equipment require doors 18 feet high by 20 feet wide (5.5 m x 6.1 m).

(c) Small Equipment. For small equipment, doors 16 feet high by 18 feet wide (4.9 m x 5.5 m) are adequate.

(2) Weatherproofing. All overhead doors and exits should be weather-stripped to prevent the infiltration of air, moisture, and snow.

(3) Thresholds. A robust steel plate with checkered design on the top surface should reach from jamb to jamb in the door opening. In areas having an extremely cold climate, heated door thresholds with integral drains may also be necessary to prevent ice or frozen doors.

(4) Door Operators. Electric door operators should be installed on overhead doors which are used on a regular basis. Their design should provide for a manual override operation. Mechanical/electrical safety devices should be incorporated into overhead doors so that if the bottom edge of a door touches a person or machine, the door will automatically reopen.

(5) Door Frame Protection. Outside entryways, through which equipment passes, should be protected by free-standing guardposts and/or other impact resistant devices located at either side of the door opening. All interior door frames, through which equipment passes, shall also be protected by impact resistant devices embedded in or attached to the door jamb.

(6) Traffic Control. At least one glass panel, located at operators eye level for safety and traffic control purposes, shall be provided in doorways through which equipment passes.

g. Roof. Roofs should not only be designed to withstand snow and wind loads but should also have the structural capacity to accommodate light loads hung from or stored on roof trusses.

h. Insulation. Insulation of the roof and walls to control heat transfer and noise is recommended. If the building is located within an airport's DNL 65 dB to DNL 75 dB noise contour, acoustic insulation should be considered. Inside the DNL 75 dB contour, acoustic insulation is likely to be required. In the administrative area of the building, measures to achieve an outdoor to indoor noise level reduction of 25 dB are suggested (see Table 1 - Land Use Compatibility with Yearly Day-Night Average Sound Levels, FAR Part 150, Appendix A.)

i. Mechanical.

(1) Heat. Airport operators should equip the building with heating units that have the capability of maintaining a 40øF (4øC) temperature in the equipment service area and a 60øF (16øC) temperature in the maintenance and office areas. There are several types of heating arrangements that can provide acceptable service. Overhead systems in the service area are recommended and include gas or oil-fired unit heaters or gas or electrically energized infrared radiation systems. Baseboard or forced air systems are more appropriate for maintenance and office areas. Consideration should also be given to installing a heated floor system, particularly in the material storage areas where materials should be kept dry and friable, ready for use when needed for de/anti-icing and friction enhancement.

(2) Ventilation. Interior areas of the building, which are subject to vapor accumulation, must be ventilated in accordance with local building codes to preclude the buildup of fumes harmful to personnel or vapors which would damage mechanical equipment, corrode the roof deck, or saturate the insulation.

(3) Air Compressor. If compressed air is provided, the air compressor and tank system should deliver air at a minimum of 100 psi and provide a minimum of 60 cubic feet (1.8 cubic meters) of tank storage. Multiple quick disconnect outlets should be provided in the shop, tire change area, and other areas where compressed air may be needed.

(4) Engine Exhaust Discharge. Ducts should be provided to discharge engine exhaust from equipment service areas.

j. Lighting and Electrical.

(1) Service Panel. Electrical service panels should be installed in a readily accessible location.

(2) Lights. Lights should be manually controlled and be of industrial high bay, self-cleaning design used in dusty atmospheres. The following table may be used to estimate the electrical load for incandescent or fluorescent lighting in buildings:

AREA	ESTIMATED POWER REQUIREMENTS
Equipment Storage	1 watt/sq ft (1 watt/.09 sq m)
Repair Bays	5 watts/sq ft (5 watts/.09 sq m)
Offices/locker facilities, etc	5 watts/sq ft (5 watts/.09 sq m)

Exterior lighting in areas adjacent to door entrances should be provided to aid in equipment movements during low visibility conditions.

(3) Outlets. All storage, repair, and office/locker areas should have appropriate electrical outlets. Workbench areas should have outlets at bench level.

k. Fire Protection.

(1) Heat Detectors. Heat-activated fire detectors shall be placed at strategic locations throughout the building in accordance with the National

Fire Protection Association standards (NFPA-13) and local fire codes. This type of detector is particularly recommended in equipment storage and aisle areas of the buildings where exhaust from running engines could activate smoke actuated detectors.

