DEPARTMENT OF VETERANS AFFAIRS
DESIGN INSTRUCTIONS TO ARCHITECTS AND ENGINEERS

LOCATION :

PROJECT TITLE :

PROJECT NO. :

[ ] SCHEMATICS [ ] DESIGN DEVELOPMENT [ ] CONSTRUCTION DOCUMENTS

_____________________________________________________________________

AUTOMATIC TRANSPORT

TRANSPORT SYSTEMS (ELEVATORS) DESIGN MANUAL FOR:

[ ] HOSPITAL, CLINICAL ADDITION, PSYCHIATRIC

[ ] AMBULATORY CARE/OUTPATIENT CLINIC

[ ] DOMICILIARY

[ ] COMMUNITY LIVING CENTER

[ ] ENERGY CENTER

[ ] PARKING STRUCTURE

[ ] VBA OFFICE BUILDING

[ ] LAUNDRY

[ ] WAREHOUSE

FROM: 

DATE: 

Package Preparer:
Telephone Number:
CONTENT

1. General---------------------------------------------------------------3
2. VA Automated Transport Design Standards-----------------------------3
3. Elevators-------------------------------------------------------------4
4. Size and Number of Elevators----------------------------------------5
5. Service Demand Guidelines-------------------------------------------6
6. Power Door Operation-----------------------------------------------8
8. Elevator Hoistways-----------------------------------------------9
9. Elevator Pits---------------------------------------------------------9
10. Elevator Machine Room---------------------------------------------10
11. Basic Electrical Notes---------------------------------------------10
12. Hoistway Venting---------------------------------------------------12
13. Drawings------------------------------------------------------------12
15. Automated Transport Systems Master Specifications Index-----------13
16. Electrical Specification--------------------------------------------14
1. GENERAL

A. The automated transport equipment for new facilities shall be included in the general contract with specification sections prepared for each transport system as required.

B. The requirements of the latest editions of the ASME A17.1 Safety Code for Elevators and Escalators, National Electric Code (NEC), International Building Code (IBC), constitutes the minimum requirements of all transportation systems, including design, methods of construction, manner of installation, and testing.

2. VA AUTOMATED TRANSPORT DESIGN STANDARDS

A. Curved hoistway door jamb.

B. Solid grouting of door jamb.

C. Two emergency stop switches in every elevator pit.

D. Cab walls constructed of 14 gauge steel and canopy constructed of 12 gauge steel.

E. Stainless steel clad hoistway and car doors.

F. Traction Elevators:

1. Machine and Controller located in a code approved machine room.

2. Minimum 1/2"x8x19 or 1/2"x8x25 preformed traction steel hoist ropes.

G. Hydraulic elevator:

1. Controller and Pump assembly located in a code approved machine room.

2. Automatic shut-off valve located next to the cylinder head.

3. Oil line manual shut-off valve located in the pit and machine room.

4. Oil return scavenger pump located in the pit.

H. Hoistway lighting.

I. Motorized hoistway louvered venting activated by top of hoistway smoke detector. The smoke detectors shall activate hoistway venting and alarms in accordance with Hoistway Venting System Design Criteria and NFPA72.
3. ELEVATORS

A. Passenger elevators are used to transport the public, hospital staff, ambulatory and wheelchair patients.

B. Hospital service elevators are used to transport employees, patients, carts, and equipment. Patients may be in wheelchairs, beds, and gurneys.

C. Combination passenger and service elevators are installed where combined use is possible without interfering with normal activities in hospitals, outpatient clinics, domiciliary, and nursing home facilities.

D. Elevators shall be provided in all facilities having two or more floors and shall be designed for the type of traffic anticipated. Passenger and service elevators shall be sized to accommodate special equipment used by handicapped persons.

E. Elevators for limited special use, such as those for private passengers, are economically undesirable. They shall not be installed unless they can be fully justified. The use of slow speed elevators shall be considered and separated from other traffic if required for mortuary use or the transport of animals.

F. When planning the location of elevators, the following principles shall be observed:

1. Elevators shall be located so that the building entrances with the heaviest traffic will have adequate elevator service. Elevators shall be as near to the center of the building as practical, taking into consideration the distance from the elevators to the most distant patient care areas.

