U.S. Department of Veterans Affairs

VA Parking Design Manual & Demand Model

Office of Construction and Facilities Management
Washington, DC

Sect 4, Rev 11-01-2016

Sect 7, Rev 08-01-2014

April 2013

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U.S. Department of Veterans Affairs

VA Parking Demand Model Part I

Office of Construction and Facilities Management
Washington, DC

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FOREWORD

The material contained in the Parking Demand Model (PDM) is the culmination of a partnering effort with the Office of Construction & Facilities Management (CFM), Office of Facilities Planning at the U.S. Department of Veterans Affairs and the consultant team, led by DESMAN Associates. The goal of the Parking Demand Model is to facilitate the planning process and to ensure the quality of VA facilities, while controlling construction and operating costs.

This document is intended to be used as a procedure by which the PDM should be used, as well as an initial tool for projecting parking need. The PDM documents current parking demographics at a number of VA Medical Centers (VAMC). The pilot and test institutions presented in this document were selected by VA and CFM as representative of the varying types of VA health care centers.

Since the parking facility is often the functional front door of a facility or campus, it is important to recognize opportunities for a welcoming presence. Parking facilities should be designed either as open surface areas with sufficient landscaping or as structures. These facilities may be utilitarian; however, the structures and the surface lots should be designed to enhance the aesthetics of the facility and the campus. The goal is for parking to be a positive experience for all users.

Lloyd H. Siegel, FAIA
Associate Executive Director
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ACKNOWLEDGEMENTS

Credit is due to the following individuals whose guidance, advice, and effort made this publication possible.

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We especially appreciate the cooperation and assistance of stakeholders from the ten VAMC facilities that were used for field data collection and development of the parking demand model.

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INTRODUCTION

The U.S. Department of Veterans Affairs (VA) constructs, leases, and operates a nationwide system of health care facilities dedicated to serving the nation's Veterans. Providing adequate parking has become a major concern. VA must quantify, prioritize, and ultimately address present and future parking needs.

To date, the Department and its Veterans Integrated Service Network (VISN) and Medical Centers (VAMC) have used a spreadsheet-based model based on patient and staffing population volumes and auto use demographics to estimate current and future parking demand, and associated surplus or deficit conditions. The model was created in 1991. Changing patterns of demand and patient care are leading health care facilities to increase outpatient services, while decreasing traditional inpatient services. These changes create an unanticipated need for additional parking spaces, which the 1991 parking demand model (PDM) does not reflect.

The VA Office of Construction & Facilities Management (CFM) was instructed to retain a parking study expert to update the PDM. DESMAN, Inc. was initially retained by Cannon Design and the LA Group through its IDIQAE classification to work with CFM and its member institutions to investigate VA's current parking criteria and methodologies for determining required parking spaces at new and existing facilities. New parking demand ratios would be developed that accurately calculate current and future demand in a variety of VAMC environments and best practice design standards for its parking facilities would be documented.

Key to developing the new PDM was the selection of ten (10) pilot facilities. These pilot institutions were selected by CFM as representative of the range of parking conditions and experiences throughout the VA health care system. Parking industry best practices were used to determine current parking demand and practical surplus or deficit conditions. This study involved requesting detailed facility, staffing, and patient population data through administrator survey forms, performing on-site parking inventory and peak parking occupancy surveys, administering point-of-access questionnaires to determine trip purposes, origin/destination, and travel mode data, gathering regional census data, conducting public transit route ridership research, and interviewing stakeholders at each of the ten (10) VAMCs. Stakeholder interviews involved one-on-one and group discussions regarding parking and commuting patterns that were unique and relative to each of the pilot facilities. The following lists pilot facilities that were surveyed.

Charlie Norwood VAMC, Augusta, GA
James J. Peters VAMC, Bronx, NY
Michael E. DeBakey VAMC, Houston, TX
Long Beach VAMC, Long Beach, CA
Clement J. Zablocki VAMC, Milwaukee, WI
Minneapolis VAMC, Minneapolis, MN
San Francisco VAMC, San Francisco, CA
Puget Sound Healthcare System, Seattle, WA
James A. Haley VAMC, Tampa, FL
Washington DC VAMC, Washington, DC

In April 2011 DESMAN submitted to CFM an updated PDM along with a Preamble that presented the information that was collected from the pilot facilities. Upon review of that document, and in consultation with the Paralyzed Veterans of America (PVA), a veterans' service organization which has a unique expertise on a variety of issues involving special needs veterans, CFM retained DESMAN once again to revisit the study of parking supply, utilization, and demand for ten (10) additional VAMC's. Unlike the original effort, this additional or expanded VAMC work included an investigation of Spinal Cord Injury/Disorder (SCI/D) patient parking needs. While the original pilot facility analysis did estimate the demand for all employee and patient groups, an analysis specific to SCI/D inpatients and outpatients was not performed. These additional services were retained under the guidance of EBA Ernest Bland Associates, P.C., an IDIQAE firm that developed SCI/D center design guidelines for CFM and has invaluable knowledge on space programming and SCI/D patient needs. At present, space guidelines for SCI/D patients require 1.5 spaces per hospital bed. As no empirical data exists to support these space requirements,

CFM and PVA selected these expanded pilot facilities for additional study as they represent a broad range of VAMC and SCI/D parking experiences.

VAMC Washington, DC (Spoke)
Edward Hines Jr. VA Hospital, Hines, IL (Hub)
Louis Stokes VAMC, Cleveland, OH (Spoke)
Bruce W. Carter VAMC, Miami, FL (Hub)
Jefferson Barracks Div. /St. Louis, MO (Hub)
Audie Murphy VA Hosp., San Antonio, TX (Hub)
VAMC Memphis, TN (Hub)
VAMC Prescott, AZ (Spoke)
VA HCS, San Diego, CA (Hub)
VAMC Reno, NV (Spoke)
VA HCS Palo Alto, CA (Hub)
James J. Peters VAMC Bronx, NY (Hub)

It should be noted that the expanded pilot institutions include both "hub" and "spoke" facilities. VA services are delivered through a hub and spoke system of care, extending from 24 regional SCI/D Centers offering primary care and specialty care by multidisciplinary teams (hubs) to the 134 SCI/D Primary Care teams (spokes) at local VA medical centers. While the definitions are duly noted, the methodology used to identify overall and SCI/D specific parking demand for hub and spoke facilities does not differ. It should also be noted that two of the ten expanded pilot facilities, Bronx, NY and Washington D.C., were studied during the initial assignment. However, and as noted in the introduction, SCI/D patient parking needs were not specifically defined in those earlier surveys.

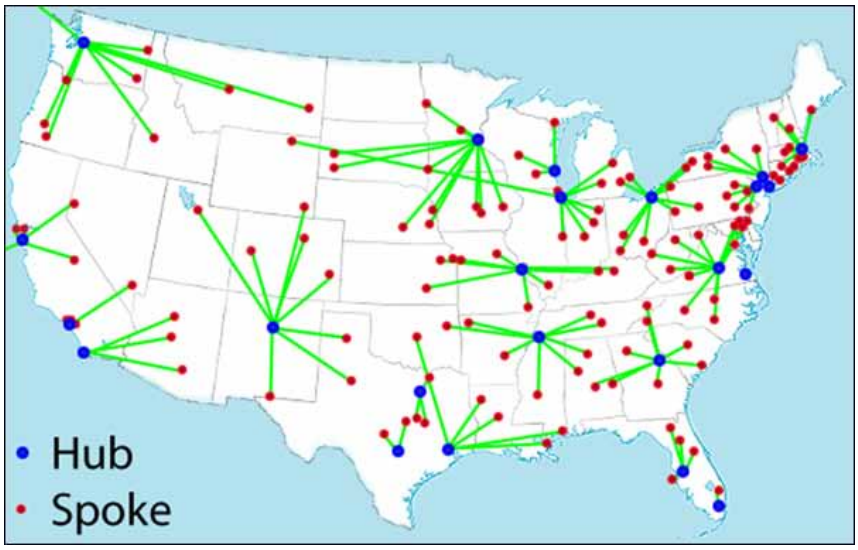

Image Source: http://www.sci.va.gov/docs/VA_Spinal_Cord_Injury_Patient_Brochure.pdf

While spoke facilities are referenced in both the overall study of VAMC parking demand and demand specific to SCI/D patients, parking space requirements for SCI/D patient which are based on this research and published in the Part I Parking Demand Guide (PDG) will not extent to spoke facilities. Spoke facilities do not have dedicated SCI/D department building entrances, do not have SCI/D beds, and have less significant daily outpatient volumes. The VA's policy regarding spoke facilities and SCI/D parking notes that it is not appropriate to single out one particular patient population at spoke facilities for dedicated parking as this sets a precedent that likely cannot be met for other patient populations with physical disabilities. For these facilities general handicap parking will be used by SCI/D patients.

Based on original and expanded pilot studies, a new PDM was developed along with this document entitled Part II Preamble to the PDM, which accompanies Part I PDG and Part III – Using the Demand Model. This preamble is used to: (1) document background data that was obtained during facility surveys; (2) illustrate the standard methodology employed in hospital/medical center parking demand studies; (3) present a justification of the determination of parking demand and peak parking demand ratios for key parking user groups, and (4) offer other VISN and VAMC capital asset managers and planners insight into peer institutions. Other VAMC

managers and planners may wish to use the parking demand ratios from one of these member institutions to model their current and future parking needs. As opposed to using a generic parking demand matrix, commuting patterns and auto utilization percentages used at the pilot facilities can be used at other VA facilities. Therefore, this preamble includes all initial and revised data on the ten (22) pilot institutions, including administrator survey form responses, auto use characteristics, persons-per-auto occupancy ratios, recommended peak hour parking demand ratios for each facility, and preliminary demand and surplus/deficit calculations.

It must be noted that during the course of these surveys, interviews, and requests for facility, patient and staffing information, it was discovered that VISN and VAMC facility planners and capital asset managers (CAMs) often use different population definitions and measurements. The PDM cannot and does not adjust for deviations in base population volumes. The PDM requires that all inputs, particularly those related to outpatients and employees, be defined using the common terms and definitions referenced in the model (see PDM Instructions tab in the spreadsheet). Therefore, it is anticipated that some intuitive thinking will be required. Depending on the source and definition of base data, VISN/VAMC planners and CAMs may be required to interpret and reclassify the data to fit the requirements of the PDM. It is also anticipated that CFM will need to thoroughly understand the source of facility and population data, as provided by VAMC and VISN participants, to ensure accurate parking demand calculations.

The PDM model is simply an initial tool that VAMC and VISN planners and CAMs use to estimate current and future parking shortages in the aggregate. Local facility directors will reference this model when examining site specific opportunities for additional surface or structured parking. Given the variety of site conditions, that opportunity may or may be achievable as determined by the model. Furthermore, the model does not address specific SCI/D space requirements as then needs are included in the overall calculation of inpatient and outpatient need. However, Preamble to the PDM does contain information gathered on SCI/D supply and utilization, including the demand for van accessible stalls. The result of this information and recommendations regarding the provision of SCI/D spaces is referenced in the Parking Design Guide (PDG). In short, the PDM is simply an initial measuring stick to be used to evaluate site specific parking development opportunities and limitations, and in the justification of VA capital funding. Once the funding and site opportunity are secure, VAMC and VISN planners and capital asset managers will still need to make appropriate decisions regarding the provision and management of SCI/D and other medical center user groups' parking facilities.

The following presents a summary of findings for the extended pilot facilities and their influence on the existing PDM.

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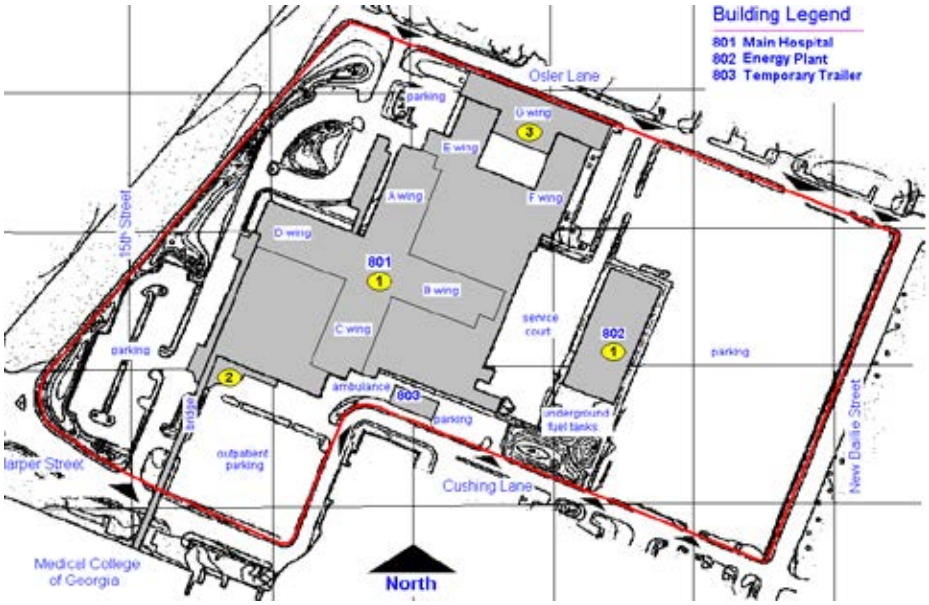
1.0 ORIGINAL PILOT SITES

1.1 CHARLIE NORWOOD VETERANS AFFAIRS MEDICAL CENTER, DOWNTOWN DIVISION - AUGUSTA, GEORGIA

The Charlie Norwood Veterans Affairs Medical Center (Exhibit 1) is a two-division Medical Center that provides tertiary care in medicine, surgery, neurology, psychiatry, rehabilitation medicine, and spinal cord injury. The Downtown Division, which was the focus of this evaluation, is located in downtown Augusta and is bound by the Medical College of Georgia to the south and low density commercial buildings to the north, east, and west. The 686,000 square foot facility is located on 20 acres, has 155 beds (58 beds for medicine, 37 beds for surgery, and 60 beds for spinal cord injury), services an estimated 40,000 outpatients annually, employs nearly 2,200 people, and is affiliated with the Medical College.

Exhibit 1: Charlie Norwood VAMC Downtown Division Campus Map



The Downtown Division of Charlie Norwood Medical Center provides 811 parking spaces, distributed in 7 surface lots on campus. An occupancy survey conducted in August 2010 shows a typical weekday peak period occupancy of ninety-six percent (96%). A shuttle operates between the Downtown and Uptown campuses and alleviates some of the parking stress at the Downtown campus. Parking occupancy counts noted that of the 778 vehicles parked during the peak hour of use, 19percent displayed ADA handicapped placards and/or license plates.

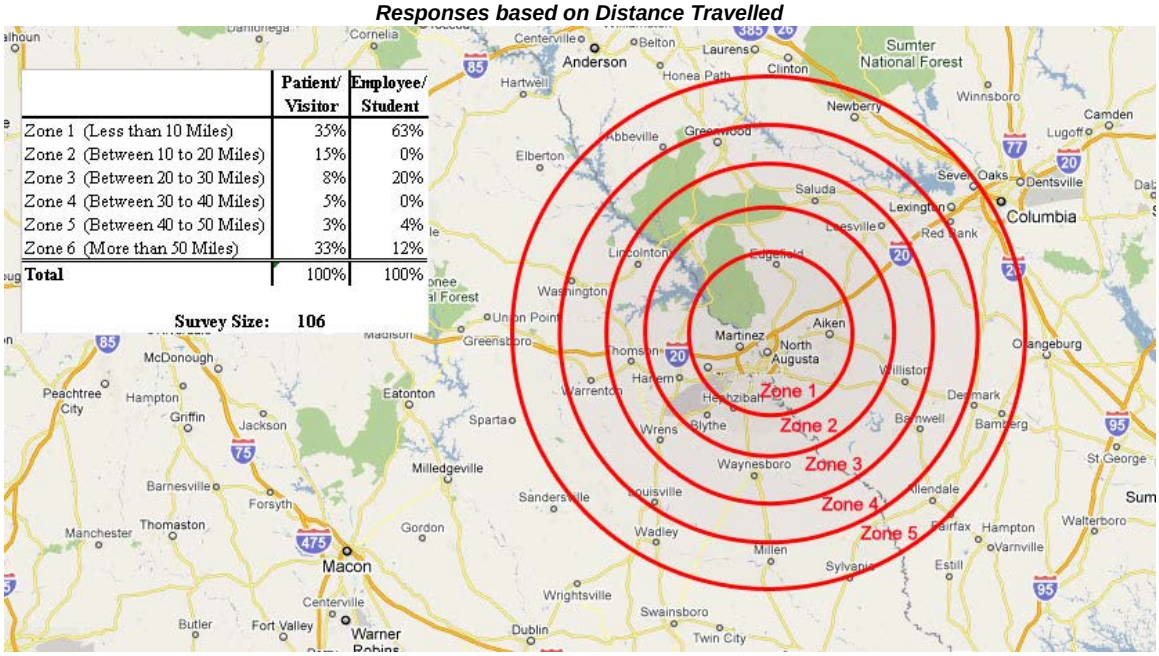
A point-of-access survey was conducted to document auto use and auto occupancy (passenger) characteristics, as well as distance travelled for each of the major staffing, patient, and visitor groups that frequent the facility (Table 1 and Exhibit 2). Auto use and persons-per-auto data is used to determine the relationship between trip purpose and trip mode. Travel distances, which are based on employee and patient/visitors residential zip code data, illustrate auto-dependency of a certain percentage of a facility's population. Ultimately, these factors are used to convert daily or peak shift staffing, patient, and visitor volumes into peak parking demand.

