TOPIC 18

TRANSPORTATION AND LOGISTICS DELIVERY

(FEASIBILITY STUDY REQUIREMENTS FOR AUTOMATED DELIVERY SYSTEMS)

2. GENERAL

This Program Guide provides guidance for the study, selection, and design of transportation and logistics systems in support of the design and construction of VA facilities and provides guidance for the completion of the feasibility study requirement listed in PG18-15. The purpose of the guide is to define the requirements for transport studies that will identify transportation options for VA to select in the design of projects. The Program Guide establishes requirements for the qualifications of the Medical Transport and Logistics Consultant and for systems including, but not limited to, elevators, escalators, dumbwaiters, material delivery equipment (automatic guided vehicles [AGVs] and Autonomous Mobile Robots [AMRs]), pedestrian traffic, service cart systems, pneumatic tube systems (PTS), gravity and pneumatic chute return systems for linen and trash, and Sterile Supply Distribution Systems for Veterans Affairs (VA) Facilities. This guide supplements PG 18-1 *Master Construction Specifications-Division 14 Conveying Equipment* and PG 18-10 *Design Manual-Automatic Transport* as found on CFM's technical information library at: http://www.cfm.va.gov/til/. The Program Guide is not intended to cover all aspects of transportation analysis or design, but rather to serve as a guide for planners, designers, and Medical Transport and Logistics Consultants (MTLConsultants).

a) Medical Transportation and Logistics Consultant (MTLConsultant).

The A/E will submit the qualifications of their MTLConsultant to VA for review and approval. A qualified Consultant to the A/E is a professional individual or Consulting Firm who has successfully provided comprehensive study, design, and Construction Administration services in the areas of materials management, food and nutrition, solid waste management, horizontal and vertical transport of people, materials and equipment, sterile supply distribution, automated and manual materials handling for a period of not less than five years. These services should have been specific to transportation and logistics and must be documented. The MTLConsultant must demonstrate prior experience on a minimum of three (3) completed and fully operational healthcare facilities that relate to the scope and nature of the project. The MTLConsultant shall be a fully independent consultant with no direct or indirect involvement in the sale, installation, distribution, manufacture, or representation of conveyance and materials and/or waste management equipment. The MTLConsultant shall provide all studies and designs from internal sources and shall not utilize any outside resources without the written notification to and written approval of that resource by the VA Project Manager for the project in question. Under no circumstances shall vendors, manufacturers or distributors of conveyance and materials and/or waste management equipment provide studies, designs or specifications for a VA Design Project. Recommendations and designs shall be fully generic and are to promote competitive bidding. The A/E will submit the MTLConsultant's qualifications to the VA for review and approval.

b) Scope

This Program Guide applies to horizontal and vertical circulation within VA Facilities, and the transportation devices, equipment, and methodologies required for efficient, cost-effective, and timely movement of people, equipment, materials, and related materials-management logistical functions. Addition/alteration projects are to meet these guidelines to the extent practical and provide a holistic design approach in addressing the correction of existing facility shortcomings.

This Program Guide does not prescribe when systems are required or where they should be employed. Table 18-1 prescribes when different technical analyses are required based on a facility's size and depending on the results of the analysis different transportation systems may be required. It is the responsibility of the designer of record to develop a holistic and efficient design incorporating the facility's operational and functional needs.

Table 18-1 Analysis Requirements

Purpose: Table identifies level/extent of analysis required by the type of VA Facility.

Analysis	Facility Characteristic
Transportation Logistics Analysis (TLA)	Any facility >200,000 BGSF All major renovations and new construction of Ambulatory Care and Hospitals
Elevator Traffic Study & Analysis (ETSA)	All facilities >1 story
Material Management Analysis (MMA)	All facilities >100,000 BGSF All Warehouse facilities > 20,000 BGSF
Waste Management Analysis (WMA)	All facilities > 50,000 BGSF

Notes:

Facilities include outpatient clinics (CBOCs), Health Care Clinics (HCC) research and laboratory buildings, Ambulatory Care Centers, Hospitals, and Medical Centers.

BGSF – Building Gross Square Feet

c) Transportation Systems Evaluation

i) For all projects requiring a Transportation Logistics Analysis (TLA) as described in section 2-a), the A/E shall ensure the services of a qualified MTLConsultant are included in the request for planning and architectural services. The MTLConsultant shall be an integral part of the design team, and shall be involved in every aspect of the design as it relates to transportation and logistics. This includes, but is not limited to, departmental adjacencies, space requirements, vertical and horizontal circulation, facility logistics, designs for materials management, central sterile processing, food and nutrition services and waste management.

ii) The A/E and the Medical Transportation and Logistics Consultant

(MTLConsultant) shall ensure all transportation and material handling systems selected are designed, procured, installed, and commissioned in accordance with design documents and applicable codes and standards. The MTLConsultant shall be responsible to coordinate with and provide the A/E with the design requirements and design criteria to ensure the facility concepts through final designs incorporate the necessary spaces, adjacencies, utilities and other appropriate building elements to provide the physical properties necessary for the various systems and equipment that will be installed.