2. Locate elevators to serve all floors that require service, including the basement, sub-basement, overhead mechanical spaces as well as all of the typical floors of the building. Avoid placing elevators or dumbwaiters over occupied spaces as this will require counterweight safeties and reinforced pits.

3. Elevators shall be grouped in banks of adjacent cars or banks of cars facing each other. Do not exceed three service cars in a bank or three passenger cars in a bank, and not more than six cars in a group of facing banks.

4. Consideration shall be given to the maximum walking distance from the elevators to the most distant patient care areas. This factor shall be weighed along with the advantages of locating elevators near the center of the building and the advantage of elevator clustering. In general, the maximum walking distance to elevators should not exceed 60 m (200 ft). Decentralized elevators should be planned to include at least two cars to maintain an acceptable dispatch interval and insure continuity of service.
5. The lobby width between two banks of passenger elevators shall not be less than 3.6 m (12 ft). Service elevator lobbies shall not be less than 4.2 m (14 ft).

4. SIZE AND NUMBER OF ELEVATORS

A. The size and number of elevators required for a building depends upon the size and function of the building, density of population, the physical location and grouping of elevators. The overall annual cost of the transport systems, including amortized costs of the original investment, cost of maintenance, material, and consumed power shall be considered.

B. Estimating the number of elevators required:

1. The anticipated population density figures shall be provided by the Department of Veterans Affairs to assist in the system design. However, in all cases, the vertical transportation requirements shall be planned for the total population that the facility could reasonably house, rather than a forecast of initial occupancy.

2. Maximum traffic peak. This is the maximum percentage of the total population on the floors served by the elevators that must be handled during any 5 minute period. This maximum traffic peak will vary with the type of functional areas and special conditions applicable to the facility. In general, the maximum traffic peak shall be considered as being up peak by the 24 hourly summaries based on elevator loading at the lower main terminal, or terminals, local discharge of passengers on the up trip and express runback to the lowest main terminal.

3. The computations for vertical transportation equipment shall be based on transporting 10 to 14 percent of those persons who move between floors during periods of maximum demand in five minutes. The peak values, together with the population density factor should provide a reserve capacity adequate to maintain reasonable satisfactory service during periods when one elevator is shut down for repairs.

4. Possible changes in the type of occupancy and reassignment of building areas that would result in a greater volume of traffic shall be investigated. When possibilities exist, the building framing shall be arranged to permit future installation of additional elevator equipment that will be required to handle future increase in traffic volume.

5. Special conditions which must receive consideration in estimating elevator requirements include cafeteria traffic, canteen store traffic, dietary distribution and retrieval, transient traffic, visitor traffic, outpatient traffic, pharmacy, building management, SPD, surgery warehousing, spinal cord injury, grouping of elevators, external transport facilities, building entrances at more than one level, basement facilities, unusual inter-floor traffic requirements, and trash removal if chutes are not used.
6. Where groups of elevators serving identical floors are required in two or more locations for the purpose of providing reasonable convenience of use, the elevators shall provide a minimum carrying capacity of not less than 120 percent of the maximum traffic peak.

7. Passenger and service elevators shall be capable of handling their maximum peak loads while providing satisfactory interval of service.
   
a. Capacity and speed shall be selected that will require the least number of elevators to handle the peak loads with an acceptable interval. Passenger elevators in a group shall have an interval of 45 seconds maximum. Service elevators in a group shall have an interval of 60 seconds maximum.
   
b. Passenger elevators, except special outpatient elevators or other special purpose elevators, shall have a capacity of 1815 kg (4,000 lb). When separate service elevators are provided, they shall have a minimum capacity of 2270 kg (5,000 lb).
   
c. Where one elevator would normally meet the requirements in the facility where patient elevator service is essential, facilities with two (2) or more floors shall have two (2) elevators installed to insure continuity of service.

5. SERVICE DEMAND GUIDELINES

   A. The equipment specified shall depend upon the service demand and the equipment commercially available to meet those demands.

   1. Overhead gearless or geared hoisting machines shall be used for elevators in buildings of ten floors or less. Only gearless machines shall be used for elevators in buildings eleven floors or more. Machines and controllers shall be located in overhead machine rooms. The placing of hoisting machines in basement machine rooms or in machine rooms adjacent to the hoistway shall be limited to conditions that do not permit the installation of overhead machines.

      a. Single wrap geared traction configuration may be used for speeds up to 1.75 m/s (350 fpm).

      b. Single wrap gearless traction configuration may be used for speeds up to 2.03 m/s (400 fpm) roped 2:1.

      c. Double wrap gearless traction configuration shall be used with speeds of 2.5 m/s (500 fpm) and greater roped 2:1.