Table 1: Charlie Norwood VAMC Downtown Division Auto Use and Persons-per-Auto Characteristics

Population Group	Augusta	
	Auto Use	Persons per Auto
Staffing		
Full-time	89%	1.05
Part-time	89%	1.00
Physicians	100%	1.00
Service Organization	90%	1.00
Volunteers	80%	1.00
Students	80%	1.20
Patients		
Outpatients	91%	1.00
Inpatient Admissions	90%	1.00
ED Patients & Visitors	90%	1.00
Visitors		
Inpatient Visitors	90%	1.20
Vendors	100%	1.00
Non-treatment Visitors	90%	1.10

The Charlie Norwood VAMC was found to be
unique when compared to other pilot institutions in that sixty-three percent (63%) of employees and students live within a 10-mile radius of the campus, while thirty-three percent (33%) of patients and visitors live more than 50 miles away.

Exhibit 2: Charlie Norwood VAMC Downtown Division Number of Responses based on Distance Travelled

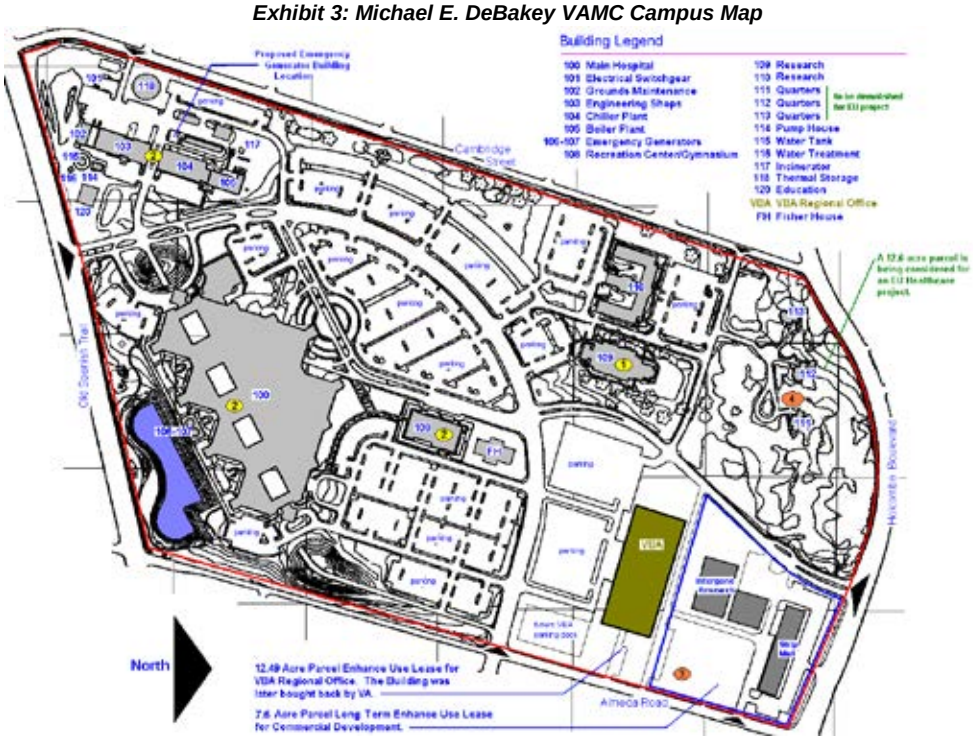


1.2 MICHAEL E. DEBAKEY VETERANS AFFAIRS MEDICAL CENTER, HOUSTON, TEXAS

Michael E. DeBakey VAMC serves as the primary health care provider for more than 108,000 Veterans in southeast Texas. Veterans from around the country visit the facility for specialized diagnostic care, radiation therapy, cardiovascular surgery, gastrointestinal endoscopy, nuclear medicine, ophthalmology, spinal cord injury, and other inpatient and outpatient services. Located on a 118-acre campus and built in 1991 (see Exhibit 3), the Medical Center is a state-of-the-art facility with 17 buildings, 420 hospital beds, a 21-bed family residential complex, and a 120-bed nursing home unit. Its spinal cord injury department is one of the oldest and largest within the VA system. It has nearly 3,800 full and part-time employees and attending physicians. Its affiliation

with the University of Texas brings an estimated 2,500 students and interns annually. In addition to its treatment and research functions, the DeBakey campus also includes the Veterans Benefits Administration's (VBA) regional office.

Exhibit 3: Michael E. DeBakey VAMC Campus Map



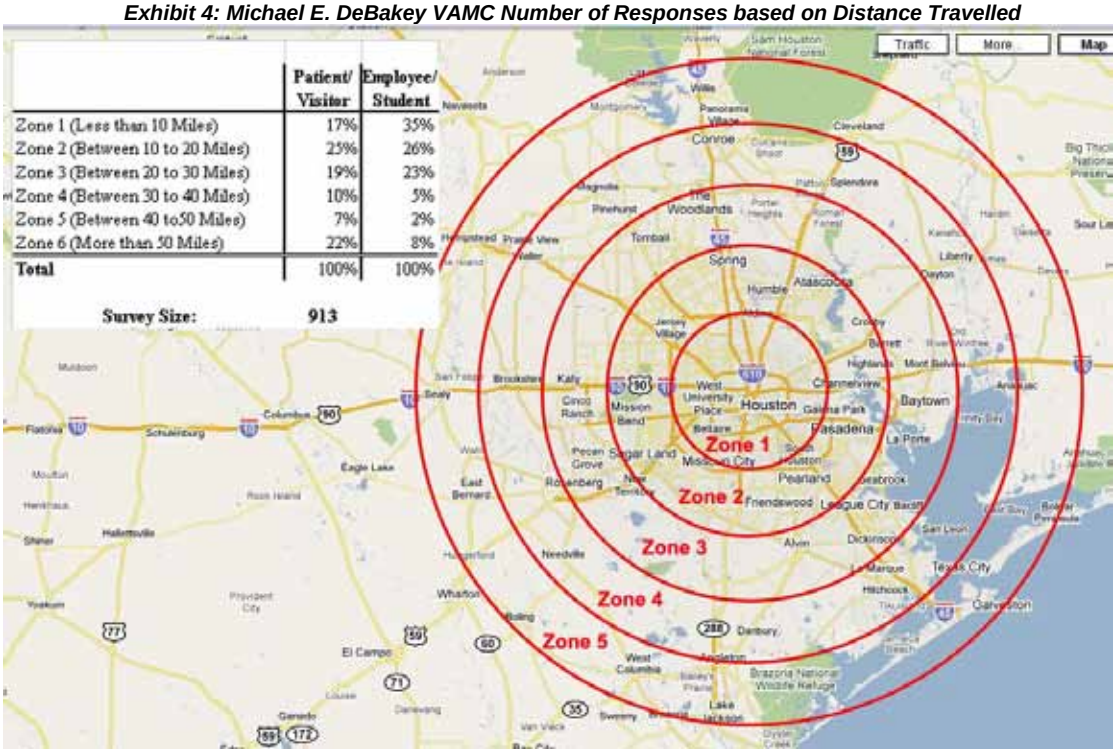
The Medical Center campus accommodates 3,768 parking spaces, distributed in 28 surface parking lots. During the August 2010 field surveys 3,777 vehicles were observed parked, many illegally. While the facility is located roughly 3 miles south of Houston's central business district, it is adjacent to the Texas Medical Center (TMC), the largest medical center in the world with approximately 75,000 employees and over 5 million patients per year. Given the high fees for monthly and daily parking at TMC, VAMC facilities planners and administrators are faced with unique challenges when trying to reserve parking facilities for VAMC patients and visitors. At this facility, approximately seven percent (7%) of cars parked during the peak hour displayed handicapped tags or license plates.

A point-of-access survey was conducted to capture the mode of travel and the distance travelled data for DeBakey VAMC employees, patients, and visitors. Table 3 summarizes the survey responses by the mode of travel used. Exhibit 4 summarizes the distance travelled based on residential zip code of employees and visitors.

Table 3: Michael E. DeBakey VAMC Auto Use and Persons-per-Auto Characteristics

Population Group	Houston	
	Auto Use	Persons per Auto
Staffing		
Full-time	79.0%	1.15
Part-time	65.0%	1.15
Physicians	44.4%	1.00
Service Organization	16.0%	1.15
Volunteers	23.8%	1.14
Students	69.6%	1.15
Patients		
Outpatients	83.9%	1.00
Inpatient Admissions	80.0%	1.00
ED Patients & Visitors	100.0%	1.00
Visitors		
Inpatient Visitors	67.9%	1.11
Vendors	100.0%	1.20
Non-treatment Visitors	69.6%	1.10

Exhibit 4: Michael E. DeBakey VAMC Number of Responses based on Distance Travelled



	Patient/ Visitor	Employee/ Student
Zone 1 (Less than 10 Miles)	17%	35%
Zone 2 (Between 10 to 20 Miles)	25%	26%
Zone 3 (Between 20 to 30 Miles)	19%	23%
Zone 4 (Between 30 to 40 Miles)	10%	5%
Zone 5 (Between 40 to50 Miles)	7%	2%
Zone 6 (More than 50 Miles)	22%	8%
Total	100%	100%

Survey Size: 913

1.3 LONG BEACH VETERANS AFFAIRS MEDICAL CENTER, LONG BEACH, CALIFORNIA

The Department of Veterans Affairs Long Beach Health-Care System is a tertiary care facility with 185 authorized hospital beds, 120 for spinal cord injury and 110 for Geriatric & Nursing. It employs 3,185 employees and non-medical staff, and serves an average of nearly 30,000 outpatients per month. The campus is situated in a suburban area, and is bound by the University of California to the north and west and by residential neighborhoods to the south and east. The 100-acre campus includes 32 buildings (see Exhibit 5). Currently, there is extensive construction and renovation occurring that has caused a significant loss of parking.

Exhibit 5: Long Beach VAMC Campus Map

Long Beach VAMC maintains 2,357 parking spaces for its employees and visitors. August 2010 surveys noted that ninety-five percent (95%) of the spaces were occupied. The supply of spaces on campus is unique from three major perspectives: 1) the large number of lots (28); 2) the wide range of different parking restrictions (27); and 3) its level of dependence on patient/visitor valet services.

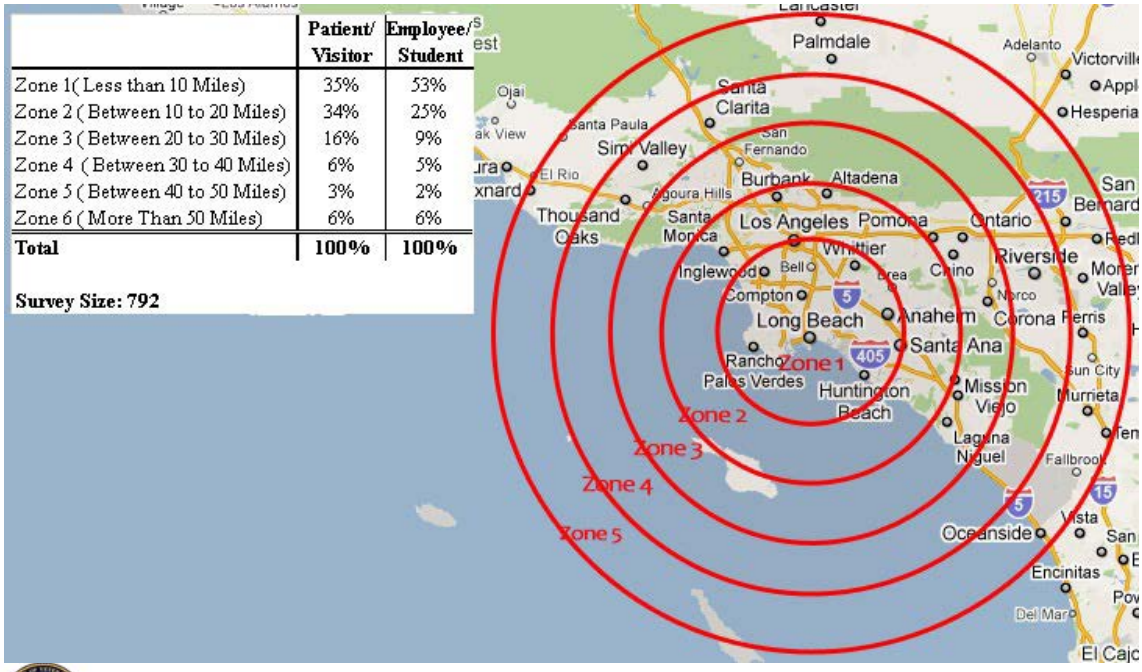
In addition to the parking occupancy counts, a point-of-access survey was conducted to record travel mode and travel distance for employees, students, patients, and visitors. Table 4 illustrates the mode of travel characteristics of the Medical Center's employees, patients and visitors. Exhibit 6 illustrates the distance travelled based on residential zip code data.

Population Group	Long Beach	
	Auto Use	Persons per Auto
Staffing		
Full-time	74.8%	1.10
Part-time	75.0%	1.00
Physicians	100.0%	1.00
Service Organization	100.0%	1.00
Volunteers	56.9%	1.14
Students	83.3%	1.20
Patients		
Outpatients	81.8%	1.00
Inpatient Admissions	77.8%	1.00
ED Patients & Visitors	100.0%	1.00
Visitors		
Inpatient Visitors	100.0%	1.20
Vendors	100.0%	1.20
Non-treatment Visitors	77.4%	1.10

Table 4: VAMC Long Beach Auto Use and Persons-per-Auto Characteristics

Though the public transit network that directly accesses the Medical Center does not immediately serve areas to the northwest, northeast, or southwest of the campus, the strong north, east, and west routes that do exist serve major residential areas. As thirty-five percent (35%) of employees and fifty-three percent (53%) of patients and visitors live within this 10 mile radius, resulting in relatively low auto utilization patterns (seventy-four percent and eighty-one percent respectively) for what would appear to be an auto-dependent, suburban environment.

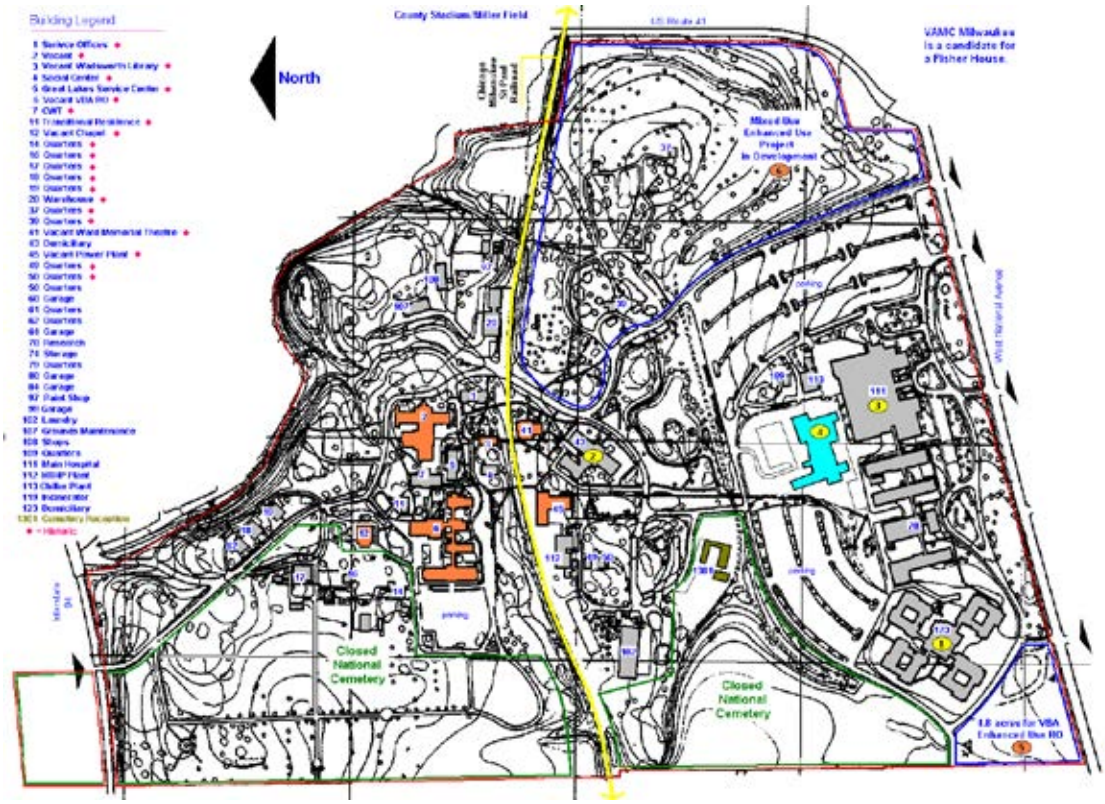
Figure 6: VAMC Long Beach Number of Responses based on distance travelled



1.4 CLEMENT J. ZABLOCKI VETERANS AFFAIRS MEDICAL CENTER, MILWAUKEE, WISCONSIN

The Clement J. Zablocki VAMC is located on the western edge of Milwaukee. The Medical Center delivers primary, secondary, and tertiary medical care in 170 acute care operating beds, and accommodates over 500,000 visits annually through an extensive outpatient program. The nursing home care unit of 113 beds offers geriatric programming, and the 326 domiciliary beds are the focus of programs in substance abuse rehabilitation, psychiatric rehabilitation, and post traumatic stress disorder care. At present, the Zablocki Medical Center employs 3,626 employees and staff. The campus is unique (see Figure 7) in that it has 53 buildings, is located on a campus of 185 acres, and shares the property with Woods National Cemetery and a number of buildings on the Historic National Register. As such, though the campus has significant green space, property is unavailable for development and/or permanent surface parking expansion.

Figure 7: Clement J. Zablocki VAMC Campus Map



The Clement J. Zablocki VAMC provides 2,549 parking spaces, distributed in 31 surface lots. The August 2010 survey noted ninety-one percent (91%) of the spaces were occupied during the peak hour.