(2) Fire Extinguishers. Fire extinguishers should be provided in battery, work bench, and solvent storage areas. Guidance for this protection can be found in the National Fire Protection Association's standard for portable fire extinguishers (NFPA-10).

14. INTERIOR FINISHES.

a. Interior Walls. Interior walls may be constructed of masonry, wood, or metal framing covered with sheet rock, metal sheeting, or comparable noncombustible materials.

b. Floors. Concrete sealer should be applied to all concrete floors. Floors should be painted only where floor area demarcation is necessary, e.g., walkways, safety zones, areas with restricted clearance, etc.

c. Roof. Steel joints and the underside of roof decks should be painted with a suitable finish to protect against the corrosive condensation produced by the drying of wet materials or equipment in an enclosed area.

15. PROVISIONS FOR INDIVIDUALS WITH DISABILITIES.

The Americans with Disabilities Act, P.L. 101-336, (ADA) requires that any public or private entity which provides public accommodations must:

a. Ensure that new buildings and facilities are designed and constructed to be free of architectural and communication barriers that restrict access or use by individuals with disabilities;

b. Ensure that existing buildings and facilities be altered to be readily accessible by individuals with disabilities, to the maximum extent feasible;

c. Furnish auxiliary aids, services, and/or telecommunication devices to afford communication by the disabled.

Designers and renovators of buildings and other facilities on airport properties will be required to meet these provisions. Guidance relative to their implementation may be found in the following documents:

a. The Uniform Federal Accessibility Standards (41 CFR Part 101, Appendix A) and the ADA Accessibility Guidelines for Buildings and Facilities (28 CFR Part 36 Appendix A) provide overall requirements needed for the design and construction or alteration of buildings and facilities.

b. The Department of Transportation rules governing transportation for individuals with disabilities (49 CFR Parts 27, 37, and 38) provide additional guidelines specific to airports.

For still more information about ADA requirements, contact should be made with the Architectural and Transportation Barriers Compliance Board at (800) USA- ABLE.

APPENDIX 1. EXAMPLE OF BUILDING SIZE COMPUTATION

This Appendix provides sample calculations to size an airport equipment, storage and maintenance building. In order to develop the geometrics for this building, the planner determines individual space needs for equipment, storage, and personnel. Accurate information on the operational areas to be cleared of snow and the airport's activity level is also required.

In this example, a hypothetical commercial service airport (VIP International) is used to illustrate a method in determining building size. This airport has over 40,000 annual operations and 1,600,000 square feet (148,800 square meters) of priority one pavement to be cleared of snow.

1. Parking Spaces.

a. Rotary Snowplows. The rotary snowplow is the critical piece of equipment needed in determining an airport's equipment needs. Once the number and type of rotary plows are determined, the number of displacement snowplows, spreaders, sweepers, etc., can also be determined. Using AC 150/5220-20, we find that two class IV rotary snowplows are needed requiring two separate parking spaces within the building.

b. Displacement Snowplows. The number of displacement snowplow units required is dependent on the selection and number of rotary plows discussed in paragraph a above. As a general rule, each rotary snowplow is supported by two displacement snowplows. More specific guidance on the selection of displacement snowplows may be found in AC 150/5220-20.

c. Spreaders. A conventional dry spreader having a hopper capacity of 8 cubic yards can cover about 750,000 square feet (69,700 square meters) of pavement area with urea applied at the recommended application rate. Accordingly, two spreaders will be required at VIP International. One liquid spreader for de/anti-icing will also be required. Specifics on application rates, hopper capacities, and tank sizes are more fully discussed in AC 150/5220-20. Three parking spaces within the building will be needed for this equipment.

d. Sweepers. Two large sweepers having a swath width greater then 12 feet will be required to sweep and clean snow from the aircraft operational areas. Additional information on sweepers may be found in AC 150/5220-12, Airport Snowsweeper. Separate parking spaces within the building for these sweepers will be required.

e. Front-End Loaders. One front-end loader will be required with appropriate parking within the building.