   2. Microprocessor Control System with VVVF AC Regenerative Drive shall be used on electric traction elevators.

      a. All control systems shall be non-proprietary.

      b. Proprietary tools shall not be necessary for adjustments, maintenance, and testing.
c. The control systems vendors shall provide factory training, and engineering technical support to the VA Medical Center’s designated Elevator Maintenance Service Provider.

d. Replacement parts shall be shipped overnight within 48 hours of an order being received.

3. Oil hydraulic direct plunger elevators will be considered for limited rise up to four stops, 12.2 m (40 ft) with a rated speed of 0.63 m/s (125 fpm). A Microprocessor Control System with Electronic Motor Starter shall be used on hydraulic elevators. Do not use Wye-Delta or across the line starters.

4. Operations: In general, the following systems of operation shall be provided for elevators:

a. Single car selective collective operation.

b. Two car banks of elevators shall have duplex selective collective automatic operation with zone dispatching.

c. A group of three or more elevators shall have group automatic operation with zone dispatching.

5. Special service features and emergency requirements should be anticipated. Possible areas for consideration are surgery, intensive care, cardiac emergency, emergency receiving and dietary usage. Medical Emergency Service may be required.

B. Elevator capacity and platform design:

1. Passenger elevators, with single speed center opening doors, shall be 1818 kg (4,000 lb) capacity not to exceed 3.92 square meters (42.2 square feet) inside net platform area.

2. Passenger/Service elevators, with two speed side opening doors, shall be 1818 kg (4,000 lb) capacity not to exceed 3.92 square meters (42.2 square feet) inside net platform area.

3. Service elevators, with two speed side opening doors, shall be 2273 kg (5,000 lb) capacity not to exceed 4.65 square meters (50 square feet) inside net platform area.

4. Bariatric elevators, with single speed center opening doors or two speed side opening doors, when required, shall be a minimum of 2727 kg (6,000 lb) capacity not to exceed 5.36 square meters (57.7 square feet) inside net platform area.

C. Maximum size and weight of electric powered vehicles, carts, portable medical, and X-ray equipment shall be determined before selecting elevator size and capacity. Maximum area allowed by the ASME A17.1 Code shall be used to determine inside dimensions of car enclosure.

D. Elevator cars: Car enclosures shall be front entrance or front and rear entrance and shall be of standard design unless modifications are dictated due to special project conditions. Cab designs shall be
detailed on the architectural drawings. Materials for elevator cabs shall be selected so the car enclosure conforms to ASME A17.1 and the specifications.

1. Car enclosure shall have a dome height inside the cab of 2440 mm (8 ft).

2. Car enclosure base shall be 14-gauge stainless steel, 152 mm (6 in.) high.

3. Construct canopy of not less than 12-gauge steel.

4. Front return wall panel, entrance columns, rear corner columns, entrance head-jamb and transom shall be 14-gauge stainless steel full height of car.

5. Side and rear walls up to 1220 mm (48 in.) above finished floor shall be covered with stainless steel directly applied to the walls or raised panels. Side and rear walls from 1220 (48 in.) above finished floor to the ceiling shall be covered with high pressure plastic laminate or stainless steel directly applied to the walls or raised panels.

6. Car doors shall be reinforced two panel construction, wrapped with stainless steel on the inside surface, leading and trailing edges.

E. Entrances for Passenger, Service and Freight Elevators:

1. Doors shall be single speed center opening or two speed side slide. Hoistway doors shall be reinforced two panel construction, wrapped with stainless steel the outside surface, leading and trailing edges. Do not use two speed center opening doors.

2. Passenger elevator entrance width: 1220 mm (4 ft) standard.

3. Service elevator entrance width: 1220 mm (4 ft) standard, 1523 mm (5 ft) optional if required by facilities function.

4. Door opening height: 2133 mm (7 ft).

5. Freight elevators: Hoistway bi-parting doors and car gate shall have automatic power operation. Opening size determined by facilities function.