Table 5 summarizes the results of a point-of-access survey conducted in August to study the mode of travel and distance travelled by employees, patients and visitors coming to the campus, while Exhibit 8 illustrates the distance travelled based on the residential zip code of survey respondents.

Table 5: Clement J. Zablocki VAMC Auto Use and Persons-per-Auto Characteristics

Population Group	Milwaukee	
	Auto Use	Persons per Auto
Staffing		
Full-time	86.0%	1.10
Part-time	59.6%	1.26
Physicians	100.0%	1.00
Service Organization	100.0%	1.00
Volunteers	75.0%	1.00
Students	50.0%	1.20
Patients		
Outpatients	74.4%	1.00
Inpatient Admissions	25.0%	1.00
ED Patients & Visitors	71.4%	1.00
Visitors		
Inpatient Visitors	70.0%	1.40
Vendors	100.0%	1.20
Non-treatment Visitors	100.0%	1.10

Exhibit 8: Clement J. Zablocki VAMC Number of Responses Based on Distance Travelled

	Patient/ Visitor	Employee/ Student
Zone 1 (Less than 10 Miles)	35%	46%
Zone 2 (Between 10 to 20 Miles)	17%	26%
Zone 3 (Between 20 to 30 Miles)	8%	8%
Zone 4 (Between 30 to 40 Miles)	9%	6%
Zone 5 (Between 40 to50 Miles)	7%	4%
Zone 6 (More than 50 Miles)	25%	9%
Total	**100%**	**100%**

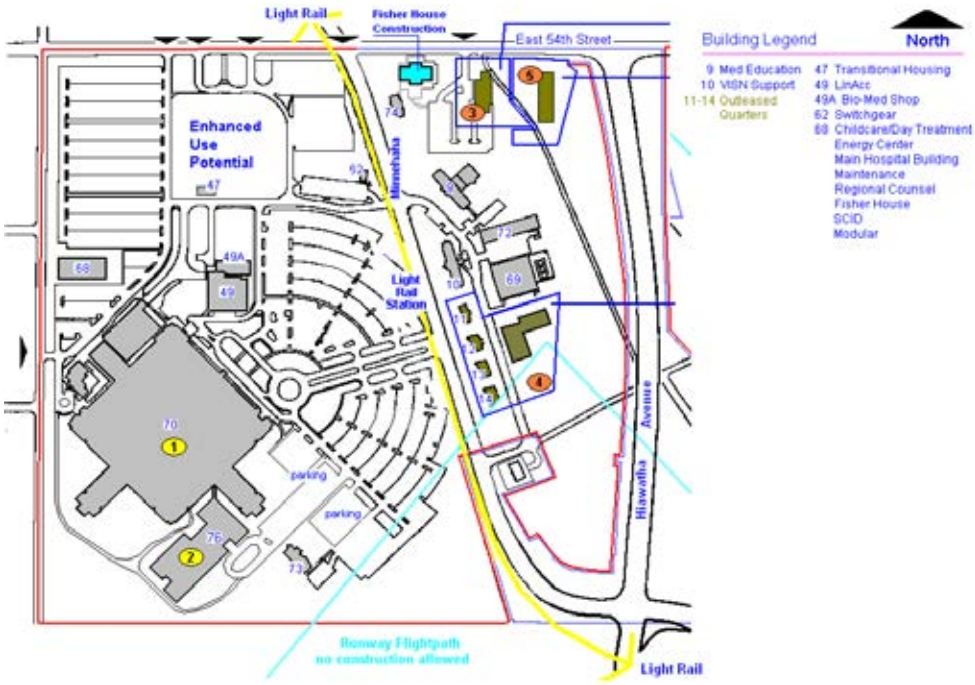
Survey Size: 631

1.5 MINNEAPOLIS DEPARTMENT OF VETERANS AFFAIRS MEDICAL CENTER, MINNEAPOLIS, MINNESOTA

Minneapolis VAMC is a teaching hospital providing a full range of patient care services with state-of-the-art technology, as well as education and research. The VAMC provides comprehensive health care through primary care, tertiary care and long term care in the areas of medicine, surgery, psychiatry, physical medicine and rehabilitation, neurology, oncology, dentistry, geriatrics and extended care. The Medical Center is designated as one of the four poly-trauma VAMCs, and serves active duty personnel and Veterans for rehabilitation of injuries such as traumatic brain injury, blindness and amputation. This unit provides continued rehabilitation therapies to assist Veterans and active duty service members to reach their highest level of independence. The Spinal Cord Injury/Disorder (SCI/D) Center provides acute rehabilitation, primary care, and sustaining care for Veterans with spinal cord injuries and disorders.

The campus (see Exhibit 9) sits on 112 acres approximately 4 miles south of downtown Minneapolis, and contains 25 buildings totaling 1.8 million gross square feet. It is bound by residential neighborhoods to the north and west, Minneapolis/St.Paul International Airport to the south, and Fort Snelling State Park and the Mississippi River to the east. It employs nearly 3,700 individuals, services an annual outpatient population of nearly 600,000, and has 236 hospital and 70 nursing home beds.

Exhibit 9: Minneapolis VAMC Campus Map



The campus maintains 3,318 parking spaces distributed in 21 surface parking lots. Field surveys in August 2010 noted peak occupancy at 2,796 spaces (eighty-four ppercent). Of the total number of vehicles parked on campus during the peak period of parking activity, nearly eight percent (8%) displayed handicapped accessible hangtags and/or license plates.

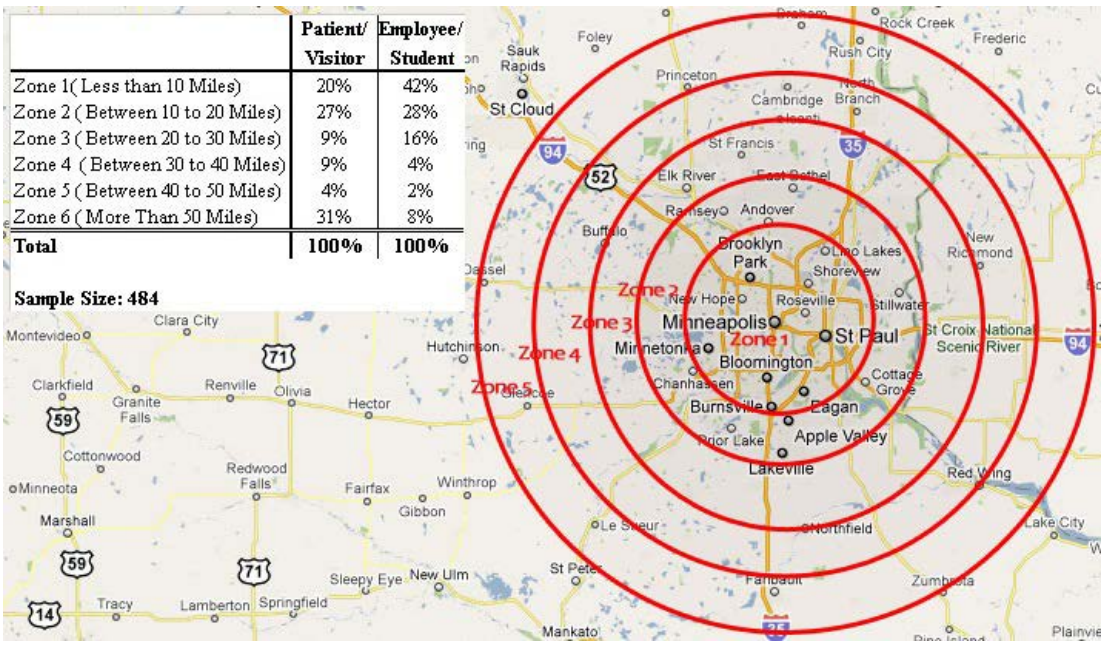
A point-of-access survey was conducted to capture auto use and persons-per-auto data, with the results shown in Table 6. Exhibit 10 shows the distance travelled by employees and visitors based on the residential zip code data collected.

Table 6: Minneapolis VAMC Auto Use and Persons-Per-Auto Characteristics

Population Group	Minneapolis	
	Auto Use	Persons per Auto
Staffing		
Full-time	87.7%	1.04
Part-time	42.9%	1.00
Physicians	100.0%	1.00
Service Organization	82.4%	1.04
Volunteers	76.2%	1.00
Students	100.0%	1.21
Patients		
Outpatients	83.1%	1.00
Inpatient Admissions	83.3%	1.00
ED Patients & Visitors	na	na
Visitors		
Inpatient Visitors	100.0%	1.64
Vendors	87.5%	1.00
Non-treatment Visitors	92.9%	1.64

While forty-two percent (42%) of employees live within a 10-mile radius and a light rail station is located adjacent to the campus, it appears that these existing transit services are ineffective in discouraging employees from using their personal automobile. Nearly eighty-eight percent (88%) of full-time employees drive and park a vehicle on the campus.

Exhibit 10: Minneapolis VAMC Number of Responses Based on Distance Traveled



	Patient/ Visitor	Employee/ Student
Zone 1(Less than 10 Miles)	20%	42%
Zone 2 (Between 10 to 20 Miles)	27%	28%
Zone 3 (Between 20 to 30 Miles)	9%	16%
Zone 4 (Between 30 to 40 Miles)	9%	4%
Zone 5 (Between 40 to 50 Miles)	4%	2%
Zone 6 (More Than 50 Miles)	31%	8%
Total	**100%**	**100%**

Sample Size: 484

1.6 SAN FRANCISCO DEPARTMENT OF VETERANS AFFAIRS MEDICAL CENTER, SAN FRANCISCO, CALIFORNIA

The San Francisco Department of Veterans Affairs Medical Center serves an 8-county area of Northern California. Located on this site since 1934, the Medical Center consists of 124 authorized hospital beds and 120 nursing home beds. The 29-acre site includes 34 buildings with 933,000 gross square feet of space. The Medical Center currently employs 2,342 employees and non-medical staff, and served approximately 65,000 outpatients during FY 2008. With views of the Golden Gate Bridge, the campus (see Exhibit 12) is bound by the Pacific Ocean to the north and west, Lincoln Park to the east, and high density single family residential neighborhoods to the south.

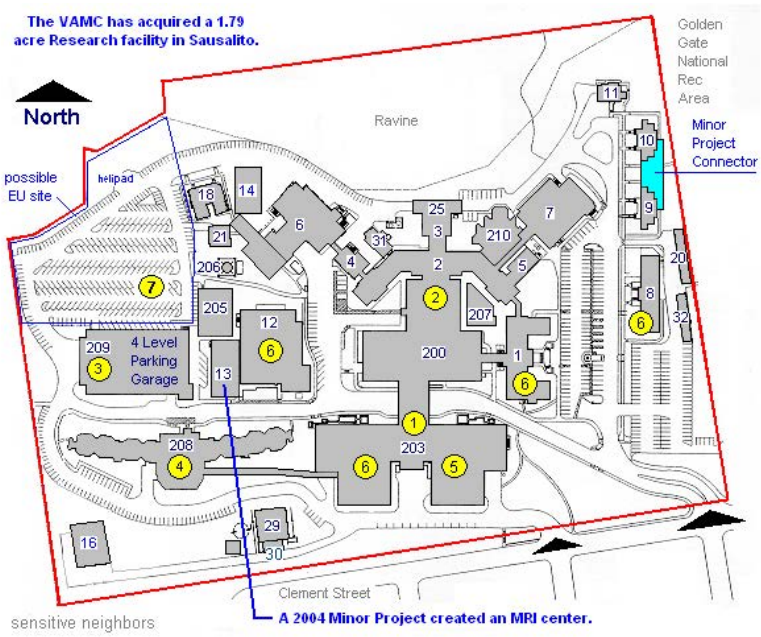


Exhibit 12: San Francisco United States Department of Veterans Affairs Medical Center Campus Map

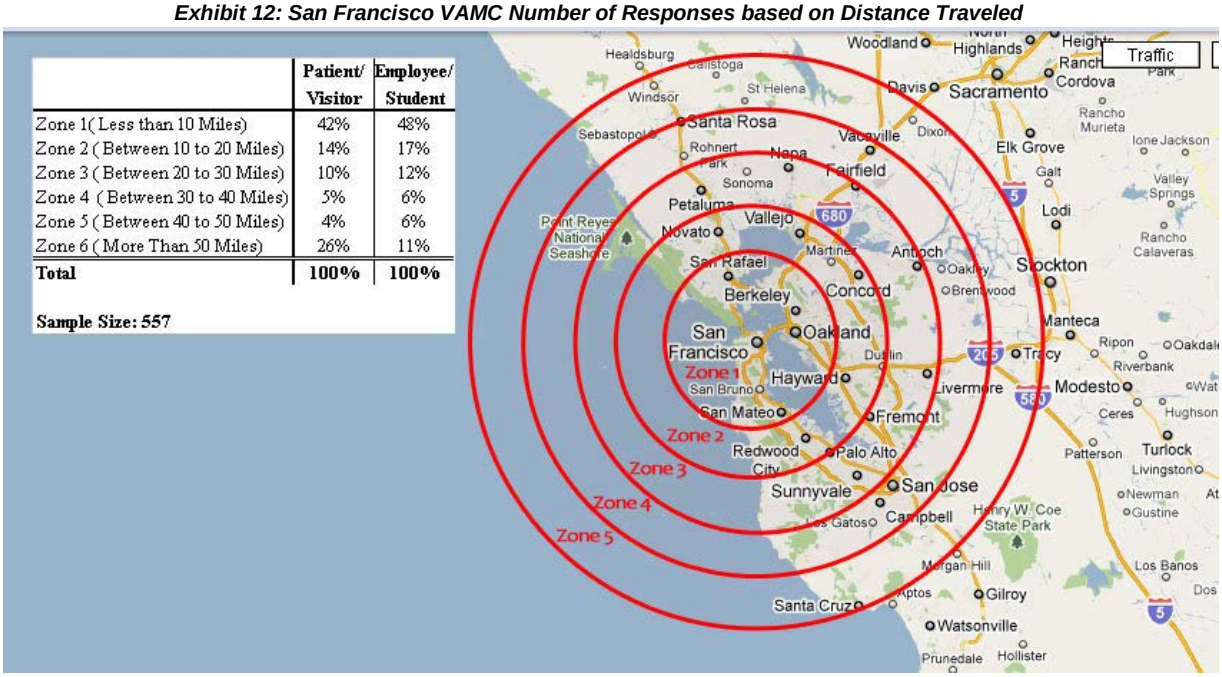
The Medical Center provides 1,225 parking spaces, distributed in 12 surface lots and one garage, of which 1,236 were occupied (illegal and double parking). Of all vehicles parked during the peak period of parking activity, six percent (6%) displayed handicapped hangtags and/or license plates.

A point-of-access survey was conducted to capture the mode of travel and the distance travelled data for Medical Center employees, patients, and visitors. Table 7 summarizes the survey responses by the mode of travel used, while Exhibit 12 summarizes the distance travelled based on the residential zip codes of employees and visitors.

Table 7: San Francisco VAMC Auto Use and Persons-per-Auto Characteristics

Population Group	San Francisco	
	Auto Use	Persons per Auto
Staffing		
Full-time	71.0%	1.16
Part-time	69.6%	1.26
Physicians	84.0%	1.24
Service Organization	81.8%	1.27
Volunteers	78.9%	1.00
Students	82.8%	1.14
Patients		
Outpatients	49.4%	1.00
Inpatient Admissions	80.0%	1.00
ED Patients & Visitors	na	na
Visitors		
Inpatient Visitors	85.7%	1.20
Vendors	100.0%	1.00
Non-treatment Visitors	80.0%	1.00

Exhibit 12: San Francisco VAMC Number of Responses based on Distance Traveled



	Patient/ Visitor	Employee/ Student
Zone 1(Less than 10 Miles)	42%	48%
Zone 2 (Between 10 to 20 Miles)	14%	17%
Zone 3 (Between 20 to 30 Miles)	10%	12%
Zone 4 (Between 30 to 40 Miles)	5%	6%
Zone 5 (Between 40 to 50 Miles)	4%	6%
Zone 6 (More Than 50 Miles)	26%	11%
Total	**100%**	**100%**

Sample Size: 557

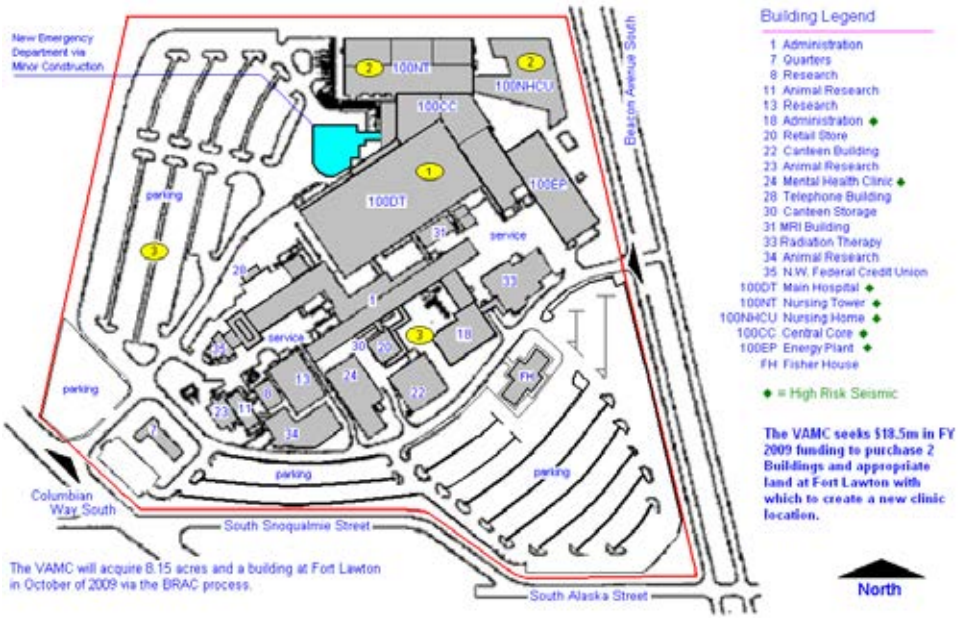
The Medical Center's geographic location significantly limits the coverage and effectiveness of direct public transit service alternatives. As a result, a larger-than-anticipated percentage of employees drive and park a vehicle on the campus, in spite of the area's low density but urban characteristics. However, the employee-based can/vanpool program appears to be quite successful, as a significant number of full/part-time employees and physicians arrive as passengers.