2. TRANSPORTATION AND LOGISTICS ANALYSIS REQUIREMENTS.

Different transportation and logistics analyses are required for facility designs as indicated in Table 18-1. These analyses must address the transportation, logistics, and waste management requirements of the project as required by this document. When required by Table 18-1, the different analyses shall be submitted with the Basis of Design narratives beginning with the initial design submission (SD1) and through the final design submission. The MTLConsultant will participate in the development of concepts identifying the general transportation requirements for each concept.

a) Transportation Logistics Analysis (TLA).

The MTLConsultant shall prepare a TLA for large (>200,000 ft^2) and complex projects. The analysis shall take into account total staff and patient travel times and travel distance with the objective of minimizing both travel times and distances. This shall help achieve higher staff efficiencies and lower patient environmental exposure.

i) **Purpose.** The Transportation Logistic Analysis (TLA) shall address all aspects of a facility's transportation, logistics, and waste management methodology. This includes, but is not limited to, traffic demand, vertical and horizontal travel distances, mix of traffic type in the areas to be served, mode of containerization, and items specifically addressed in the other studies. The TLA shall document, in a detailed functional narrative along with the associated information noted in the following:

a. Elevator Traffic Study and Analysis (ETSA). Reference section 2-b).

b. Material Management Analysis (MMA) to include a comparison of automatic vs. manual material handling systems. Automatics system include: automatic guided vehicles (AGV), automated mobile robots (AMR) pneumatic tube systems (PTS), and pneumatic or gravity chutes in addition to other or newer technologies. Reference section 2-c).

c. Waste Management Analysis (WMA). Reference section 2-d).

d. Life Cycle Cost Analysis (LCCA) shall be used to evaluate the alternatives and to determine the appropriate system. The LCCA shall include all costs of "Ownership" (i.e., installed equipment costs; costs of space used; related construction costs; utility costs; operational labor costs; maintenance (labor, parts, upgrades); expendables; periodic upgrades, overhauls and replacements as applicable to the system studied; and other applicable costs) and shall show these

costs at annual levels from day zero (0) through the first 30 years of operation. Provide a single chart showing the Life Cycle Costs of the options considered and a second chart showing the annual cash flows for the options.

e. The MTLConsultant shall sign the transportation logistics analysis certifying the information contained therein is accurate, vendor neutral, and based on empirical data.

f. For addition/alteration projects the transportation logistics analysis shall take into account the existing transportation systems and processes. The MTLConsultant shall evaluate the general condition of any existing applicable equipment (i.e., elevators, PTS, etc.) to determine their potential applicability, expansion capabilities and life expectancies. Recommendations shall be provided on replacements, upgrades, or modernizations required to meet the needs of the project and the current standards and criteria. New construction shall, where applicable and practical augment any shortfalls in the existing buildings or utilize any excess capacities offered by existing structures that will remain in service.

g. The transportation logistics analysis shall describe in detail and contain scaled drawings of the MTLConsultant recommendations to maximize the transportation and logistics efficiencies and how the recommendations are implemented into the design. The MTLConsultant shall coordinate with and provide the A/E Design Team with the design details applicable to the space, flow, adjacency, machine rooms, maintenance area, and other building elements necessary to install, operate and maintain the systems and equipment and systems for the project in question.

h. The transportation logistics analysis shall focus on defining processes and methodologies that optimize adjacencies and minimize overall patient, staff, and material movements in the project design.

i. When required by VA, the transportation logistics analysis shall include the use of simulation to more accurately analyze and optimize departmental adjacencies and horizontal and vertical transportation solutions.

iii) **Considerations.** The transportation logistics analysis shall be based on:

a. Empirical data provided by the using facility. When such data is not available the MTLConsultant shall work with the using facility to reach final estimates that are acceptable to the affected facility User departments.

b. Site visits to the existing facility, if one, to inspect and observe conditions and operations. The MTLConsultant shall conduct detailed interviews of the various departments that represent the Users and Providers of the various Support Services. Complete notes for these interviews shall be transmitted to the facility for verification of the information contained. These interview notes shall be used as an important part of the data base used for the project. The MTLConsultant shall make sufficient detailed non-technical inspections of all applicable departments and equipment, including the elevators and materials handling

systems to estimate their potential life expectancy, need for more detailed inspections and potential use for the project.