6. POWER DOOR OPERATION

A. Provide power door operation for all elevators.

1. Passenger/Service door operator shall be capable of opening doors at the rate of 0.75 m/s (2.5 fps). This is a capability speed, with actual speed being adjusted to meet requirements of the specific installation. Freight door operator shall open at 0.3 m/s (1 fps).

2. Closing speed shall be 0.3 m/s (1 fps). All power operated doors shall be equipped with an automatic reopening device for passenger
protection. Do not activate door nudging. Use audio voice announcement, “please stand clear of the doors”, and activate the nudging buzzer.

7. HANDICAPPED PROVISIONS

A. All equipment shall meet the requirements of the Uniform Federal Accessibility Standards (UFAS), Americans with Disabilities Act (ADA), for architectural barrier free requirements.

8. ELEVATOR HOISTWAYS

A. All hoistways shall comply with IBC and ASME A17.1. Structural supports shall be provided at each floor for securing guiderail brackets. Provide intermediate supports between floors where the distance between floors or structural supports exceeds 4.2 m (14 ft) or as needed by seismic requirements. Supports for guide rails shall be shown on structural drawings and included as part of the structural framing of the building.

B. The interior face of the hoistway walls shall have a smooth, flush, light colored surface. Exposed spray-on fire proofing shall not be used in the elevator hoistway.

C. Hoistway sizes for elevators with their overhead and pit clearances shall be shown on construction details sheets. These clearances are based on car structures and heights of commercially obtainable equipment together with runby and clearance requirements of ASME A17.1.

9. ELEVATOR PITS

A. Pit depths shall meet the requirements of ASME A17.1. Provide two stop switches in the pit, 1220 mm (48 inches) above the bottom landing at the top of the pit ladder and 1220 mm (48 inches) above the pit floor adjacent to the pit ladder.

B. Pits shall be provided with a fixed vertical steel access ladder for each elevator. The ladder shall be located within reach of the elevator hoistway entrance door unlocking device at the bottom landing and clear all elevator equipment.

C. Pits 2440 mm (8 ft) and deeper shall be provided with a permanent means of external access. Where external access is impractical a permanent ladder accessible from the bottom hoistway entrance door shall be provided in each pit in accordance with ASME A17.1. The external access shall be carefully studied before it is declared impractical.

D. Door to pit space shall be of fire resistant construction and shall be provided with self closing, self locking hardware, and arranged so that a key is required for entry.

E. Elevator pit shall have sump pits covered with a removable grating. If required, drain or pump shall have the capacity to remove a minimum of
10. ELEVATOR MACHINE ROOMS

A. Elevator machine rooms shall be large enough to install the elevator machine, including space for controller and other related equipment. Clearances for control equipment shall not be less than required by the National Electric Code, and with enough working space between the various items of equipment for maintenance purposes. It must be possible to remove major equipment components of each elevator for repair without dismantling components of an adjacent elevator. Minimum headroom shall be 2134 mm (7ft).

B. Elevator machine rooms shall be of fire resistant construction equivalent to hoistway construction. The machine room side of floors, ceilings, and walls shall have a smooth surface. Exposed spray on fireproofing shall not be used in elevator machine rooms. Walls, ceilings, and floors shall be painted a light color. Floors shall be sealed to eliminate concrete dust.

C. All openings in the floor for passage of hoist ropes, etc. shall have 50 mm (2 in) high metal sleeves.

D. Elevator machine room access door shall conform to ASME A17.1.

E. Industrial stairs shall be provided for access to machine rooms. Access to machine rooms should preferably not require passage across a roof or similar exposed area.

F. Geared or gearless machines and deflector sheave shall be mounted on a vibration and sound isolating base. These isolating devices shall conform to seismic design requirements.

G. Skylights shall not be installed in elevator machine rooms.

H. Provide air conditioning, heating, and ventilation in machine rooms that meet the requirements of the elevator equipment manufacturer.

I. Lighting shall be provided to insure proper illumination in the front and rear of all controllers, supervisory panels and over each hoisting machine.

11. BASIC ELECTRICAL NOTES

A. Power Supply:

1. Each elevator shall be provided with a separate three phase power supply through a shunt trip circuit breaker and surge suppressor located in the respective machine room, adjacent to the entry and with clear access. The supply should terminate at the respective elevator controller. Indicate the design electrical loads; (horsepower, voltage, amperage, etc.) switch sizes, breaker settings, wire sizes and conduit sizes.
2. The elevator power supply shall be a dedicated main feeder utilizing the shortest practical run and continuous ground conductor as required by NEC.