1.7 PUGET SOUND HEALTHCARE SYSTEM, SEATTLE, WASHINGTON

VA's Puget Sound Health Care System (HCS) is a distinguished leader in teaching, research, and patient care, while earning prestigious recognition as part of the largest health care network in the country. Puget Sound HCS serves more than 70,000 Veterans living in the Pacific Northwest. As a teaching hospital, the Puget Sound system provides a full range of services, with state-of-the-art technology as well as education and research.

The 1.12 million gross square foot facility (see Exhibit 13) occupies 34 acres and includes 18 buildings providing 274 hospital beds, 38 nursing unit beds, and 20 family resident suites. Puget Sound HCS employs 3,145 employees and non-medical staff, and served approximately 71,600 outpatients in FY 2008. The campus is located roughly 3 miles south of downtown Seattle in a suburban area, and is bound to the north and west by a golf course and to the south and west by low density residential neighborhoods.

Exhibit 13: Veterans Affairs Puget Sound Healthcare System Campus Map



The Puget Sound Healthcare System provides 2,037 parking spaces for its employees and visitors. As per an occupancy survey conducted in August 2010, the peak period occupancy is ninety-seven percent (97%).

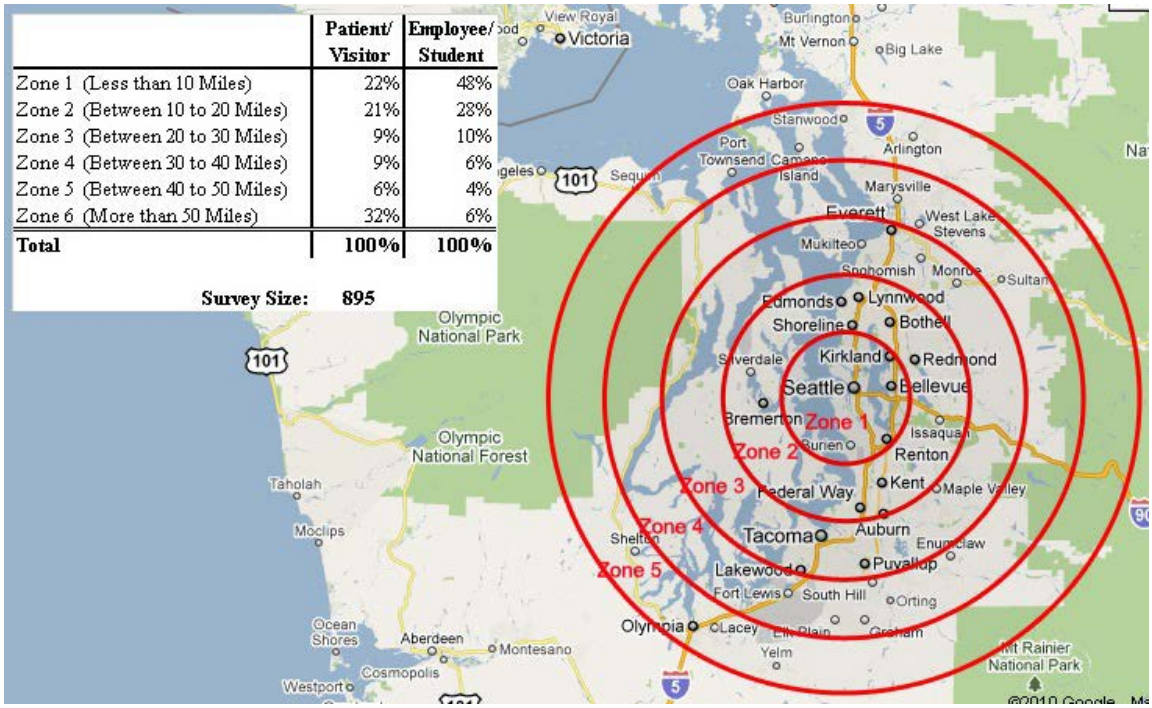
To understand the mode of travel and the distance travelled by the employees and visitors to the Medical Center, a point-of-access survey was conducted. Table 8 summarizes the mode of travel and persons-per-auto occupancy data.

Table 8: Veterans Affairs Puget Sound HCS Auto Use and Persons-per-Auto Characteristics

Population Group	Seattle	
	Auto Use	Persons per Auto
Staffing		
Full-time	77.3%	1.16
Part-time	80.0%	1.15
Physicians	75.0%	1.00
Service Organization	66.7%	1.33
Volunteers	66.7%	1.11
Students	59.3%	1.38
Patients		
Outpatients	67.7%	1.00
Inpatient Admissions	46.7%	1.00
ED Patients & Visitors	na	na
Visitors		
Inpatient Visitors	88.5%	1.20
Vendors	100.0%	1.00
Non-treatment Visitors	90.0%	1.00

Exhibit 14 shows the distance travelled by employees and visitors to the facility based on residential zip code data. It is apparent that a large number of people working or receiving treatment at the Puget Sound Health Care System live within a 20-mile radius of the hospital.

Exhibit 14: Veterans Affairs Puget Sound HCS Mode of Travel Puget Sound HCS Number of Responses based on Distance Traveled



	Patient/ Visitor	Employee/ Student
Zone 1 (Less than 10 Miles)	22%	48%
Zone 2 (Between 10 to 20 Miles)	21%	28%
Zone 3 (Between 20 to 30 Miles)	9%	10%
Zone 4 (Between 30 to 40 Miles)	9%	6%
Zone 5 (Between 40 to 50 Miles)	6%	4%
Zone 6 (More than 50 Miles)	32%	6%
Total	**100%**	**100%**

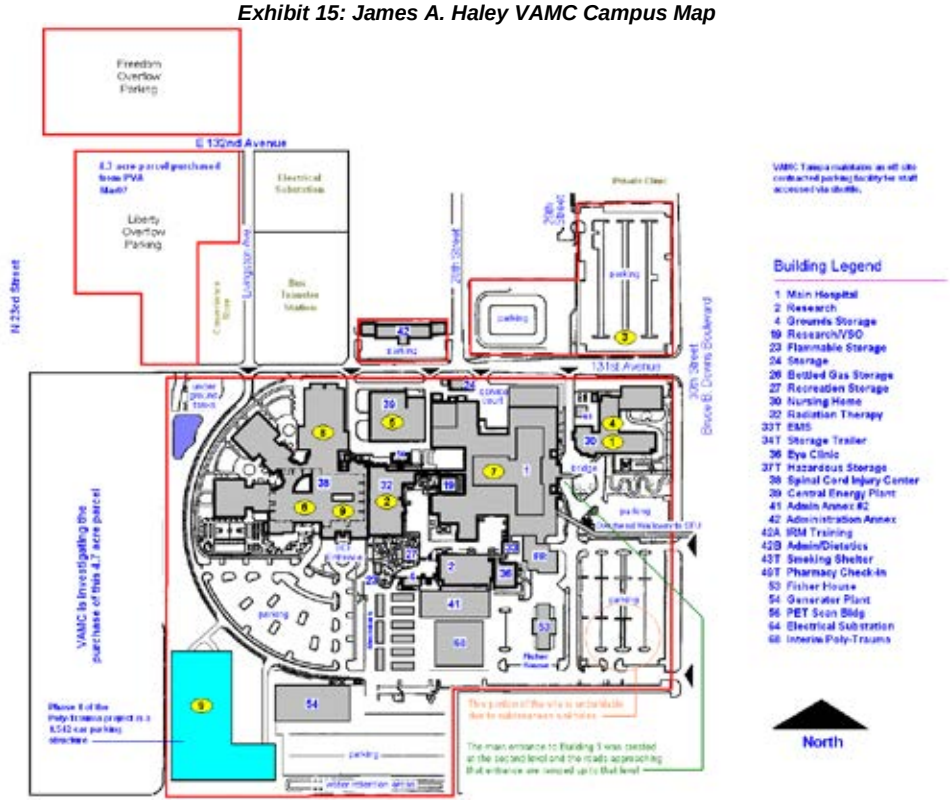
Survey Size: 895

1.8 JAMES A. HALEY VETERANS AFFAIRS MEDICAL CENTER, TAMPA, FLORIDA

James A. Haley VA hospital is the busiest of the four poly-trauma facilities in the nation. Services are available to more than 116,000 Veterans living in a four-county area of Florida. As a teaching hospital, James A. Haley VAMC provides a full-range of services, with state-of-the-art technology as well as education and research. James A. Haley VA hospital accommodates 415 hospital beds, 35 domiciliary beds, and 118 nursing home beds. The Medical Center employs 6,253 employees and non medical staff, and in FY2008 treated over 55,000 outpatients.

The 1.29 million gross square foot campus (see Exhibit 15) occupies 53 acres and 39 separate buildings. It is affiliated with and adjacent to the University of South Florida, and is connected to that campus via a pedestrian bridge over Bruce Downs Boulevard. It is located in a predominantly low density residential neighborhood that is approximately 9 miles from Tampa's central business district.

Exhibit 15: James A. Haley VAMC Campus Map



James A. Haley VAMC provides 2,801 parking spaces, distributed in 11 on site lots and 4 offsite lots. Included in the off-site inventory are 300 spaces that the Medical Center leases from a shopping mall, located approximately three-quarters of a mile away. Designated as patient and visitor overflow parking, it employs a shuttle to transport patients, visitors, and some employees to the Medical Center. Of the total supply of spaces including lease lots some 2,398 vehicles were parked, and of that number, 231 had handicapped hangtags and/or license plates (ten percent).

A point-of-access survey was conducted to record the mode of travel and the distance travelled by each of the Medical Center's user groups. Table 9 summarizes the mode of travel, while Exhibit 16 illustrates the distance travelled based on residential zip code data of employees and visitors.

Table 9: James A. Haley VAMC Auto Use and Persons-per-Auto Characteristics

Population Group	Tampa	
	Auto Use	Persons per Auto
Staffing		
Full-time	87.0%	1.12
Part-time	89.0%	1.05
Physicians	91.7%	1.00
Service Organization	75.0%	1.00
Volunteers	70.8%	1.00
Students	100.0%	1.00
Patients		
Outpatients	72.9%	1.00
Inpatient Admissions	42.9%	1.00
ED Patients & Visitors	100.0%	1.00
Visitors		
Inpatient Visitors	71.4%	1.40
Vendors	100.0%	1.00
Non-treatment Visitors	50.0%	1.00

Exhibit 16: James A. Haley VAMC Number of Responses based on Distance Traveled

	Patient/ Visitor	Employee/ Student
Zone 1(Less than 10 Miles)	27%	34%
Zone 2 (Between 10 to 20 Miles)	19%	31%
Zone 3 (Between 20 to 30 Miles)	17%	17%
Zone 4 (Between 30 to 40 Miles)	12%	6%
Zone 5 (Between 40 to 50 Miles)	4%	2%
Zone 6 (More Than 50 Miles)	21%	10%
Total	**100%**	**100%**

Sample Size: 627

2.0 EXPANDED PILOT SITES & SCI/D DEMOGRAPHICS

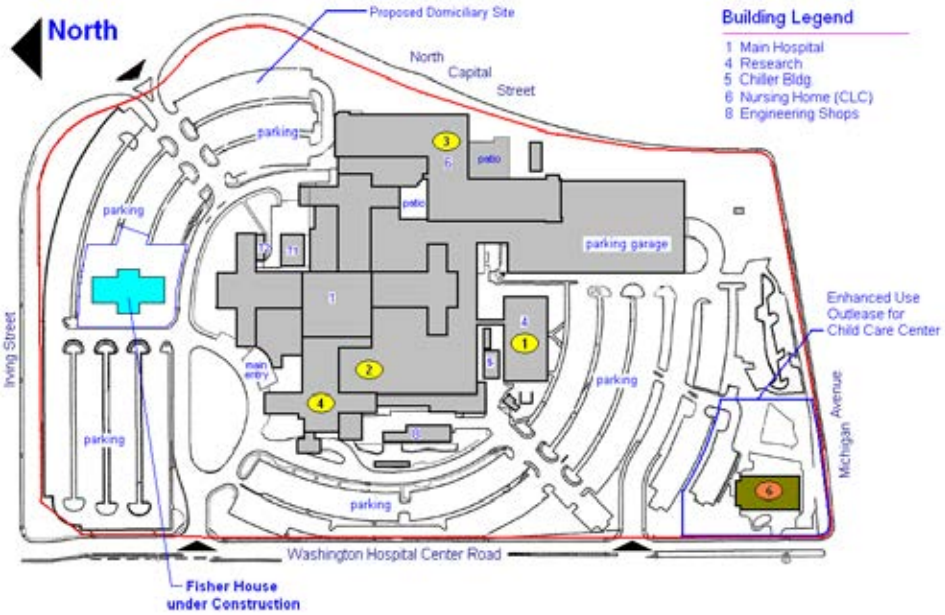
As noted in the introduction, the analysis of parking demand generated by expanded pilot facilities increases the sample size of data used to create the PDM, and therefore, the relative accuracy of the model, and provides insight for the first time into SCI/D patient parking needs. As population data and auto use characteristics represent the foundation of the PDM, this section of the preamble presents the basic facility size, parking inventory/utilization, auto use demographics, and origin/destination data but it also introduces information on SCI/D beds, treatment units, and inpatient and outpatient volumes.

2.1 WASHINGTON D.C. DEPARTMENT OF VETERANS AFFAIRS MEDICAL CENTER. WASHINGTON, DC (SPOKE)

The Washington DC Veterans Affairs Medical Center treats over 50,000 inpatient veterans and has over 500,000 outpatient visits each year. Washington DC VAMC is a tertiary care teaching facility that provides acute, general, and specialized services in medicine, surgery, neurology, and psychiatry, as well offering nursing home care treatment. In addition, the Medical Center oversees one satellite Substance Abuse Clinic and three Veteran Centers.

The 34-acre campus includes 7 buildings with 968,000 gross square feet of space (see Exhibit 17). It is affiliated with medical schools at Georgetown University and Howard University, and is contiguous to but unaffiliated with Washington Hospital Center and Children's National Medical Center, a 926-bed medical complex with approximately 6,000 employees conducting 400,000 outpatient visits annually.

Exhibit 17: Washington DC United States Department of Veterans Affairs Medical Center Site Plan



The Medical Center provides 2,045 parking spaces to its employees and visitors in various on-site and off-site locations. The on-site parking consists of 10 surface lots and 1 garage. Washington DC VAMC provides additional off-site employee and visitor parking in the Old Soldiers home campus, which is accessed via shuttle bus. A parking occupancy survey conducted in August 2011 recorded a peak period occupancy of eighty-eight percent (88%), with 1,808 of the total 2,045 spaces being occupied.

A survey of peak period handicapped placards, hangtags, and license plates found 27 such designed vehicles parking in non-ADA accessible spaces. This volume would be in addition to the 64 vehicles found in ADA accessible spaces. Of the 1,808 vehicles parked during the peak hour 91, or five percent (5%), displayed ADA placards.

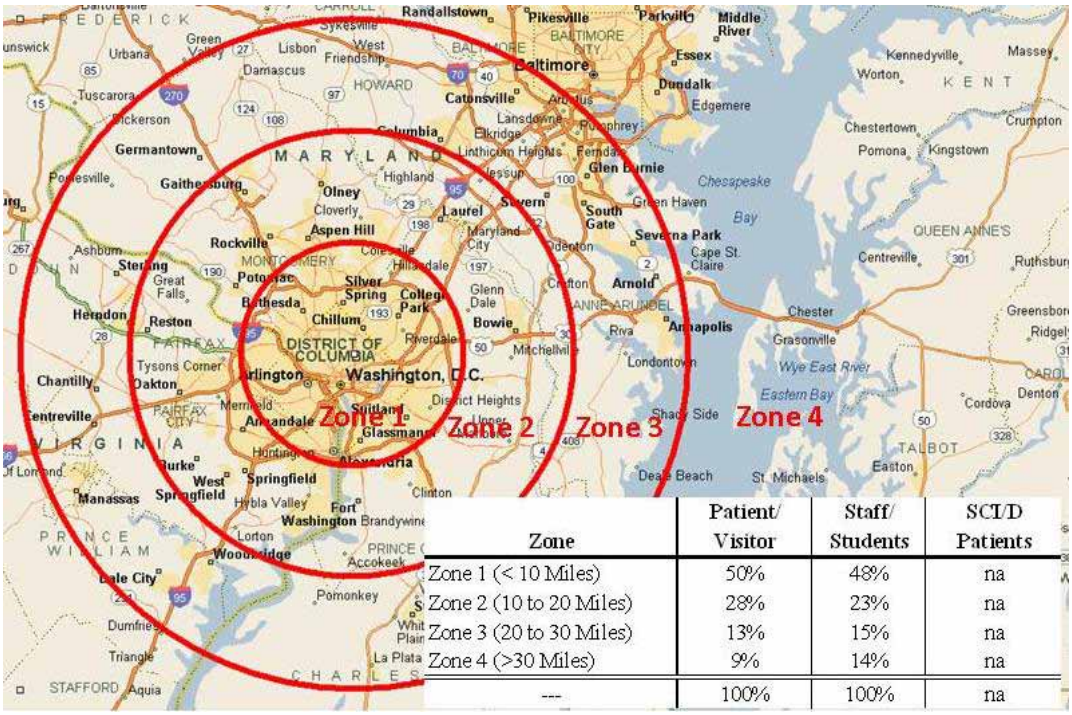
A point-of-access survey was conducted to understand the mode of travel adopted and distance travelled by the VAMC employees and visitors. Table 10 presents the travel mode characteristics based on the survey responses and Exhibit 18 illustrates, both numerically and graphically, the distance travelled based on residential zip code data.