c. Data including site constraints, Design Concept of Operations (CONOPS) (including CONOPS for the logistical departments like food service, linen and waste management, materials management, housekeeping, pharmacy, sterile processing, distribution) and projected workload for the new facility will be noted and documented.

d. The transportation logistics analysis shall include all of the necessary studies such that every major and predictable traffic type (i.e., patients, staff, visitors, clean and soiled materials, equipment, maintenance, security, fire service and etc.) is considered and that a proper and timely mode of transport is provided for everything that needs to move within a building.

e. Elevator loading density and the load/unload time based on site visits to account for unique conditions at a facility and the cultural aspects of the area, e.g., amount of "personal space" required by individuals, number of visitors per patient, number of escorts or companions accompanying outpatients. Studies shall also include the factors and requirements for the proper and safe transport of the various devices required by handicapped users (i.e., wheelchairs, scooters, walkers, etc.) and other expected vehicles (strollers, carriages, carts, etc.). Refer to: PG 18-10 *Design Manual-Automatic Transport.*

b) Elevator Traffic Study and Analysis (ETSA)

Elevators provide the basic transportation mechanism for most vertical moves in multistory buildings. The MTLConsultant shall prepare the ETSA to determine the appropriate types, locations, sizes, speeds, and groupings of elevators that result in a cost-effective and efficient operation. See VA Standards and Design Guide located on the Technical Information Library (TIL) at: http://www.cfm.va.gov/til/.

i) **ETSA Requirements.** The ETSA shall document the following:

a. A description of the elevator plant proposed, including an analysis of the walking distances, elevator types, and locations as described in section 4.c-*Elevator Design*. Elevator studies and designs shall consider the complete horizontal and vertical circulation for the populations studied.

b. The pedestrian population (number of working and visiting population within the facility).

c. The number and average size of material movements within the facility.

d. The peak hours of vertical transportation, including but not limited to: Morning Shift Change Peak (primarily a one-way peak period in upward travel), Lunch Peak (heavy two-way traffic), Afternoon Shift Change Peak (primarily a one-way peak period in downward travel, with moderate opposing traffic).

e. The elevator loading densities used for each proposed elevator for working and visiting population, e.g., pedestrians, person on crutches/walker, wheelchairs,

motorized wheelchairs, gurneys, beds, and carts. Include extra “spare capacity” when determining the aggregate elevator cab size.

f. Elevator Performance - Study Criteria

In determining the elevator performance (PG 18-10 *Design Manual-Automatic Transport)* provide the following information and considerations in the transportation logistics analysis:

i. Studies shall be based on the type and quantity of the elevator populations for the facility being considered. Studies for materials handling transports to be based on the data derived from the Material Management Analysis (see below).

ii. The assumed population load/unload times

iii. The average space occupied by the individual elements that make up the population, making sure that the studies are based on the cumulative occupied space and not the weight of the occupants. Weight being a separate calculation to ensure adequate and safe lifting capacity is provided.

iv. Door types, sizes and the time required to open and close the doors.

v. Elevator traveling speeds studied.

vi. Acceleration rates studied.

vii. Door hold open times based on ADA requirements.

viii. Lobby hold times.

ix. Elevator design considerations such as total rise, number of total stops, number of probable stops, high call reversal, location of main lobby(ies),

x. Provide the proposed elevator response times

xi. The study results shall include final recommendations based on meeting the VA criteria for average intervals and handling capacity

xii. Local population characteristics, i.e. wheelchairs, scooters, family members, etc.

c) Material Management Analysis (MMA).

The Material Management Analysis is a reduced version of a Transportation Logistics Analysis and is required for smaller projects less that 100,000 BGSF and all warehouse facilities that are greater than 20,000 BGSF. For these projects material would be considered to be manually moved throughout a facility unless the designer can show an automated system is physically and economically justified. The specific systems included in a project shall be determined by detailed physical, functional, and economic factors including LCCA. The MTLConsultant shall prepare the Material Management Analysis to determine the appropriate types, locations, sizes, and design of material movement methods that result in a cost-effective and efficient operation.

i) **MMA Requirements – General**. The MTLConsultant shall be responsible for the detailed studies and designs of the Materials Management functions (including; docks, stores, order fulfillment, distribution, linen stores and distribution, sterile supply distribution, equipment cleaning/holding/distribution) as required by the VA Design requirements.

a. For new construction the MTLConsultant shall follow the VA design requirements for the spaces in question and shall fully integrate the applicable materials handling systems into the physical, functional and operational aspects of those areas. A complete functional narrative shall be provided for the departments in question, including descriptions of how they integrate with the applicable materials handling systems.