2. Building Floor Area.

a. Equipment Parking Area. Using the standard parking space dimensions shown in paragraph 9d, the recommended floor area for equipment storage is calculated as follows:

	Square Feet	Square meters
Two class IV rotary snowplows 25 ft by 40 ft (7.6m x 12.2m)	2,000	186
Four displacement plows 25 ft by 40 ft (7.6m x 12.2m)	4,000	371
Two spreaders (dry) 20 ft by 30 ft (6.1m x 9.2m)	1,200	112
One spreader (liquid) 25 ft by 40 ft (7.6m x 12.2m)	1,000	93
Two sweepers 20 ft by 40 ft (6.1m x 12.2m)	1,600	149
One front end loader 20 ft by 40 ft (6.1m x 12.2m)	800	74
Subtotal for equipment parking	10,600	985

b. Ancillary Support Area. The ancillary support area is calculated using floor area recommendations shown in paragraph 11. The following dimensions are considered typical for a medium-size commercial airport:

	Square Feet	Square Meters
One combined lavatory and locker room	350	33
One lunch/training room	300	28
One supervisor's office	150	14
One mechanic's office	150	14
One parts storage room	150	14
One lube oil, grease room	150	14
Welding area	200	19
Tire change/chain area	100	9
Machine Room (Heat/vent etc.)	600	56
Bench area	200	19
Wash and steam cleaning bay	800	74
Two repair bays	2,000	185
One sand storage room	400	37
One salt storage room	300	28
One urea storage room	400	37
Emergency power generator area	280	26
First Aid Room	280	26
Janitor's closet	100	9
Storage area (Misc.)	450	42
Steam clean area	1,000	93
Subtotal for ancillary support area	8,360	777

c. Aisle Areas. Maneuverability of equipment within a building is provided by aisle space. For VIP International, a central aisle building design was chosen for overall efficiency. It is estimated that an aisle 30 feet (9.1 m) wide and 240 feet (73.2 m) long will be required.

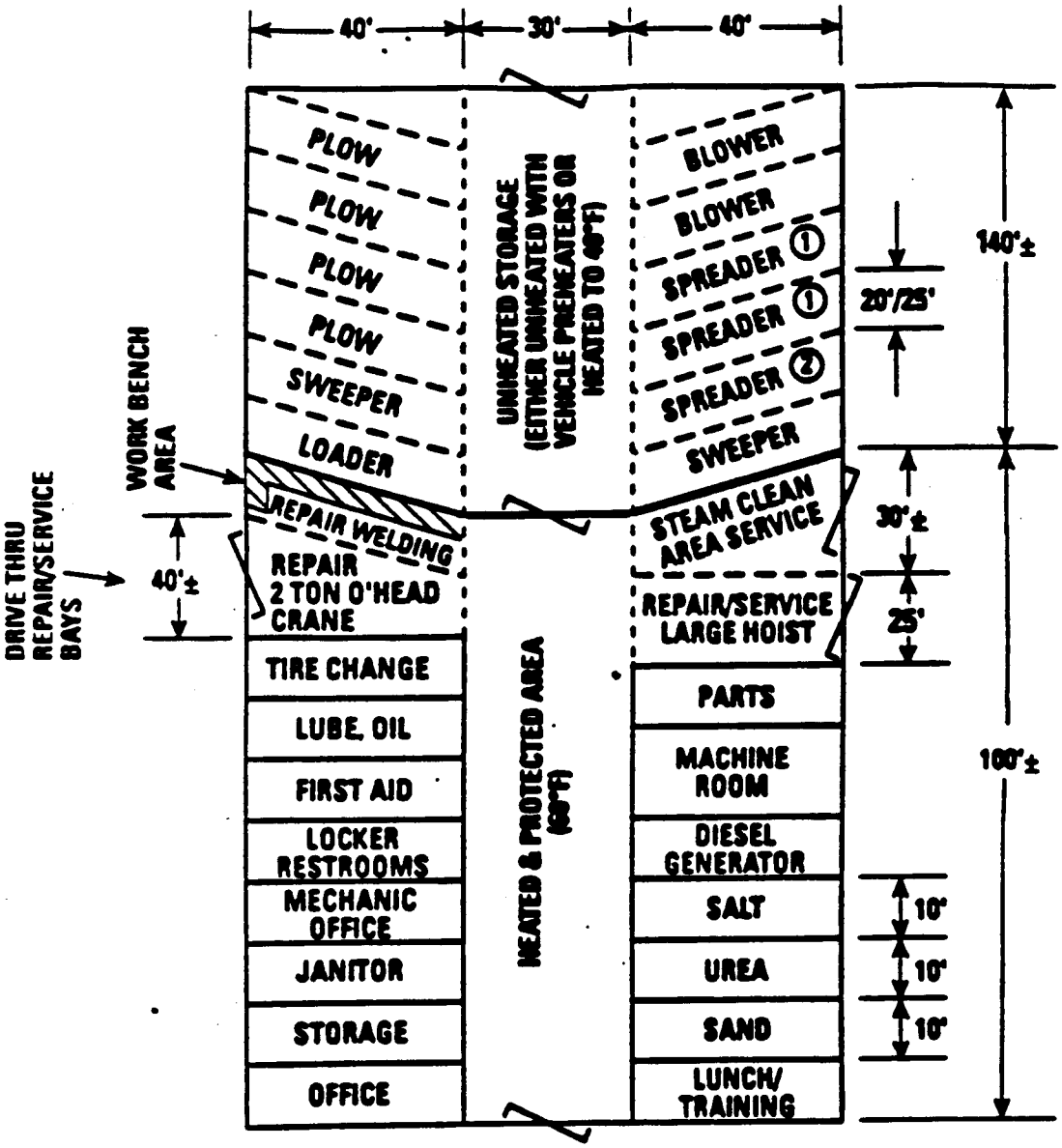
	Square Feet	Square Meters
Subtotal for aisle space	7,200	669