Table 10: Washington DC VAMC Auto Use and Persons-per-Auto Characteristics

Population Group	Auto Use	Persons per Auto
Staffing		
Full-time	61%	1.27
Part-time	38%	1.00
Physicians	100%	1.00
Service Organization	----	----
Volunteers	----	----
Students	----	----
Patients		
Spinal Cord Injury	----	----
Outpatients	54%	1.06
Inpatient Admissions	100%	1.00
ED Patients	----	----
Visitors		
Inpatient Visitors	100%	1.00
Vendors	100%	1.00
Non-treatment Visitors	67%	1.00

As the campus is adjacent to other major employers, is in an area of high traffic congestion, and has excellent access to bus and rail public transportation, employee and outpatient auto utilization percentages and employee-per-auto ratios, i.e., car/vanpool participation, are representatively low.

Exhibit 18: Washington DC VAMC Number of Responses based on Distance Travelled



Zone	Patient/ Visitor	Staff/ Students	SCI/D Patients
Zone 1 (< 10 Miles)	50%	48%	na
Zone 2 (10 to 20 Miles)	28%	23%	na
Zone 3 (20 to 30 Miles)	13%	15%	na
Zone 4 (>30 Miles)	9%	14%	na
---	100%	100%	na

As Washington DC VAMC is a spoke facility with no dedicated SCI/D treatment rooms, no separate building access point, and no reserved parking spaces, the point of access questionnaire was unable to differentiate between SCI/D patient travel characteristics and non-SCI/D characteristics. However, subjective information on patient volumes, duration of stay, and parking need were obtained through conversations with staff and the PVA representative. Washington DC VAMC provides clinic/outpatient access/treatment services twice per month (second and fourth Wednesdays) with treatment hours between noon and 4 PM. Presently, the clinic sees three (3) SCI/D patients during a typical day, treatment services/observations are comprehensive, and visits generally are all day (4 hours). Based on conversations with SCI/D and PVA staff all SCI/D patients arrive with a family member via personal automobile. The medical center does not have dedicated/reserved SCI/D parking spaces.

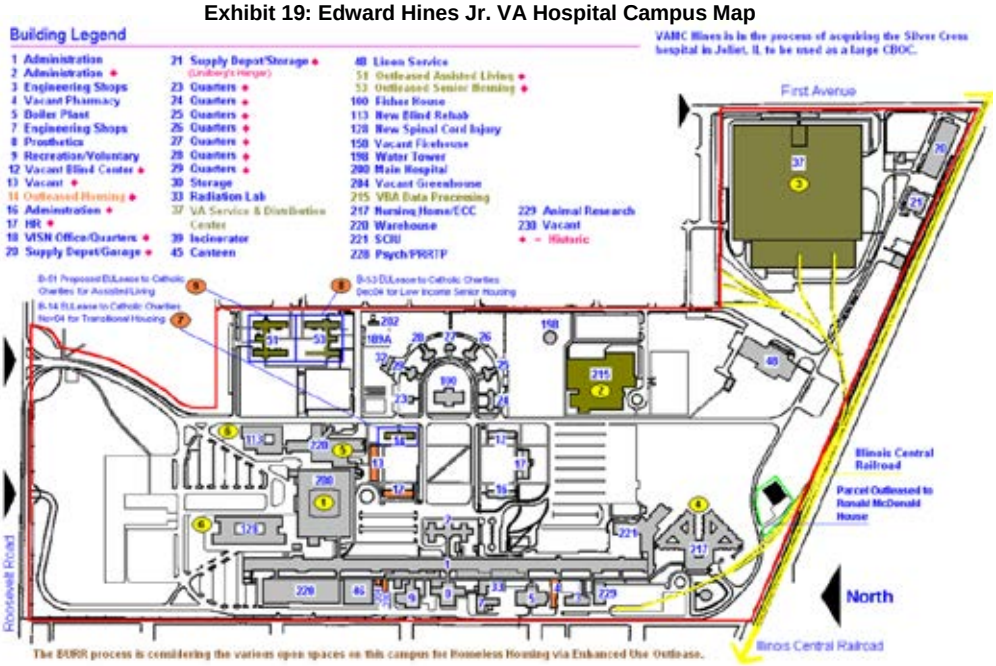
Like the original pilot facility surveys, information regarding overall treatment services, staffing, outpatient volumes, and bed capacity/average occupancy for Washington DC VAMC were provided by the local capital asset manager/facility manager via an administrator survey form.

2.2 EDWARD HINES JR. VA HOSPITAL, HINES, ILLINOIS (HUB)

Edward Hines, Jr. VA Hospital, a hub facility, is located 12 miles west of downtown Chicago on a 147-acre campus, offers primary, extended and specialty care and serves as a tertiary care referral center for VISN 12. Exhibit 19 presents the site plan as provided by CFM. Specialized clinical programs include blind rehabilitation, spinal cord injury, neurosurgery, radiation therapy and cardiovascular surgery. The hospital also serves as the VISN 12 southern tier hub for pathology, radiology, radiation therapy, human resource management and fiscal services. With 53 buildings, 134 hospital beds, 74 domiciliary beds, 135 nursing home beds, a Fisher House and

nearly 2.4 million gross square feet of space the medical center served over 70,000 patients in Year 2010.

Exhibit 19: Edward Hines Jr. VA Hospital Campus Map



The Medical Center provides 3,403 parking spaces to its employees and visitors in various on-site lots. A parking occupancy survey conducted in February 2012 recorded a peak period occupancy of eighty-four percent (84%), with 2,855 of the total 3,403 spaces being occupied.

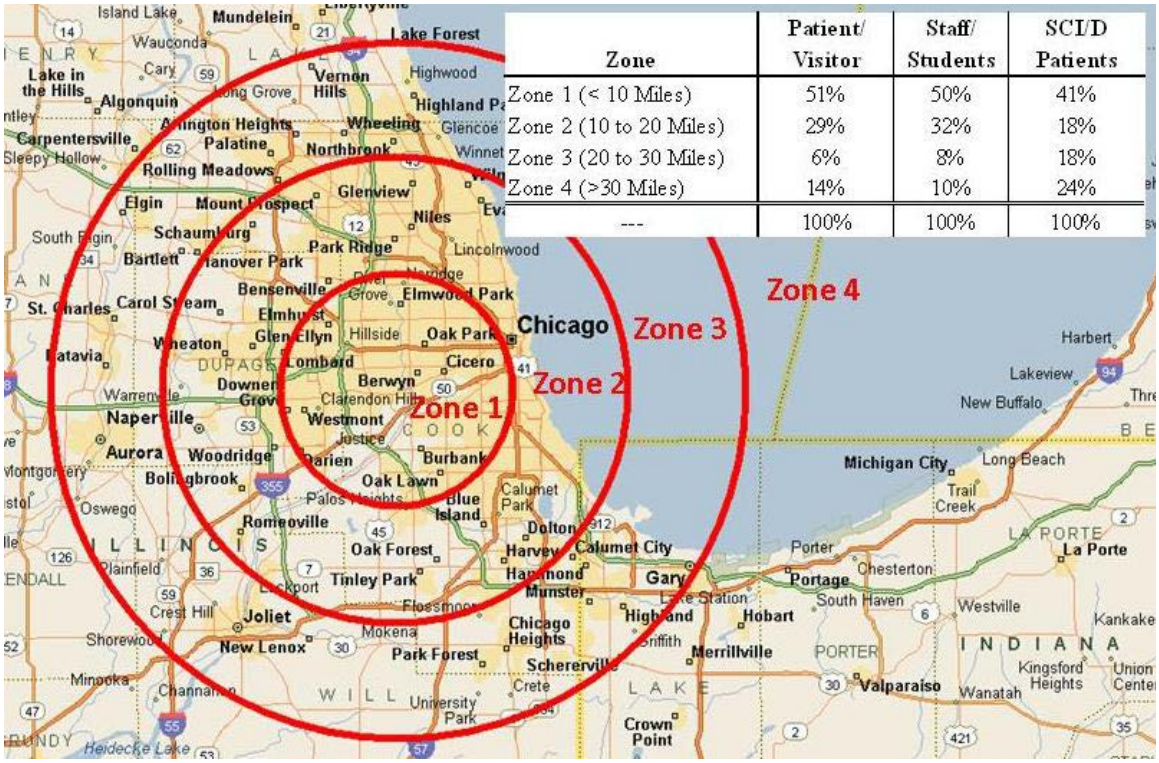
It must be noted that the designation, allocation, and enforcement of patient/visitor and employee spaces is quite vague. Therefore, employees could be parking in visitor spaces and vice versa. Occupancy surveys also recorded the number of parked vehicles displaying handicapped placards/hangtags. During the peak hour of parking utilization 190 vehicles displayed the placards, of which, 19 were found parked in non-ADA accessible spaces.

A point-of-access survey was conducted to understand the mode of travel adopted and distance travelled by the VAMC employees and visitors. Table 11 exhibits the travel mode characteristics based on the survey responses, and Exhibit 20 illustrates, both numerically and graphically, the distance travelled based on residential zip code data. The data includes responses for patients as they entered the SCI/D wing.

Table 11: Edwards Hines Jr. VAMC Auto Use and Persons-per-Auto Characteristics

Population Group	Auto Use	Persons per Auto
Staffing		
Full-time	81%	1.00
Part-time	75%	1.00
Physicians	55%	1.00
Service Organization	60%	1.00
Volunteers	67%	1.00
Students	96%	1.04
Patients		
Spinal Cord Injury	26%	1.10
Outpatients	64%	1.10
Inpatient Admissions	50%	1.00
ED Patients	100%	1.00
Visitors		
Inpatient Visitors	81%	1.00
Vendors	56%	1.40
Non-treatment Visitors	75%	1.17

Exhibit 20: Edwards Hines Jr. VAMC Number of Responses based on Distance Travelled



Zone	Patient/ Visitor	Staff/ Students	SCI/D Patients
Zone 1 (< 10 Miles)	51%	50%	41%
Zone 2 (10 to 20 Miles)	29%	32%	18%
Zone 3 (20 to 30 Miles)	6%	8%	18%
Zone 4 (>30 Miles)	14%	10%	24%
---	100%	100%	100%

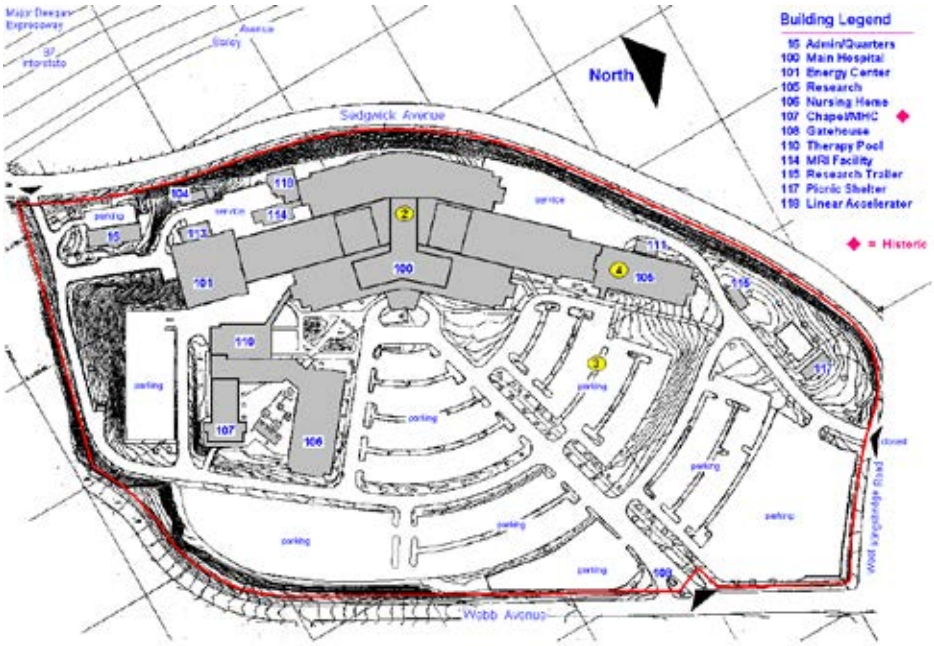
Information regarding treatment services, staffing, outpatient volumes, and bed capacity/average occupancy for the SCI/D department was not provided using the administrator survey form. However, some qualitative information was obtained during the stakeholder interviews.

2.3 JAMES J. PETERS VETERANS AFFAIRS MEDICAL CENTER, BRONX, NEW YORK (HUB)

The James J. Peters VAMC located in Bronx, NY within VISN 3 is a tertiary care facility classified as a Clinical Referral Level 1 Facility. It is a teaching hospital providing a full range of patient care services, with state-of-the-art technology. Comprehensive health care is provided through primary care, tertiary care, and long term care in the areas of medicine, surgery, psychiatry, physical medicine and rehabilitation, neurology, oncology, dentistry, geriatrics, and extended care.

The facility has 1.43 million gross square feet contained in 8 buildings, with 258 authorized hospital beds and 120 nursing home beds. This Medical Center also operates several regional referral points, including Spinal Cord Injury (SCI) and VISN referrals for medical/surgical subspecialties. At present, the James J. Peters Medical Center employs 2,135 employees, and serves approximately 28,400 patients annually. The facility occupies nearly 30 acres, and is situated between Interstate 87 to the north and high density residential apartment buildings to the south, east, and west.

Exhibit 21: James J. Peters VAMC Site Plan



Bronx VAMC provides 1,091 parking spaces for employees and visitors. The occupancy survey conducted in February 2012 also noted a total of 86 vehicles with handicapped placards and/or license plates during the peak hour of use. Of that total, 27 were found in non-ADA accessible spaces.

A point-of-access survey was conducted to capture the mode of travel and distance travelled data for VAMC employees, patients, and visitors. Table 12 summarizes the survey responses by the mode of travel used, while Exhibit 22 summarizes the distance travelled based on residential zip code for employees and visitors.

Table 12: James J. Peters VAMC Auto Use and Persons-per-Auto Characteristics

Population Group	Auto Use	Persons per Auto
Staffing		
Full-time	56%	1.00
Part-time	56%	1.10
Physicians	63%	1.00
Service Organization	64%	1.10
Volunteers	24%	1.25
Students	75%	1.33
Patients		
Spinal Cord Injury	77%	1.00
Outpatients	44%	1.04
Inpatient Admissions	50%	1.00
ED Patients	----	----
Visitors		
Inpatient Visitors	55%	1.00
Vendors	33%	1.50
Non-treatment Visitors	28%	1.00

Exhibit 22: James J. Peters VAMC Number of Responses based on Distance Travelled

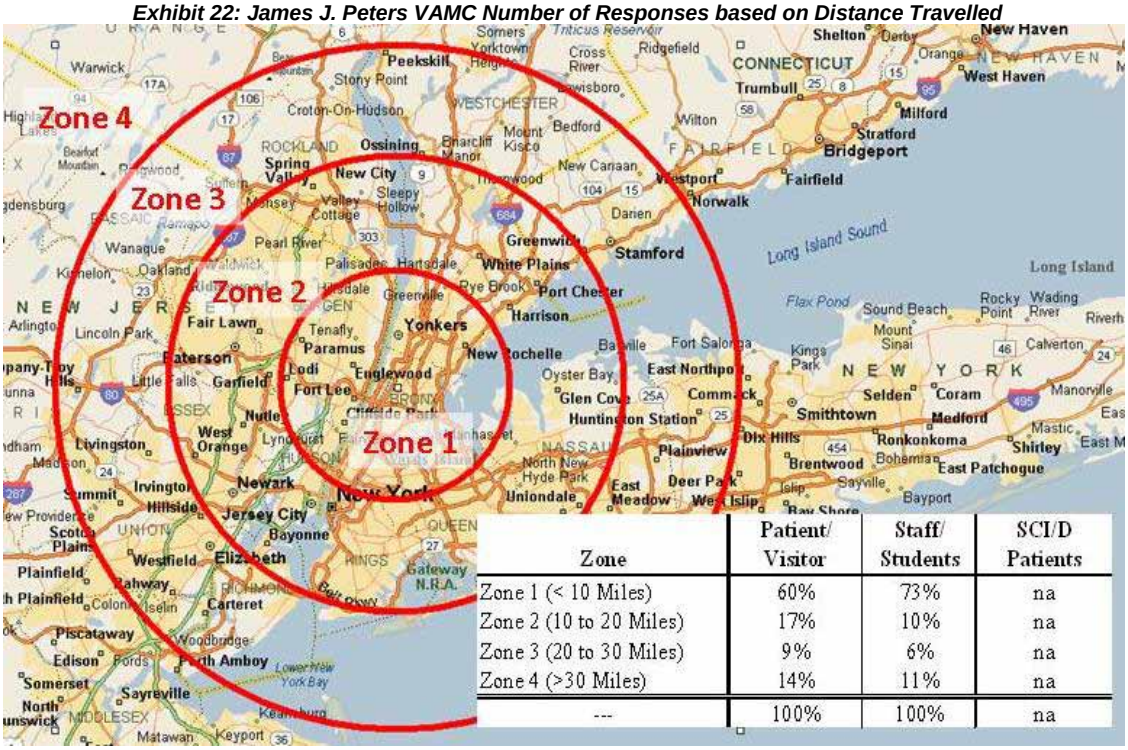
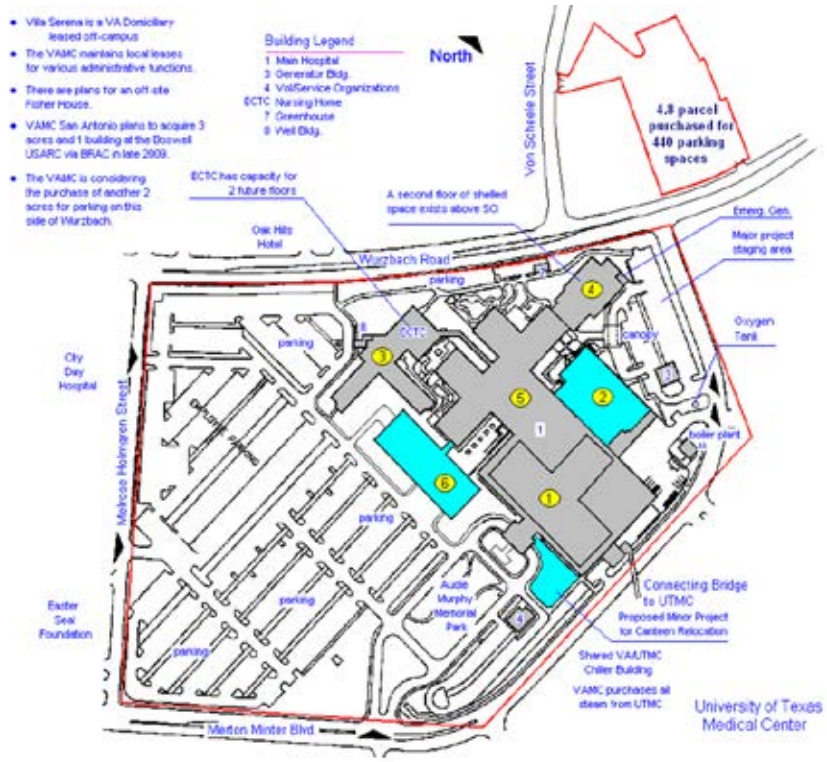