b. For major additions and alterations the MTLConsultant shall provide adequate site inspections and departmental interviews to determine the physical, functional and operational conditions of the existing transport systems and material management departments and issue a report on the adequacy of those systems and departments in meeting the needs of the total planned facility. If shortfalls are predicted the report shall include detailed recommendations and scaled drawings of the recommended renovations and/or additions that are required to match their capabilities with the estimated needs. Where capacity can be provided from existing departments for the existing and new building(s) the MTLConsultant shall study and recommend whether it would be in the VA's best interest to build new departments or operate from the existing departments, "as-is" or renovated/modernized. A final report shall include the functional narratives and the basis for the decisions made

ii) **MMA Requirements – Movement Methods.** If the using facility does not require an automated system, the Material Management Analysis shall document such to include the number of FTE required to accomplish the functions. Otherwise the MMA shall document the following:

a. The number of estimated scheduled and non-schedule demand transports that would be applicable to transport by a pneumatic tube system (PTS) (i.e., Lab Specimens, Medications, etc.). This data to be used in the studies and possible development of alternative delivery methods.

b. A listing of estimated major bulk materials handling moves that would be transportable by a cart indicating the number of transports, their origins and destinations. This data shall be used in the Elevator Studies and the Materials Management and Handling Life Cycle Cost analyses (LCCA).

c. Proposed automated systems including but not limited to Automated Guided Vehicle (AGV), PTS, and mobile robots.

d. The users of the proposed systems.

e. The number of Full-Time Equivalent (FTE) on staff for the movement of materials.

f. Location, size, speeds of proposed systems.

g. Specific requirements for each type of system, i.e., dry vs. wet Pneumatic Trash and/or Linen System.

h. An LCCA comparing manual movement vs. proposed alternatives.

i. All information relating to the vertical transport elements shall be included in the elevator studies and any requirements (vertical and/or horizontal circulation, space, adjacencies, etc.) specific to the building design shall be coordinated with and provided to the A/E Design Team.

d) Waste Management Analysis (WMA)

The proper preliminary design of a VA Facility waste management system requires consideration of the operational and mission characteristics of the facility, the existing waste disposal practices of the facility and local jurisdiction, the governmental regulations affecting the design, and the costs and application of system handling and disposal technologies.

i) **WMA Requirements.** The WMA shall document the following:

a. Determination of the solid waste stream components and soiled linen types. As a minimum provide the following breakdowns: general trash; regulated medical wastes; sharps; recyclables; chemical wastes; radioactive wastes; wet and dry food wastes; soiled patient linen; soiled surgical linen and soiled uniforms.

b. Estimation of waste and soiled linen volumes by type.

c. Concepts for segregation, holding at the generating departments and central bulk holding.

d. Space and utility requirements for departmental soiled holding rooms.

e. Concepts for collecting and transporting waste and soiled materials within the facility.

f. Soiled dock arrangement, layout, and equipment.

g. Waste Management Center (WMC) space, layout, equipment, and support utility requirements.

h. Concepts for the disposal of each waste category.

i. Proposed Waste Management Transport Systems including, but not limited to, manual or automated cart systems, gravity chutes and pneumatic trash/linen systems.

j. Life-cycle costing studies for the transport options and those for waste processing, including Regulated Medical Waste (RMW) processing equipment.

k. Aspects of Regulated Medical Waste processing, operations, maintenance, safety, and infection control.

2) FACILITY DESIGN

Transportation and logistics requirements shall be integrated into the overall facility design. The A/E shall design the overall floor plan and circulation to provide the most direct routing practical and will utilize the transportation systems as determined by the studies listed in Table 18-1.

a) Traffic Separation.

Establish traffic patterns to separate the various traffic types in an efficient, logical, safe, and secure manner, while maintaining levels of aseptic control consistent with the requirements of the facility. Consider all of these factors for separation for horizontal and vertical circulation: patient privacy; accessible access; aseptic control; routing efficiency; utilization of appropriate hardware systems, safety, and security. Where circulation conflicts occur, prioritize traffic as listed here:

i) Patient

ii) Staff

iii) Equipment

iv) Visitors

v) Materials/logistics (may be combined use-service elevators with staff)

b) Transportation Systems.

The MTLConsultant shall consider traffic demand, vertical travel distance, mix of traffic type in the areas to be served, and mode of containerization. Traffic demand and vertical travel distance shall determine equipment type and speed required. Traffic mix and mode of containerization shall determine load capacity, platform size, configuration, and door type.

c) Vertical Automation.

Systems designed for vertical only transportation of materials on carts shall use service elevators, guide paths, and other devices, as applicable. Designs shall consider future upgrade to allow horizontal travel.

d) Equipment/Materials Separation.