d. Total Building Area.

	Square Feet	Square Meters
Equipment Parking Area	10,600	985
Ancillary Support Area	8,360	777
Aisle Area	7,200	669
Total Building Area	26,160	2,431

These calculations suggest a building having a floor area of about 26,200 square feet (2,434 square meters) with overall dimensions 240 feet long (73.2 m) by 110 feet (33.5 m) wide. Doors and aisles will be 25 feet wide (7.6 m), and there will be a 22 foot (6.7 m) floor to ceiling clearance in the service areas. The layout for this example is shown in Figure A1. Although the parking/storage areas may seem narrow considering the width of large equipment such as snowplows and sweepers, the sweeper heads or snowplows will be angled when parked to conserve space and provide adequate clearance.

FIGURE A1. **SAMPLE CALCULATED BUILDING LAYOUT**
CENTRAL AISLE TYPE
(NOT TO SCALE)



TYPICAL BUILDING FOR 1,600,000 FT^2
OPERATIONAL CLEARANCE AREA WITH 40,000 OR MORE ANNUAL AIR CARRIER OPERATIONS.

ALL DOORS – 25' WIDE/20' HIGH

①DRY ②LIQUID

Figure A1. Sample Calculated Building Layout

APPENDIX 2. SNOW REMOVAL EQUIPMENT DIMENSIONS

Equipment	Dimension	Maximum	Minimum
Rotary Snowplow	Height	13 ft (4.0m)	10 ft (3.1m)
	Width	9 ft (2.8m)	7 ft (2.1m)
	Length	30 ft (9.2m)	21 ft (6.4m)
Sweepers			
Towed Type	Height	7 ft (2.1m)	5 ft (1.5m)
	Width	16 ft (4.9m)	10 ft (3.1m)
	Length*	31 ft (9.5m)	18 ft (5.5m)
Pushed Type	Height	13 ft (4.0m)	9 ft (2.8m)
	Width	24 ft (7.3m)	13 ft (4.0m)
	Length	37 ft (11.3m)	24 ft (7.3m)
Displacement Plows**			
Power Reversible	Length	28 ft (8.5m)	16 ft (4.9m)
Rollover	Length	10 ft (3.1m)	8 ft (2.4m)
Flexible Reversible	Length	11 ft (3.4m)	9 ft (2.7m)
Expressway	Length	15 ft (4.6m)	12 ft (3.7m)
Spreader Vehicle (Dry)	Height	9 ft (2.8m)	
	Height***	18 ft (5.5m)	
	Length	23 ft (7.0m)	
Spreader Vehicle (liq)	Height	11 ft (3.4m)	8 ft (2.4m)
	Width	11 ft (3.4m)	8 ft (2.4m)
	Length	34 ft (10.4m)	23 ft (7.0m)
Graders	Height	12 ft (3.7m)	
	Width	10 ft (3.1m)	
	Length	3 ft (10.1m)	
Wheel Loaders	Height	12 ft (3.7m)	
	Width	20 ft (6.1m)	
	Length	20 ft (6.1m)	

* Uncoupled from towed vehicle

** Large plows are generally uncoupled and stored outside when not in use. For interior storage of smaller plows with carrier vehicle, add an additional 20 feet (6.1m) to the dimensions shown.

*** Bed Raised