B. Auxiliary Power Supply:

1. The elevators shall have auxiliary power available with the capacity to operate a minimum of one elevator per group.

2. If emergency generator is not available, traction elevators shall be provided with an auxiliary power system that will run the elevator to the nearest floor, open the doors, and maintain an energized door open button.

3. If emergency generator is not available, hydraulic elevators shall be provided with an emergency lowering system to lower the elevator to the bottom floor, open the doors, and maintain an energized door open button.

C. Ground-Fault Circuit-Interrupter Protection for Personnel (GFCI):

1. Each elevator machine room shall be provided with a minimum of one GFCI receptacle per elevator.

2. Each elevator pit shall be provided with one GFCI receptacle per elevator.

D. Communication:

1. Each elevator shall be equipped with a Hands Free Telephone located in the auxiliary car operating panel. Conduit and wire shall be provided from the elevator machine room to a 24 hour monitoring location.

E. Fire Alarm Initiating Devices:

1. Fire Alarm Initiating Devices shall be installed in elevator lobbies, top of hoistways, elevator machine rooms and conform to the requirements of ASME A17.1, NFPA 72, and IBC.

F. Heat Detectors and Sprinkler Heads:

1. Shall meet the requirements of IBC, NFPA 13, and ASME A17.1.

G. Machine Room Appliance Panel:

1. Provide a circuit breaker panel capable of locking the disconnecting means in the off position in each machine room. The panel shall contain:

   a. A separate emergency power circuit to supply 120 Volts to each elevator for fan, lights, and alarm.

   b. A separate circuit for the machine room lights.
c. A separate circuit for the machine room GFCI receptacles.

d. A separate circuit for the hoistway lights.

e. A separate circuit for hoistway GFCI receptacles.

f. Each hydraulic elevator shall be provided with a separate circuit for the scavenger pump in the pit.

g. Provide fluorescent lighting fixtures in the elevator hoistway. The lights are to be stacked vertically in a back corner wall for a single elevator or on the back wall between the divider beams of a duplex or triplex installation. The extreme top and bottom fixtures shall be mounted to illuminate the pit area when the car is at the bottom landing and the car top when the car is at the top landing. A three way light switch is to be provided at the top of the pit ladder and five feet above the top terminal landing at the inside front wall near the hall button box.

12. HOISTWAY VENTING FOR VA ELEVATORS

A. VAFM and IBC require that all elevator hoistways that penetrate more than three floors shall be vented to prevent accumulation of hot gases and smoke inside the hoistway. This requirement includes cartlifts and dumbwaiters if equipped with top of car operation by service personnel.

B. The required vent shall be controlled by a motorized louver that is powered closed. This louver shall open upon loss of electrical power or by a signal from a smoke detector activated at the top of the elevator hoistway.

13. DRAWINGS

A. Separate architectural drawings shall be prepared for the transport systems. Elevator drawings shall show electrical services, materials, sizes, details, space conditions, etc., of hoistway enclosures, pits, cabs, entrances, machine rooms, and other features. The elevator drawings shall be coordinated with the other architectural, structural, mechanical, and electrical drawings to insure that proper space conditions and other requirements have been provided.

B. The spaces shall be designed to accommodate the elevator equipment specified.

C. Architectural drawings shall show reactions at point of elevator machine beams and buffer supports. Indicate impact loads.

D. Architectural drawings shall show elevator rail bracket spacing and maximum horizontal and vertical forces on guide rails.

E. Dumbwaiter hoistway entrance details shall be shown complete with doors. The top and bottom entrances shall be provided with hoistway access. Provide permanent access to overhead machine spaces. Provide
an access door and industrial ladder into machine space and industrial stairs to machine room.

14. AUTOMATED TRANSPORT SYSTEMS STANDARD DETAILS INDEX

Details not provided as a hard copy with the A/E Package shall be available at the first review. Details are provided in VA Program Guide PG-18-4 and ARCHITECTURAL STANDARD DETAILS.