Separate the equipment/materials traffic from patient and visitor traffic as noted on the Elevator Traffic Separation Guide, Table 18-2. Where separate elevators are not required, separate the materials traffic by schedule and policy. Careful, simple, and clear space planning can maximize separation between visitor/patient and staff/materials/logistics. Primary horizontal materials circulation should occur on a single level, with vertical penetrations that are convenient to heavy use areas. It is undesirable for AGVs, carts, pallet trucks, and similar material carriers to be moved long distances on floors and corridors routinely traveled by patients or visitors. For example, it is preferred to use two (or more) single elevators in distributed areas if traffic needs dictate more than one service/AGV elevator is required.

Table 18-2 Elevator Traffic Separation Guide	
Purpose: Table presents recommended arrangement of elevators by facility configuration and mission.	
Analysis	**Facility Characteristic**
Combine all elevators regardless of function	All facilities <50,000 BGSF, multi-story
Combined and separated elevators acceptable	All facilities <200,000 BGSF
Separate Passenger Traffic. Separate Inpatient Traffic. Separate Logistics/Materials Traffic.	All facilities >200,000 BGSF All Ambulatory Care Centers, Hospitals, and Medical Centers regardless of size

Notes:

The decision to separate or combine any elevator function must be supported in the ETSA. Combines operations should include at least one elevator of service configuration.

e) Clean and Soiled Material Separation.

Materials management programs shall provide for clean and soiled separation consistent with all applicable codes and standards, including those of the Joint Commission (TJC).

i) **Soiled Material.** Soiled materials are normally transported in separate covered or closed carts designed to provide containment of the material and to maintain infection control. Soiled material transport may occur in the same corridor and elevator systems that handle other traffic. However, soiled materials are not transported on elevators at the same time with patients, visitors, or clean or sterile materials. Transport circulation design must allow soiled carts to be properly washed prior to reuse as a soiled container, and washed and sanitized prior to use for transporting clean materials.

ii) **Sterile Material.** Transport all sterile material for use in Surgery or other areas requiring sound aseptic controls from the sterile processing/storage area to its destination via a clean route that shall not compromise the integrity of the material. Where case carts are used, they shall be transported from sterile storage to the clean surgical core by means that protect the cart and its contents from contact with less clean environments. A direct connection between sterile processing service to the surgical core is preferred by VA.

f) Escalators.

Do not use escalators for VA projects.

3) ELEVATOR DESIGN

Follow VA CFM Specifications PG 18-1 *Master Construction Specifications Division 14 Conveying Equipment and* PG 18-10 *Design Manual-Automatic Transport.* All multistory facilities shall have at least two elevators and at least one should be a service elevator configuration. The Elevator Traffic Study Analysis (ETSA) shall include a risk assessment to determine if at least one elevator should be sized to accommodate a gurney.

a) Codes.

Elevators shall be designed in accordance with all applicable Federal, state and local codes, including NFPA's *National Electrical Code,* ASME A17.1. This includes designing to the appropriate rating/load classification for the intended application. Elevators shall be designed to meet all VA and ABA provisions applicable to the project.

b) Elevator Selection.

VA facilities use elevators for three major functions: passenger movement, service/staff movement, and logistics. Passenger elevators are intended for use by the public. Service/staff elevators are intended for use by staff movement, for the transport of bed-bound inpatients, and for use by staff for material and equipment movement. Dedicated patient assist/trauma elevators when needed are intended for patient transport from Critical Care Areas, i.e., ED trauma rooms to the ORs.

i) Where unique conditions exist that the consult believes require elevator designs other than those provided in PG-18-1 the consultant will clearly explain these conditions in narrative and graphic formats in the ETSA report. A request for a waiver to use the recommended designs must be included.

ii) In renovations, existing elevators that can accommodate patient beds used in the facility shall not be required to be increased in size. In unusual circumstances other existing elevators may need to be resized depending on the results of the ETSA. Where possible, elevators in an attached new structure shall be provided to augment the shortfall of existing elevators. Where applicable, excess capacity provided in existing buildings may substitute for the addition of new capacity. These conditions need to be fully covered in the ETSA report.

c) Elevator Location and Travel Distances.

Elevators shall be designed, arranged, and placed within the building to provide convenient access to healthcare delivery services while providing cost-effective elevator performance (direct capital cost of elevators, indirect cost of the space dedicated to their function, and Operation & Maintenance are major cost components of any building). The desired walking distance from the elevator doors to the center point of the farthest occupied room should not exceed 200 feet. This factor shall be weighed along with the advantages of elevator accessibility, locating elevators centrally, elevator clustering, and medical functionality. The

MTLConsultant shall provide a description of the elevator plant proposed, including an analysis of the walking distances, elevator types, and locations for evaluation. The using facility, in coordination with the A/E, shall evaluate the proposed elevator plant to determine if proposed travel distances from elevators to healthcare delivery services and administrative areas are acceptable based upon the mission, population served, and operational concepts.

d) Elevator Location, Lobbies, and Groupings.