Zone 4
Zone 3
Zone 2
Zone 1
Long Island Sound
Long Island
NEW JERSEY
NEW YORK
CONNECTICUT
WESTCHESTER
ROCKLAND
NASSAU
Yonkers
Paterson
Newark
Jersey City
New York
Stamford
Bridgeport
Fairfield
Norwalk
Greenwich
White Plains
Port Chester
Harrison
New Rochelle
Hoboken
Elizabeth
Bayonne
Westfield
Plainfield
Piscataway
Edison
Somerset
Sayreville
Carteret
Woodbridge
Perth Amboy
Lower New York Bay
Gateway N.R.A.
Peekskill
Ossining
New City
Stony Point
Croton-On-Hudson
Pearl River
Nyack
Tarrytown
Ridgefield
Danbury
Shelton
New Haven
West Haven
Milford
Stratford
Trumbull
Wilton
Darien
New Canaan
Westport
Greenwich
Port Chester
Harrison
Mamaroneck
Rye Brook
Pelham
Yonkers
Tuckahoe
Eastchester
Bronxville
Scarsdale
Hartsdale
White Plains
Greenburgh
Tarrytown
Sleepy Hollow
Ossining
Croton-On-Hudson
Peekskill
Cortlandt
Yorktown
Somers
Cross River
Lewisboro
Bedford
Mount Kisco
Pleasantville
Briarcliff Manor
Thornwood
Valhalla
Hawthorne
Elmsford
Tarrytown
Irvington
Dobbs Ferry
Hastings-On-Hudson
Ardsley
Tuckahoe
Eastchester
Bronxville
Mamaroneck
Larchmont
Rye
Port Chester
Rye Brook
Harrison
Purchase
Pleasantville
Chappaqua
Mount Kisco
Bedford
Armonk
North Castle
Rye Brook
Port Chester
Rye
Mamaroneck
Larchmont
Pelham
Bronxville
Tuckahoe
Eastchester
Scarsdale
Hartsdale
Greenburgh
Elmsford
Hawthorne
Valhalla
Thornwood
Briarcliff Manor
Pleasantville
Chappaqua
Mount Kisco
Bedford
Armonk
North Castle
Cross River
Lewisboro
Somers
Yorktown
Ridgefield
Danbury
Shelton
Derby
Orange
New Haven
West Haven
Milford
Stratford
Bridgeport
Fairfield
Westport
Norwalk
Darien
New Canaan
Wilton
Trumbull
Stamford
Greenwich
Port Chester
Harrison

Exhibit 23: Audie L. Murphy Memorial VA Hospital Site Plan



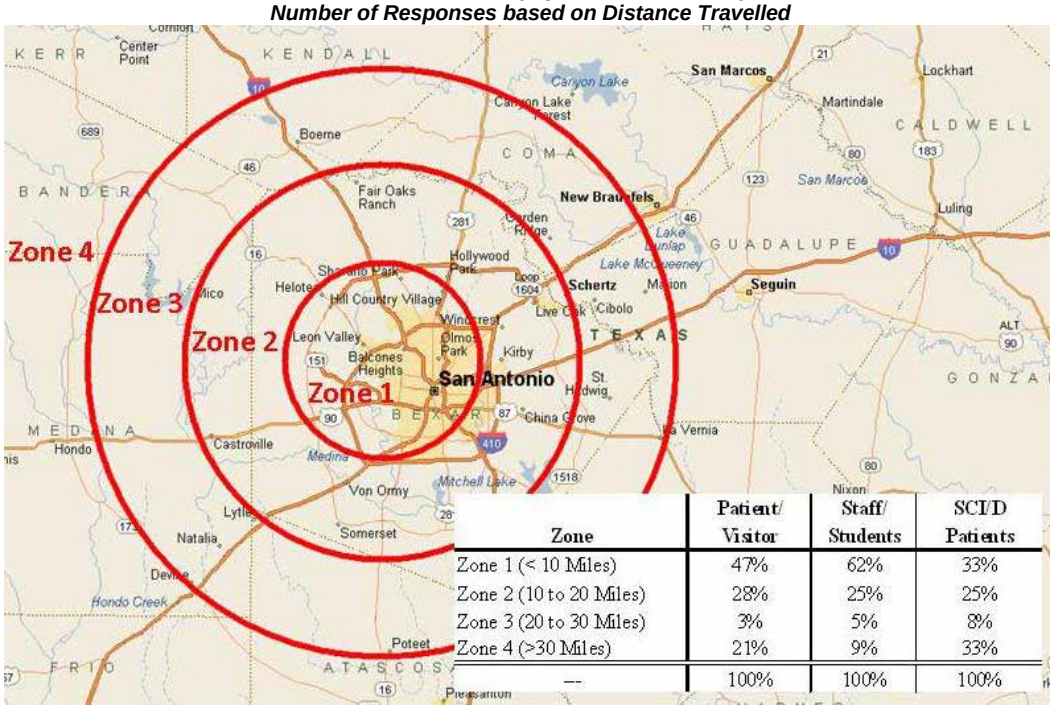
Audie L Murphy Memorial Hospital provides 2,011 parking spaces for employees and visitors. That number includes 368 spaces that the Hospital leases from a hotel and church located off site. Occupancy counts conducted in January 2012 recorded some 1,805 occupied spaces (ninety percent). This figure includes 67 vehicles that displayed handicapped placards/plates but were parked in non-ADA accessible spaces. As a percentage of all park vehicles ADA vehicles represent twelve percent (12%) of that total.

A point-of-access survey was conducted to understand the mode of travel adopted and distance travelled by the VAMC employees and visitors. Table 13 exhibits the travel mode characteristics based on the survey responses, and Exhibit 24 illustrates, both numerically and graphically, the distance travelled based on residential zip code data.

Table 13: Audie L. Murphy Memorial VA Hospital Auto Use and Persons-per-Auto Characteristics

Population Group	Auto Use	Persons per Auto
Staffing		
Full-time	74%	1.10
Part-time	40%	1.50
Physicians	58%	1.00
Service Organization	75%	1.10
Volunteers	46%	1.33
Students	96%	1.04
Patients		
Spinal Cord Injury	75%	1.22
Outpatients	80%	1.08
Inpatient Admissions	64%	1.14
ED Patients	25%	1.00
Visitors		
Inpatient Visitors	77%	1.10
Vendors	50%	1.00
Non-treatment Visitors	88%	1.00

Exhibit 24: Audie L. Murphy Memorial VA Hospital
Number of Responses based on Distance Travelled



Zone	Patient/ Visitor	Staff/ Students	SCI/D Patients
Zone 1 (< 10 Miles)	47%	62%	33%
Zone 2 (10 to 20 Miles)	28%	25%	25%
Zone 3 (20 to 30 Miles)	3%	5%	8%
Zone 4 (>30 Miles)	21%	9%	33%
--	100%	100%	100%

Facility data, bed occupancy volumes, and staffing and patient annual and average daily population information for both the entire Medical Center and SCI/D services have been provided and are presented later in the report.

2.5 BOB STUMP VAMC – NORTHERN ARIZONA HEALTH CARE SYSTEM, PRESCOTT, ARIZONA (SPOKE)

The Northern Arizona VA Health Care System provides inpatient and outpatient care at the Bob Stump VAMC in Prescott, Arizona and also provides outpatient care at community based outpatient clinics (CBOCs) in Anthem, Flagstaff, Cottonwood, Kingman and Lake Havasu City, Arizona. The Northern Arizona VA Healthcare System is part of the Veterans Integrated Service Network (VISN) 18 and serves a population of about 75,000 Veterans in a primary service area that includes six counties in North Central Arizona. The focus of this study is on the Medical Center (see Exhibit 25) which is a spoke facility.

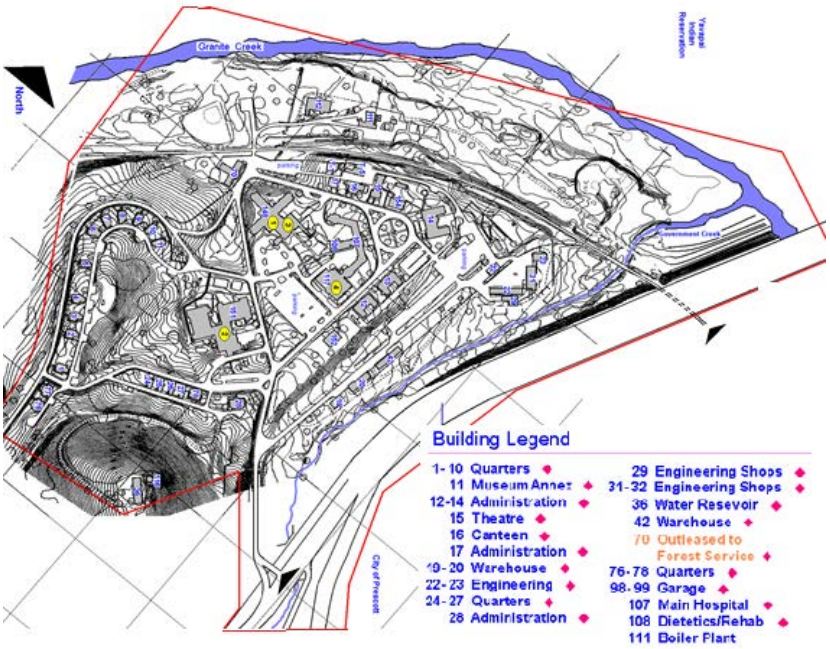


Exhibit 25: Bob Stump VAMC Site Plan

Bob Stump VAMC provides 949 parking spaces for employees and visitors. Based on occupancy counts completed in February 2012 755 of those spaces, or eighty percent (80%), of those spaces were occupied.

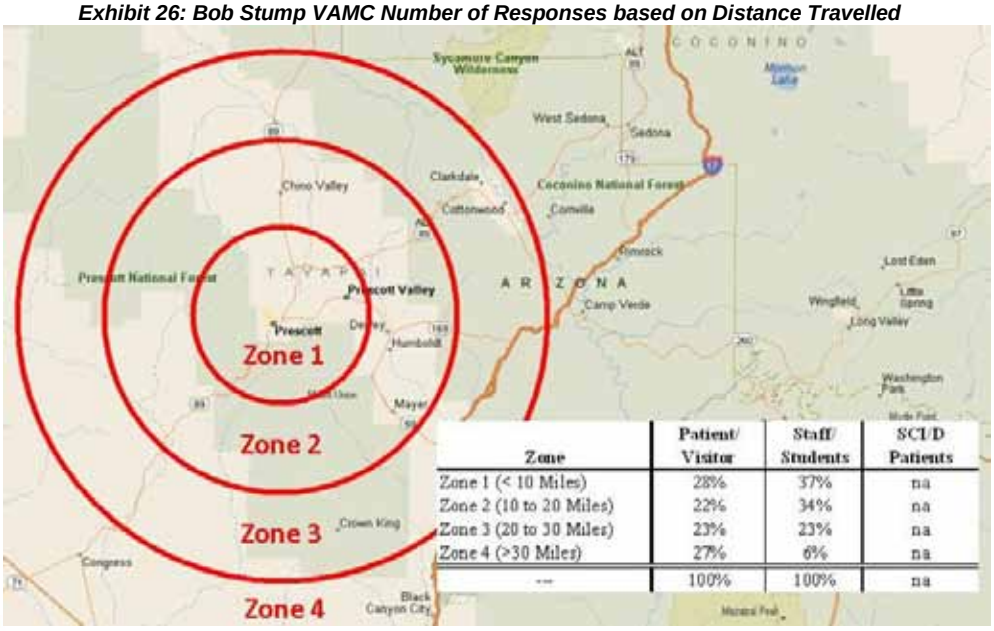
A point-of-access survey was conducted to understand the mode of travel adopted and distance travelled by the VAMC employees and visitors. Table 14 exhibits the travel mode characteristics based on the survey responses, and Exhibit 26 illustrates, both numerically and graphically, the distance travelled based on residential zip code data.

Table 14: Bob Stump VAMC Auto Use and Persons-per-Auto Characteristics

Population Group	Auto Use	Persons per Auto
Staffing		
Full-time	81%	1.00
Part-time	83%	1.00
Physicians	100%	1.00
Service Organization	78%	1.00
Volunteers	85%	1.00
Students	100%	1.00
Patients		
Spinal Cord Injury	----	----
Outpatients	88%	1.00
Inpatient Admissions	18%	1.50
ED Patients	50%	1.00
Visitors		
Inpatient Visitors	96%	1.05
Vendors	67%	1.07
Non-treatment Visitors	73%	1.00

While VA administrators were able to provide staffing and population data for the entire Medical Center that type of information was not available for SCID clinic volumes. However, valuable subjective data as presented above was collected during the stakeholder interview process. As Bob Stump VAMC is a spoke facility it does not at present have dedicated treatment spaces or dedicated parking for SCI/D patients. Furthermore, as the SCI/D clinic does not have a segregated entry/exit point for patients, the point of access questionnaires could not differentiate between SCI/D and other patients. However, interviews with SCI/D staff noted that the treatment room can see four patients during the course of a treatment day and that ninety percent (90%) of them arrive via automobile. As a clinic, SCI/D services are based in temporary/flex space which sees patients from 12:30 PM to 4:30 PM on Mondays and Wednesday and between 7:30 AM and 12:30 PM on Tuesdays and Thursdays. Given the patients typically long-distance travel requirements, SCI/D observations/treatment involve numerous services and the visits can consume the entire day

Exhibit 26: Bob Stump VAMC Number of Responses based on Distance Travelled



Zone	Patient/ Visitor	Staff/ Students	SCI/D Patients
Zone 1 (< 10 Miles)	28%	37%	na
Zone 2 (10 to 20 Miles)	22%	34%	na
Zone 3 (20 to 30 Miles)	23%	23%	na
Zone 4 (>30 Miles)	27%	6%	na
---	100%	100%	na

2.6 MEMPHIS VA MEDICAL CENTER, MEMPHIS, TENNESSEE (HUB)

The Memphis VAMC provides inpatient and outpatient care to more than 196,000 veterans living in a 53-county area of western Tennessee, northern Mississippi, and northwest Arkansas. Treatment services include but are not limited to geriatrics, mental health, physical therapy, polytrauma, and spinal cord injury/disorder. The medical center does not have a domiciliary, nursing home, or family residence. The Medical Center, see Exhibit 27, is situated on 33 acres on the fringe of downtown Memphis and occupies eight buildings, 127 hospital beds, including 60 SCI/D beds, and a total density of 1.14 million gross square feet.