<table>
<thead>
<tr>
<th>DETAIL</th>
<th>DATE</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD142100-01</td>
<td>2008</td>
<td>Hoistway Details - Elevator Electric Traction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Passenger Two Speed Sliding Doors - 4,000 lb Capacity</td>
</tr>
<tr>
<td>SD142100-02</td>
<td>2008</td>
<td>Entrance Details - Service and Passenger Electric Traction or Hydraulic Elevator Two Speed Side Sliding Doors</td>
</tr>
<tr>
<td>SD142100-03</td>
<td>2008</td>
<td>Elevator - Service Horizontal Sliding Center Opening Doors - 5,000 lb Capacity</td>
</tr>
<tr>
<td>SD142100-04</td>
<td>2008</td>
<td>Entrance Details - Service and Passenger Electric Traction or Hydraulic Elevator Horizontal Sliding Center Opening Doors</td>
</tr>
<tr>
<td>SD142100-05</td>
<td>2008</td>
<td>Elevator Hoistways - Passenger Elevators Vertical Dimensions - 4,000 lb Capacity</td>
</tr>
<tr>
<td>SD142100-06</td>
<td>2008</td>
<td>Elevator Hoistways - Service and Passenger Vertical Dimensions - 5,000 lb Capacity</td>
</tr>
<tr>
<td>SD142100-07</td>
<td>2008</td>
<td>Elevator - Passenger Horizontal Sliding Center Opening Doors</td>
</tr>
<tr>
<td>SD142100-08</td>
<td>2008</td>
<td>Entrance Details - Service and Passenger Electric Traction or Hydraulic Elevators Horizontal Sliding Center Opening Doors with Drywall Shaft</td>
</tr>
<tr>
<td>SD142400-01</td>
<td>2008</td>
<td>Hydraulic Elevator - Plan and Section</td>
</tr>
</tbody>
</table>

15. AUTOMATED TRANSPORT SYSTEMS MASTER SPECIFICATIONS INDEX

Use latest edition.

<table>
<thead>
<tr>
<th>SECTION</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>141211</td>
<td>Dumbwaiters - Drum Type</td>
</tr>
<tr>
<td>141221</td>
<td>Dumbwaiters - Geared Traction</td>
</tr>
<tr>
<td>142100</td>
<td>Traction Elevators</td>
</tr>
</tbody>
</table>
16. ELEVATOR ELECTRICAL SPECIFICATION

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>260511</td>
<td>Requirements for Electrical Installations</td>
</tr>
<tr>
<td>260533</td>
<td>Conduit Systems</td>
</tr>
<tr>
<td>260521</td>
<td>Cables, Low Voltage (600 volts and below)</td>
</tr>
<tr>
<td>262726</td>
<td>Wiring Devices</td>
</tr>
<tr>
<td>262416</td>
<td>Panel Boards</td>
</tr>
<tr>
<td>262921</td>
<td>Disconnect Switches (motor and circuit)</td>
</tr>
<tr>
<td>260526</td>
<td>Grounding</td>
</tr>
</tbody>
</table>

--End--
DO

A.  SET SERVICE ELEVATORS BACK 1800 mm (6 FT.) FROM CORRIDOR LINE

B.  SET PASSENGER ELEVATORS BACK 600 mm (2 FT.) FROM CORRIDOR LINE

C.  PROVIDE 4.2 m (14 FT.) MIN. WIDTH SERVICE ELEVATOR LOBBIES
    PROVIDE 3.6 m (12 FT.) MIN. WIDTH PASSENGER ELEVATOR LOBBIES

    a. PROVIDE POSITIVE SEPARATION OF PASSENGER & SERVICE TRAFFIC
D. Provide separate clean and soiled facilities for automatic transports (ATS).

E. Consider proximity location of functions using automatic transport systems in order to minimize horizontal travel and mixing of soiled and clean traffic.

F. Provide stairs adjacent to passenger and service elevator lobbies.

G. Consider hydraulic elevators when future floors are to be included in design.

H. Consider horizontal traffic flow from all entrances and healthcare traffic generators before deciding between centralized or decentralized vertical transportation systems.
A. **Do not place 4 or more elevators in a straight line.**

B. **Mix types of elevators.**

C. Place elevator or dumbwaiter openings on corridor line.

D. Locate elevator lobbies on main thoroughfare core.

E. Locate dedicated (serv./fri.) elevator with public (pass.) use elevators.

F. Locate automatic material lifts in public areas.
DO NOT

G. Design elevators with front and side openings.

H. Locate elevators over occupied areas.

L. Exceed 12m (40 ft.) of travel for hydraulic elevators.