Placement of elevators shall meet the travel distance requirements of paragraph c above, while considering the requirements below.

i) **Elevator Location.** Place elevators on the direct horizontal path between the areas they serve, wherever possible. Locate elevators so that visitors do not normally pass service, material, or convenience cars en route to passenger cars, unless those cars are substantially hidden from view. Consider operational impacts such as noise, vibration, temperature, and other environmental factors when adjacent to critical treatment areas or those having sensitive equipment. Place adjacent car entrances either in straight lines or in opposite banks to each other.

ii) **Elevator Lobbies.** Elevator ingress/egress should be from a distinct elevator lobby and not directly from a corridor. Minimum/maximum lobbies for service cars are 12–14 feet when the opening opposes a wall and 14–16 feet when the opening opposes another elevator. Minimum/maximum lobbies for passenger cars are 10–12 feet when the opening opposes a wall and 12–14 feet when the opening opposes another elevator.

Where elevators are accessed from corridors, they shall be located on one side of the corridor only with a maximum of three cars. Elevators shall be set back 8–12 feet for service and combined use cars and 4–8 feet for passenger cars.

Where two or more elevator group lobbies are adjacent, provide walls or other building features to prevent a free flow of traffic between those lobbies (to minimize one user from placing calls to both groups). Where Table 18-2 requires separation of elevators, passenger elevators shall not share the same lobby with service and logistics elevators. Acoustically isolate all elevator lobbies from Critical Care Areas.

iii) **Elevator Groupings.** For service and combined use cars, two in a row are preferred and not more than three in a row should be used; for passenger and service cars three in a row are preferred. Consider and use in the calculations the required ADA door hold open times in any grouping of three cars in a row.

If more than six service cars or passenger cars are required in one area, provide two smaller, strategic groups.

e) AGV System Elevator Features. When determining elevator usage requirements for automatic guided vehicles (AGV) systems, consideration shall be given to whether the elevator shall be dedicated for exclusive use of the AGV system.

i) If the AGV system requires greater than 40% of any single elevator, including empty transporter moves, over any continuous three hour period, then that elevator shall be dedicated to sole use by the AGV system during that time. If the AGV system usage

is less than 40% of the elevator, then the AGV/elevator interface shall allow for a manual mode of operation to accommodate other material transports.

ii) For shared (automatic and manual) use elevators, the AGV system shall allow an attendant to release the elevator for manual movements using a key or ID Card control when all automatic transports have been completed. All activities will stop for an adjustable period of 60 to 180 seconds to allow the AGVS to go into a safe mode, clearing elevator door areas, etc. The specific AGV actions during that period shall be studied and specified for the project in question to ensure safety.

iii) Where the ability to achieve complete safety is not possible due to specifics of the project the request for manual control of the elevator shall be denied and the attendant shall be notified as appropriate for the project. The elevator(s) in question shall revert to AGV operation after each manual use.

iv) The AGV system shall request automatic mode when needed and the elevator controls shall disable hall call buttons and flash “Elevator in Automatic Mode” warning signs in the halls. After all cabin calls are answered and the doors close, the elevator shall change from manual mode to automatic mode.

v) The specific signals and sequencing of them for AGV/elevator interface shall be in compliance with the system specifications written by the MTLConsultant and then coordinated by the AGV system vendor after selection and the elevator supplier. Continuous manual use shall only be available through setting proper control settings at the elevator and at the AGVS Master Console/Control unit.

vi) Where AGV systems are used provide the elevator capacity required to meet the needs of the areas being served. Where distances between AGV Elevator cores exceed 200 feet provide additional AGV risers that are distributed to minimize horizontal travel on patient floors. On the service levels, open AGV elevators on both sides to allow drive-through capability to achieve adequate throughput. On the patient floors, there shall be two openings (front and rear) into secure access AGV lobbies/vestibules used for the primary purpose of temporary staging, picking up, and delivering carts. Adequate space inside these lobbies should be coordinated with AGV system vendors prior to finalizing the design. AGV Elevators shall be designed to carry one or two AGV Transporters at a time as required to meet the traffic needs of the areas being served.

vii) Provide a detailed traffic analysis as a part of the facility studies and reports for the horizontal and vertical elements of an AGVS to determine the location, number, size and speeds of AGV elevators and the location and number of all associated AGV elements such as pick-up / drop-off positions, battery chargers, cartwashers, etc. This information shall be used in coordination with the building designs, provided in a report and shown in the SD-2 drawings submittal to ensure the foundation for adequate and appropriate spaces, utilities and related building elements are available to properly support the installation.

4) MATERIAL MANAGEMENT DESIGN.

a) Automatic Guided Vehicle (AGV) Systems.