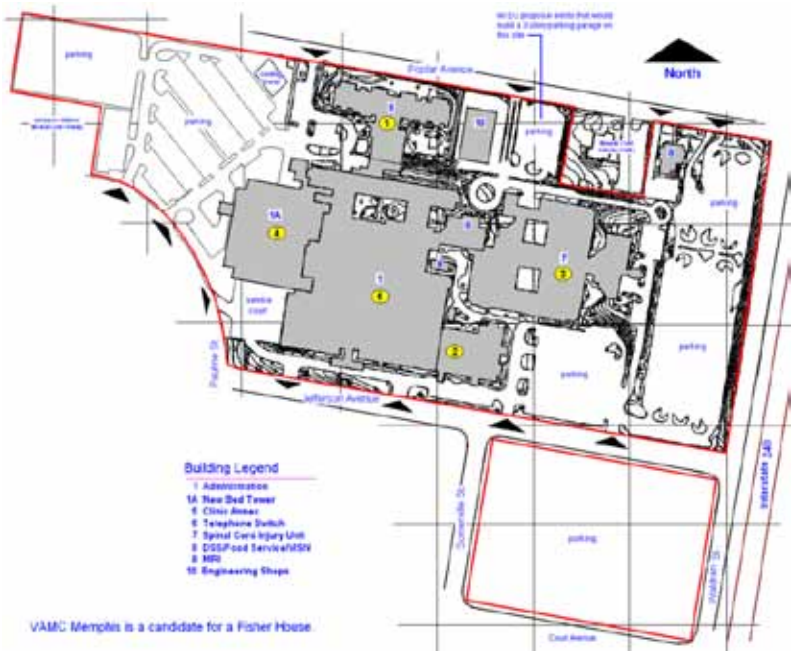


Exhibit 27: Memphis VAMC Site Plan

Memphis VAMC provides 1,785 parking spaces for employees and visitors. That number includes 250 employee dedicated spaces that the medical center leases in a garage that is served by a shuttle bus. The January 2012 field survey noted 1,558 occupied spaces. That figures include 44 vehicles that displayed handicapped placards/plates but were parked in non-ADA accessible spaces but do not include 39 vehicles that were parked illegally.

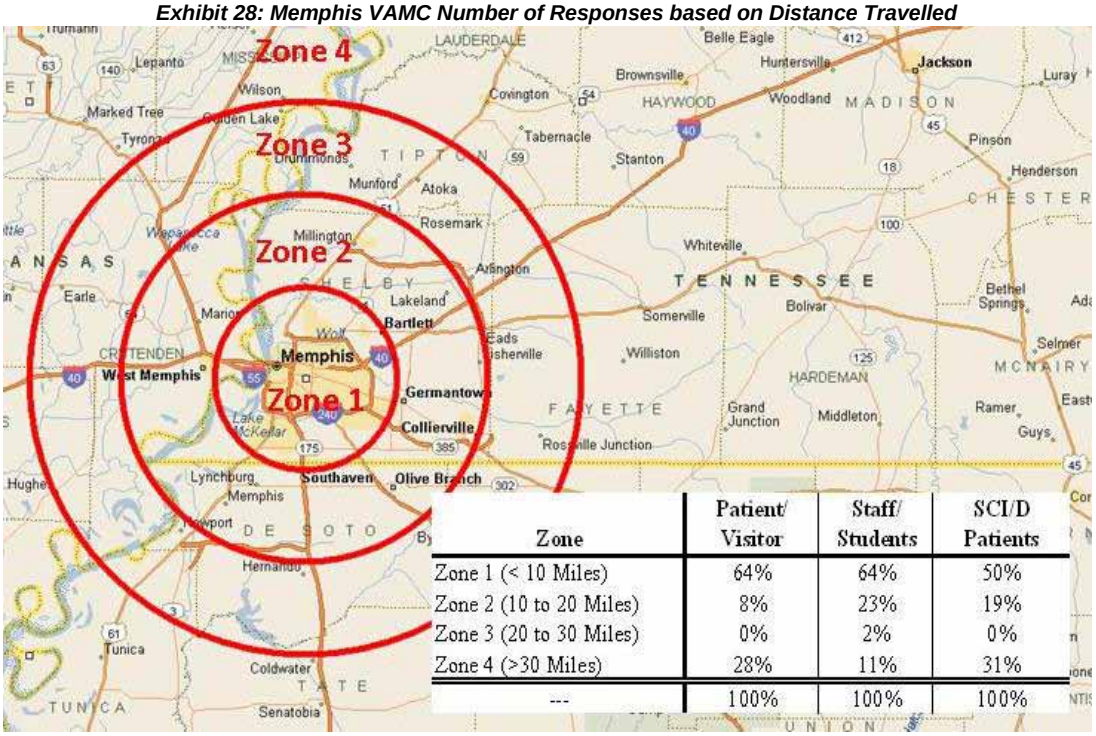
With regards to parking operations, it may be of interest to note that according to VAMC administrators Memphis is one of the few VA facilities that charge employees for parking. This enabled them to lease the 250 spaces and provide the necessary employee shuttle service.

Population Group	Auto Use	Persons per Auto
Staffing		
Full-time	86%	1.04
Part-time	100%	1.00
Physicians	100%	1.00
Service Organization	83%	1.00
Volunteers	50%	1.00
Students	100%	1.00
Patients		
Spinal Cord Injury	53%	1.00
Outpatients	56%	1.18
Inpatient Admissions	100%	1.00
ED Patients	----	----
Visitors		
Inpatient Visitors	64%	1.00
Vendors	----	----
Non-treatment Visitors	56%	1.00

A point-of-access survey was conducted to understand the mode of travel adopted and distance travelled by the VAMC employees and visitors. Table 15 exhibits the travel mode characteristics based on the survey responses, and Exhibit 28 illustrates, both numerically and graphically, the distance travelled based on residential zip code data. As Memphis VAMC has a segregated and dedicated SCI/D entrance and reserved parking spaces the survey was able to differentiate between SCI/D patient responses and all other patients.

Table 15: Memphis VAMC Auto Use and Persons-per-Auto Characteristics

Exhibit 28: Memphis VAMC Number of Responses based on Distance Travelled



Zone	Patient/ Visitor	Staff/ Students	SCI/D Patients
Zone 1 (< 10 Miles)	64%	64%	50%
Zone 2 (10 to 20 Miles)	8%	23%	19%
Zone 3 (20 to 30 Miles)	0%	2%	0%
Zone 4 (>30 Miles)	28%	11%	31%
---	100%	100%	100%

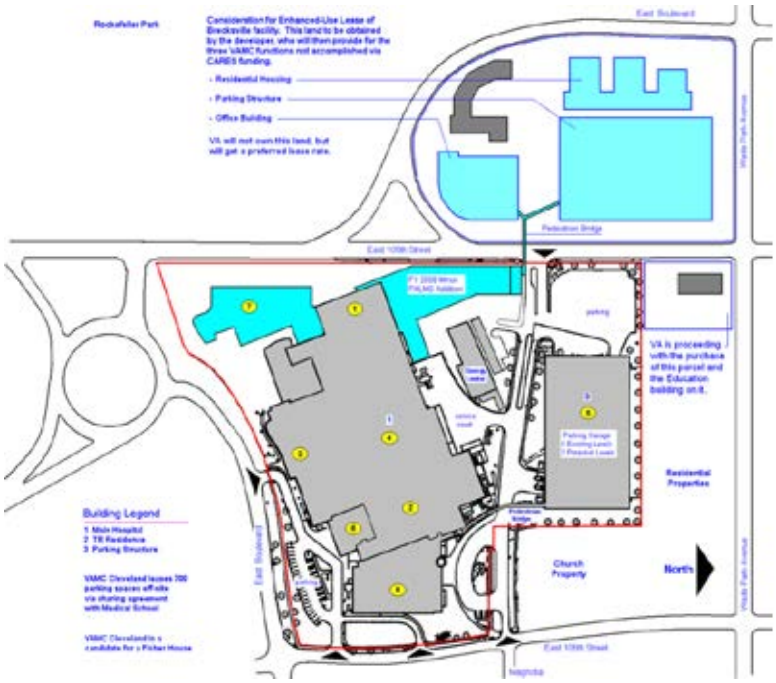
In addition to the point of access questionnaire, DESMAN interviewed key leadership. Discussions with the SCI/D coordinator suggest that as a hub facility their clinic will see between eight and ten appointments per day with an additional five to six unscheduled SCI/D patient visits. While the coordinator suggested that ten percent to twenty percent of SCI/D inpatients drive and park a vehicles between eighty percent and ninety percent of outpatients drive/park.

Facility data, bed occupancy volumes, and staffing and patient annual and average daily population information for both the entire Medical Center and SCI/D services has been provided.

2.7 LOUIS STOKES VAMC, CLEVELAND, OHIO (HUB)

The Louis Stokes Cleveland VA Medical Center is one of five facilities constituting the VA Healthcare System of Ohio. A full range of primary, secondary and tertiary care services are offered at the Cleveland VA Medical Center to an eligible veteran population covering 24 counties in Northeast Ohio. The medical center actively supports affiliation agreements, intra-agency agreements, medical education and research, training programs and broad-based research initiatives. The Medical Center sits on 18 acres, has four buildings totaling 880,630 gross square feet, and as a hub facility, the SCI/D department has 32 hospital beds, 4 treatment/procedures rooms, and 2 therapy units. A site plan of the Medical Center is illustrated on Exhibit 29.

Exhibit 29: Louis Stokes VAMC Site Plan



Per the January 2012 field survey, Louis Stokes VAMC provides 3,196 parking spaces for employees and visitors and of that number 2,769 (eighty-seven percent) were occupied during the peak period of activity. The occupancy count includes 15 vehicles that displayed handicapped placards/plates but were parked in non-ADA accessible spaces. Therefore, of the 2,769 parked vehicles some 121 of those vehicles (four percent) displayed hangtags.

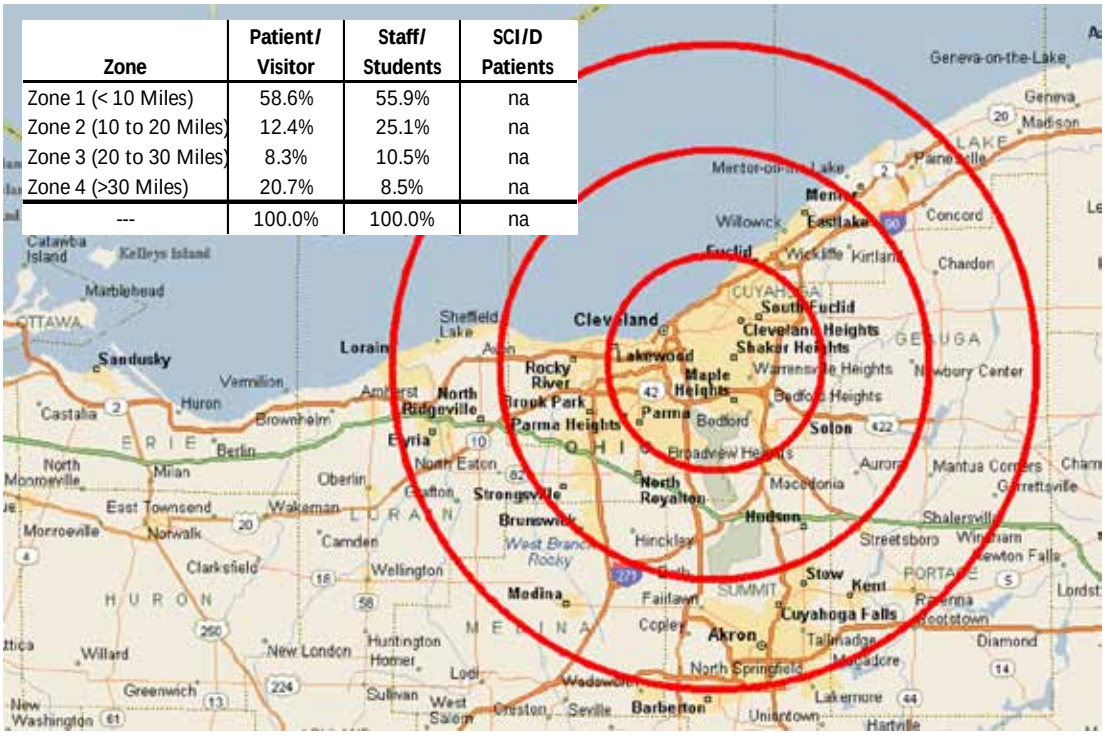
A point-of-access survey was conducted to understand the mode of travel adopted and distance travelled by the VAMC employees and visitors. Table 16 exhibits the travel mode characteristics based on the survey responses, and Exhibit 29 illustrates, both numerically and graphically, the distance travelled based on residential zip code data.

Table 16: Louis Stokes VAMC Auto Use and Persons-per-Auto Characteristics

Population Group	Auto Use	Persons per Auto
Staffing		
Full-time	81%	1.05
Part-time	67%	1.00
Physicians	100%	1.00
Service Organization	80%	1.05
Volunteers	56%	1.20
Students	95%	1.05
Patients		
Spinal Cord Injury	----	----
Outpatients	42%	1.00
Inpatient Admissions	12%	1.50
ED Patients	43%	1.20
Visitors		
Inpatient Visitors	50%	1.00
Vendors	100%	1.00
Non-treatment Visitors	78%	1.00

Exhibit 29: Louis Stokes VAMC Number of Responses based on Distance Travelled

Zone	Patient/ Visitor	Staff/ Students	SCI/D Patients
Zone 1 (< 10 Miles)	58.6%	55.9%	na
Zone 2 (10 to 20 Miles)	12.4%	25.1%	na
Zone 3 (20 to 30 Miles)	8.3%	10.5%	na
Zone 4 (>30 Miles)	20.7%	8.5%	na
---	100.0%	100.0%	na


Cleveland
Lakewood
Rocky River
Brook Park
Parma Heights
Parma
North Ridgeville
Lorain
Elyria
Sandusky
Vermilion
Huron
Berlin
Milan
Oberlin
Wellington
Medina
Akron
Cuyahoga Falls
Kent
Stow
Hudson
Solon
Bedford
Euclid
Eastlake
Mentor
Willoughby
Geneva-on-the-Lake
Geneva
Madison
Concord
Chardon
Kirtland
Wickliffe
Mantua Center
Streetsboro
Macedonia
North Royalton
Brunswick
Strongsville
Hinckley
Barberton
Norwalk
Clarksfield
Huron
Willard
New London
Greenwich
Sullivan
Lodi
Medina
Copley
Fairlawn
North Springfield
Lakemore
Uniontown
Hartville
Seville
Wadsworth
Tallmadge
Mogadore
Ravenna
Diamond
Newbury Center
Bedford Heights
Warrensville Heights
Broadview Heights
Shaker Heights
Cleveland Heights
South Euclid
Mentor-on-the-Lake
Painesville
Marblehead
Kelleys Island
Catawba Island
Castalia
Brownhelm
Amherst
Sheffield Lake
Avon
North Eaton
Grafton
Wakeman
East Townsend
Monroeville
North Monroeville
Camden
West Branch Rocky
Shalersville
Windham
Newton Falls
Lordstown
Huntington
Homer
Greenville
Greenville
New Washington
Oregon
Seville
Barberton
Akron
Cuyahoga Falls
Tallmadge
Mogadore
Lakemore
Uniontown
Hartville
Diamond
Ravenna
Streetsboro
Newbury Center
Geneva
Madison
Concord
Chardon
Kirtland
Wickliffe
Euclid
Eastlake
Mentor
Willoughby
Geneva-on-the-Lake
Painesville
Mentor-on-the-Lake
Lorain
Elyria
Sandusky
Vermilion
Huron
Berlin
Milan
Oberlin
Wellington
Medina
Akron
Cuyahoga Falls
Kent
Stow
Hudson
Solon
Bedford
Euclid
Eastlake
Mentor
Willoughby
Geneva-on-the-Lake
Geneva
Madison
Concord
Chardon
Kirtland
Wickliffe

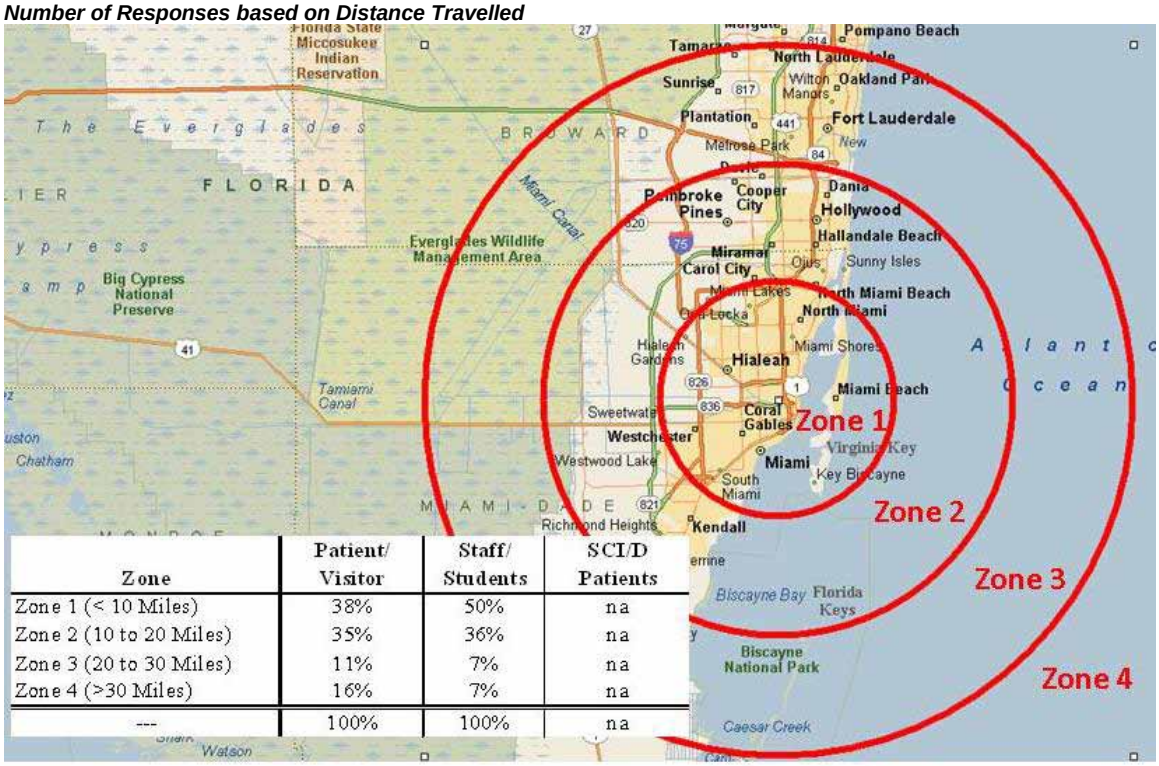
The Medical Center provides 1,062 parking spaces on site for employees and visitors and leases an additional 450 spaces at an off-site location for employee intercept parking. It should be noted that on the day of the field surveys in January 2012 the parking lot reserved for SCI/D patient parking was partially blocked/closed due to construction. Of the 1,062 on-site parking spaces some 1,007 were occupied during the peak period while 365 of the 450 off-site employee spaces were occupied. With regards to ADA parking activity, 69 vehicles with ADA placards were parked in non-ADA accessible spaces. Of the 1,007 vehicle parked on site fourteen percent (14%) displayed the placards.