Design the AGV system to incorporate the latest state-of-the-art proven technology. Systems not proven in at least five previous similar applications shall be avoided. Systems shall be an integrated turnkey automated cart transportation system. AGV systems may utilize a variety of transportation vehicles (transporters) including "cart carrying" type and forklift type; towing type transporters are not desired because they transport carts with the casters on the floor.

i) Design. The design shall establish horizontal right-of-ways to:

a. Aid in directing traffic to the appropriate vertical core, while avoiding inappropriate elevators and other building areas;

b. Provide high levels of patient privacy and protection from high noise levels; and

c. Eliminate potential contamination of clean and sterile areas.

d. The AGV shall be fully coordinated with the buildings fire and smoke doors and comply with all applicable codes and standards including NFPA.

e. Avoid interaction between the AGV system and any persons, especially patients and visitors when traveling in the facility's corridors.

f. The AGV shall be designed in compliance with all codes and standards including ANSI/ITSDF B56.5-2012 or later addition.

ii) AGV Elevators**.** See section on elevators above. The elevators that provide vertical transport for AGVs shall open into enclosed pickup and delivery (P&D) lobbies with motorized door access to the main circulation corridors on the patient floors. Except where vertical AGV traffic is expected to be less than 20 carts per hour the AGV elevator shall have both front and rear openings into AGV lobbies. Where front and rear doors exist, a path shall be included for AGV vehicle travel from the front lobby to the rear lobby without having to use the elevator cab. If required recommendations for positive/negative air pressure or motorized doors between these areas shall be included.

b) Pneumatic Tube System (PTS).

i) Provision of PTSs must be consistent with requirements for a particular VA Facility regardless of the size of the facility. No specific correlation can be made between the number of beds in a VA Facility and the need for a PTS. Facility parameters and FTE usage are the primary drivers for the use of pneumatic tubes.

ii) Design systems to reach individual project peak traffic requirements, plus a minimum spare capacity of 20%. Designs shall provide for soft handling of all systems where laboratory specimens and other delicate items are transmitted.

iii) PTS designs shall use single or multiple zones with a maximum of seven stations on a zone except where the MTLConsultant can demonstrate satisfactory operation with higher station counts.

iv) PTS designs shall be based on the use of a six inch tube unless the MTLConsultant can demonstrate the need for a different size.

v) Select tube systems that provide automatic control of carrier movement. A selector device that permits correspondence with any station served by the system shall set the destination of the carrier.

vi) Consideration must be given to feasible and ease of sterile cleaning methods for the system.

vii) Acoustic damping is required at the delivery and sending sites. Care must be taken when stations are located in nursing units (wards) or where noise would become a distracter for the work involved.

viii) Consultant will identify the location of PTS sites to include supporting blower rooms.

c) Automated Mobile Robots (AMR)

Mobile robots shall be considered only when they have been proven in other similar applications in at least five similar hospitals and can be considered for travel through any corridor. Mobile Robots are considered as a type of an AGVS and shall comply with all of the requirements for that system. Mobile Robots shall comply with all applicable codes including NFPA and ANSI/ITSDF B56.5-2012. Provide traffic studies to determine the ability of the proposed elevators to handle the estimated traffic.

Mobile robots must have sensors that will stop the robot when coming too close to people or obstacles.

d) Dumbwaiters and Cart Lifts. –Follow PG18-1, Division 14 and PG18-10 Design Manual for specifications.

Dumbwaiters shall meet the following requirements:

i) **Dumbwaiters, Counter Height.** Automatic loading and unloading shall be considered. Dumbwaiters without automated devices shall have powered or manual doors. Powered doors shall be vertical lift type and have upper safety edges.

ii) **Cartlift, Floor Loading.** Automatic loading and unloading shall be considered. Floor loading dumbwaiters shall have powered vertical lift doors with upper safety edges or curtain unit scanning feature.

iii) **Dumbwaiter Platform Size**. Dumbwaiter systems shall be limited to a maximum platform size of 9 square feet and maximum capacity of 500 pounds. By exception automatic loading and ejection devices of larger capacity and size, used in conjunction with automatic cart lifts, shall conform to the ASME standards for elevators. Determine the dimensions of the car lift platform by the largest cart selected for dietary, linen, or other materials distribution.

5) WASTE MANAGEMENT DESIGN.

The waste management system shall be designed to help maintain aseptic environments in the hospital, and to minimize or eliminate physical and infection hazards to patients, hospital staff, and the general public, at the lowest LCC to the Government. The design objectives should include hazardous waste optimization/process improvements, recycling, waste minimization, and hazardous material substitution to more environmentally friendly products/processes.

a) Waste Categories.

The categories of VA Facility waste are: Regulated Medical Waste (RMW or red bag), Hazardous Waste (HW), Recyclable Materials (RM), and general waste. Each of the categories of VA Facility waste requires individual design consideration of handling, storage, and disposal by the facility. In addition, regulatory requirements differ for each category, dependent upon the relative personnel and public hazards and environmental impact.

b) **Waste Collection and Transport.**

The waste management system shall be fully coordinated with the transportation design to determine the most appropriate means and routing of transport of wastes within the facility. Automatic or manual systems should be considered. The design shall avoid creating conditions that require or involve the double-handling of waste, especially RMW and HW.

c) Regulations, Codes, and Standards.

The preliminary design of the waste management system shall comply with all applicable Federal, state, and local codes and regulations, including: NFPA 82; 40 CFR 261–265 and 40 CFR Part 22; 49 CFR 171–180; 29 CFR 1910.1200, 29 CFR 1910.1030, and 29 CFR 1910.134. Guidelines and advisory standards available from the NFPA, the CDC, National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services (HHS), and TJC shall be utilized as applicable and considered minimum criteria for facility design. The WMA shall be based on regulations and standards enforced by the local authority.

d) Gravity Chutes. –Follow PG18-1, Division 14 for specifications

i) Consider gravity chutes either alone or in combination with horizontal pneumatic chutes, for internal general and soiled linen waste transportation in multistory institutions. Also, consider hospital service elevators, AGVs, and cart lifts for internal transportation of solid wastes in multistory buildings. Consider that the AGV system has to move empty linen carts down from patient areas and these movements can be used for transport of soiled linen at very little, if any, incremental cost.

ii) When gravity chute systems are included in multistory facilities, provide one chute system for soiled linen with a separate chute system for general waste. Single chute, dual purpose systems shall not be used. Separate charging areas, separate enclosure shafts, and separate discharge rooms are required, although they may be side by side. Separate collection areas for soiled linen and for solid waste shall be located near the loading dock. Bagged solid waste may be manually handled at the bottom of gravity chutes by loading the bags into carts, which are subsequently moved to the disposal point, or automatically discharged into compactors.

iii) Provide chute access on user levels through a separate room with dimensions adequate for holding the collection cart, with room doors closed, while the attendant is charging the chute. Rooms must be compliant with Barrier Free Design/ADA standards. Where both laundry and general trash chutes are used, each shall be in a separate and clearly marked room.

iv) Size terminal rooms to accumulate the amount of materials dictated by the WMA. Minimum dimension shall allow accumulation of 24 hours of collected materials. Design shall ensure that collected material does not block the entrance door or hinder the pickup operation.

v) Design gravity chutes in accordance with NFPA 82. The minimum diameter of gravity rubbish chutes shall be 24 inches. Chutes must penetrate the roof of the building, be within a fire-rated enclosure, be provided with automatic sprinklers, and be charged within a fire-rated room, which is provided with automatic sprinklers. These requirements apply to soiled linen and solid waste gravity chutes.

vi) Vertically aligned charging doors of the same chute system shall be interlocked so that only one station can be charged at one time, thereby reducing the possibility of charges jamming within the chute. Provide gravity chutes with negative pressure, relative to the charging area, to eliminate aerosol discharge into the charging areas when charging doors are opened.

e) Pneumatic Trash/Linen. –Follow PG18-1, Division 14 for specifications.

i) Pneumatic trash/linen systems shall be fully pneumatic, gravity pneumatic, or multi-loading. Hybrid systems are permitted where required. In general, no station shall be designed that is "up-send" in nature. All materials should travel in the down direction after first being loaded into the system. Verify system traffic capabilities by detailed traffic studies.

ii) Gravity-pneumatic systems, a combination of gravity chutes for vertical transportation, and pneumatic chutes for horizontal transportation are subject to the same fire protection requirements as gravity systems.

iii) In composite systems, the gravity chute shall be equipped with a storage section at the bottom of the chute. Gravity chute charging stations equipped with electric control systems may be loaded with as many bags of waste or linen as necessary. Bags are accumulated in the storage section and are removed as a single load on demand.

iv) Fully automatic chute systems containing horizontal and vertical elements, with automatic transfer systems, are not normally allowed in VA Facilities. Where a vertical rise is required for a pneumatic chute intended as a collector for gravity chutes, the vertical rise must be installed in a fire-rated enclosure in accordance with NFPA 82.

v) If horizontal pneumatic chutes must be manually charged, enclose charging doors and frames in fire-rated rooms. Sprinklers in the charging stations must protect pneumatic chutes. Charging stations shall have a receiving compartment with an outer and inner door. When the door is opened to put in a load, the inner door shall be automatically locked so that the load cannot freely enter the chute. When the outer door is closed, the inner door shall open in its sequential turn and the load shall be automatically transported by negative pressure to its point of discharge. Only one load shall move through each leg of a pneumatic chute system at one time.