A point-of-access survey was conducted to understand the mode of travel adopted and distance travelled by the VAMC employees and visitors. Table 17 exhibits the travel mode characteristics based on the survey responses, and Exhibit 31 illustrates, both numerically and graphically, the distance travelled based on residential zip code data. Note that as construction activity temporarily blocked access to the SCI/D wing, the point of access survey was unable to capture SCI/D patient auto use/parking demographics. However, interviews with SCI/D staff noted that ten percent of inpatients and eighty percent of outpatients drive and park their vehicle on site.

Table 17: Bruce W. Carter VAMC Auto Use and Persons-per-Auto Characteristics

Population Group	Auto Use	Persons per Auto
Staffing		
Full-time	35%	1.10
Part-time	67%	1.00
Physicians	60%	1.00
Service Organization	52%	1.10
Volunteers	67%	1.00
Students	----	----
Patients		
Spinal Cord Injury	----	----
Outpatients	66%	1.00
Inpatient Admissions	77%	1.00
ED Patients	100%	1.00
Visitors		
Inpatient Visitors	100%	1.00
Vendors	100%	1.00
Non-treatment Visitors	68%	1.00

Exhibit 31: Bruce W. Carter VAMC
Number of Responses based on Distance Travelled

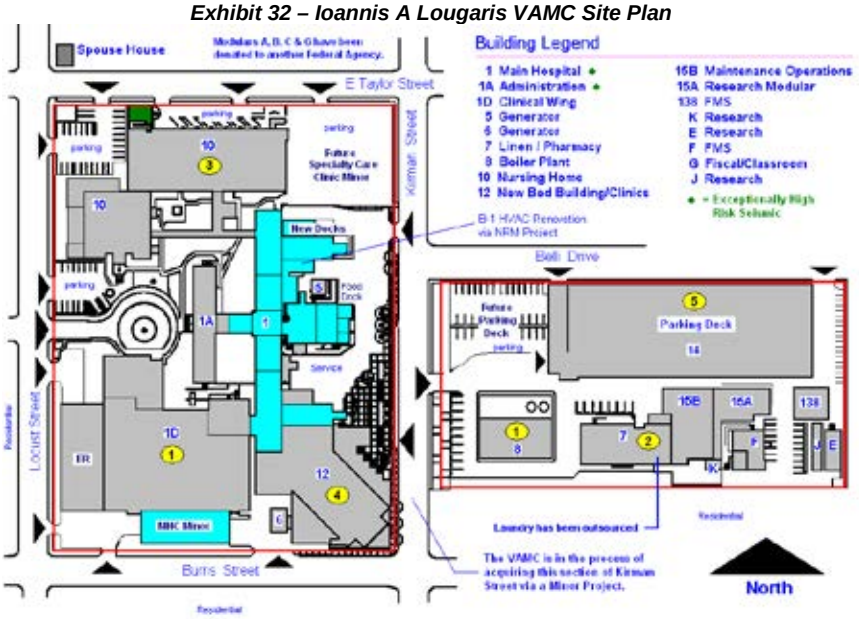


Zone	Patient/ Visitor	Staff/ Students	SCI/D Patients
Zone 1 (< 10 Miles)	38%	50%	na
Zone 2 (10 to 20 Miles)	35%	36%	na
Zone 3 (20 to 30 Miles)	11%	7%	na
Zone 4 (>30 Miles)	16%	7%	na
---	100%	100%	na

2.9 IOANNIS A LOUGARIS VAMC – SIERRA NEVADA HCS, RENO, NEVADA (SPOKE)

The VA Sierra Nevada Health Care System and its Ioannis A. Lougaris VAMC in Reno, Nevada provides primary and secondary care to a large geographical area that includes 20 counties in northern Nevada and northeastern California. The Medical Center is situated within a dense suburban residential environment with 19 buildings and 500,000 gross square feet on only 12 acres (see site plan illustrated on Exhibit 32). This spoke facility has 64 hospital beds, 60 nursing home beds, and has an SCID clinic each Thursday from 1 PM to 3:30 PM.

Exhibit 32 – Ioannis A Lougaris VAMC Site Plan



The Medical Center provides only 578 parking spaces on site for employees and visitors, of which 493 were occupied (February 2012 surveys). Given the constricted nature of the site a large percentage of employees must park on-street within the adjacent residential neighborhoods. Reno VA leadership agrees that this is not a desirable conditions and the City of Reno and the effected residents could create a residential parking permit program that would force the Medical Center employee elsewhere. With regards to ADA parking activity, 11 vehicles with ADA placards were parked in non-ADA accessible spaces; bring total handicapped parking activity to 64 vehicles (thirteen percent of all parked vehicles).

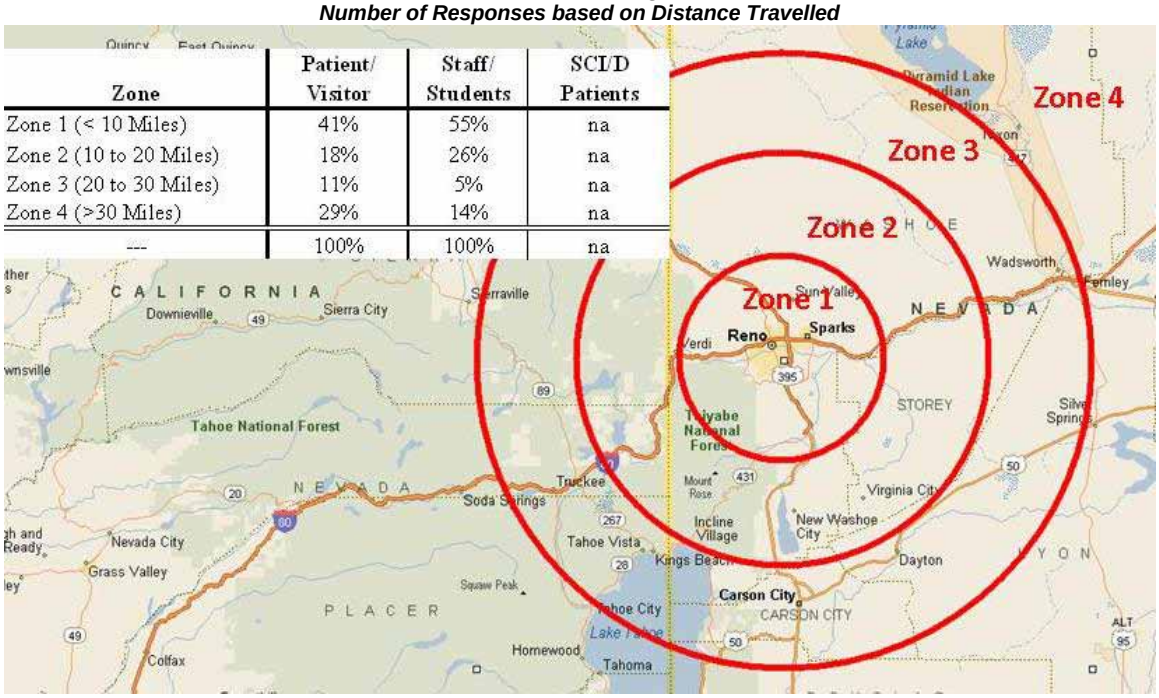
A point-of-access survey was conducted to understand the mode of travel adopted and distance travelled by the VAMC employees and visitors. Table 18 exhibits the travel mode characteristics based on the survey responses, and Exhibit 33 illustrates, both numerically and graphically, the distance travelled based on residential zip code data. As VAMC Reno is a spoke facility with no dedicated SCI/D access, the point of access survey was only able to capture responses from two (2) SCI/D patients. However, interviews with SCI/D staff did note that during outpatient clinic days, the Thursday of each week, between four and six SCI/D patients are seen and eighty percent (80%) of them drive and park a vehicle.

Table 18 – Ioannis A Lougaris VAMC Auto Use and Person per Auto Characteristics

Population Group	Auto Use	Persons per Auto
Staffing		
Full-time	89%	1.00
Part-time	100%	1.00
Physicians	50%	1.00
Service Organization	100%	1.00
Volunteers	75%	1.00
Students	100%	1.00
Patients		
Spinal Cord Injury	50%	2.00
Outpatients	74%	1.10
Inpatient Admissions	87%	1.15
ED Patients	----	----
Visitors		
Inpatient Visitors	100%	1.00
Vendors	50%	1.00
Non-treatment Visitors	86%	1.04

Exhibit 33: Ioannis A Lougaris VAMC
Number of Responses based on Distance Travelled

Zone	Patient/ Visitor	Staff/ Students	SCI/D Patients
Zone 1 (< 10 Miles)	41%	55%	na
Zone 2 (10 to 20 Miles)	18%	26%	na
Zone 3 (20 to 30 Miles)	11%	5%	na
Zone 4 (>30 Miles)	29%	14%	na
---	100%	100%	na



Detailed information on daily and average annual patient volumes and staffing by shift has been provided by the VA, but as a spoke facility and with little quantitative data available the analysis of SCI/D clinic outpatient parking demand will be based on the subjective information that was provided during staff interviews.

2.10 VETERANS ADMINISTRATION MEDICAL CENTER, PALO ALTO, CALIFORNIA (HUB)

The VA Palo Alto Health Care System consists of three inpatient facilities located at Palo Alto, Menlo Park, and Livermore. This study focuses on the Palo Alto medical center. Palo Alto VAMC provides a comprehensive range of treatment services include emergency care, education and research, neurology, oncology, polytrauma, prosthetics, spinal cord injury, and vision care. With 1.38 million gross square feet, 28 buildings, and nearly 93 acres, the Medical Center has 196 hospital beds, 39 nursing home beds, 21 family resident suites, and 43 beds in the SCI/D department. Palo Alto is a hub facility. Exhibit 34 illustrates the site plan.

Exhibit 34 – VAMC Palo Alto Site Plan

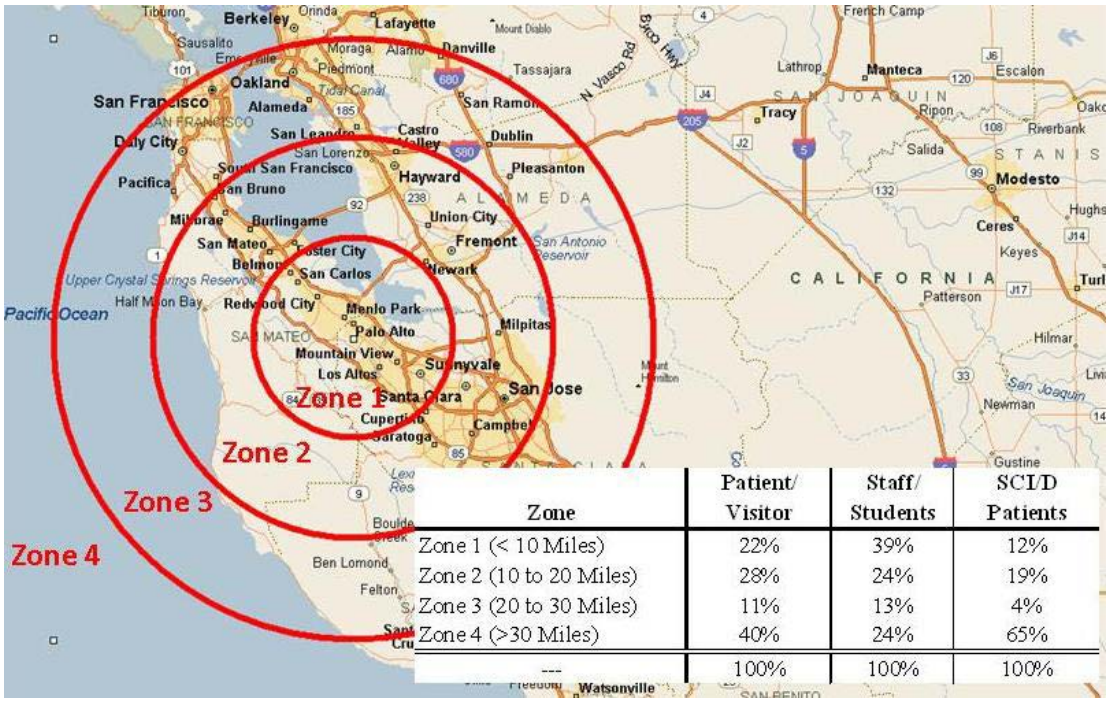
VAMC Palo Alto provides 2,337 parking spaces for employees and visitors, of which 2,075 (eighty nine percent) were occupied during the peak hour in February, 2012. This volume includes an employee intercept lot that has shuttle services to/from the Medical Center. These figures include 15 vehicles that displayed handicapped placards/plates but were parked in non-ADA accessible spaces. Therefore, of the 2,075 parked vehicles, 116 of those vehicles (six percent) displayed hangtags.

A point-of-access survey was conducted to understand the mode of travel adopted and distance travelled by the VAMC employees, patients and visitors. Table 19 exhibits the travel mode characteristics based on the survey responses, and Exhibit 35 illustrates, both numerically and graphically, the distance travelled based on residential zip code data.

Table 20 – VAMC Palo Alto Auto Use and Persons per Auto Characteristics

Population Group	Auto Use	Persons per Auto
Staffing		
Full-time	84%	1.04
Part-time	96%	1.00
Physicians	100%	1.00
Service Organization	----	----
Volunteers	72%	1.08
Students	79%	1.27
Patients		
Spinal Cord Injury	69%	1.05
Outpatients	52%	1.30
Inpatient Admissions	46%	1.50
ED Patients	33%	2.00
Visitors		
Inpatient Visitors	67%	1.00
Vendors	85%	1.00
Non-treatment Visitors	70%	1.10

Exhibit 35: VAMC Palo Alto Number of Responses based on Distance Travelled

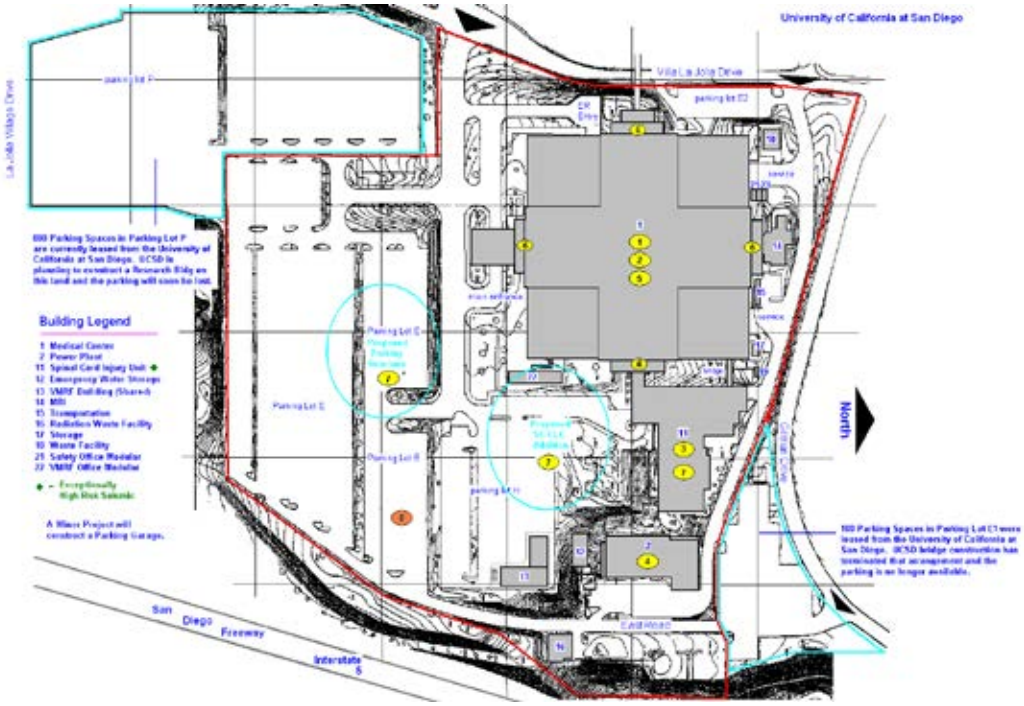


Zone	Patient/ Visitor	Staff/ Students	SCI/D Patients
Zone 1 (< 10 Miles)	22%	39%	12%
Zone 2 (10 to 20 Miles)	28%	24%	19%
Zone 3 (20 to 30 Miles)	11%	13%	4%
Zone 4 (>30 Miles)	40%	24%	65%
---	100%	100%	100%

2.11 VA MEDICAL CENTER, SAN DIEGO, CALIFORNIA

The San Diego VA Medical Center is part of the San Diego Healthcare System which serves more than 240,000 veterans in the region. Affiliated with the University of California San Diego, the Medical Center sits on 26 acres, has nine buildings with a total density of 837,000 gross square feet, 189 hospital beds, 43 nursing home beds, and served nearly 500,000 outpatients in 2011. Of the 189 hospital beds 30 are dedicated to the SCI/D department. Exhibit 36 presents a recent site plan of the medical center.

Exhibit 36 – VAMC San Diego Site Plan



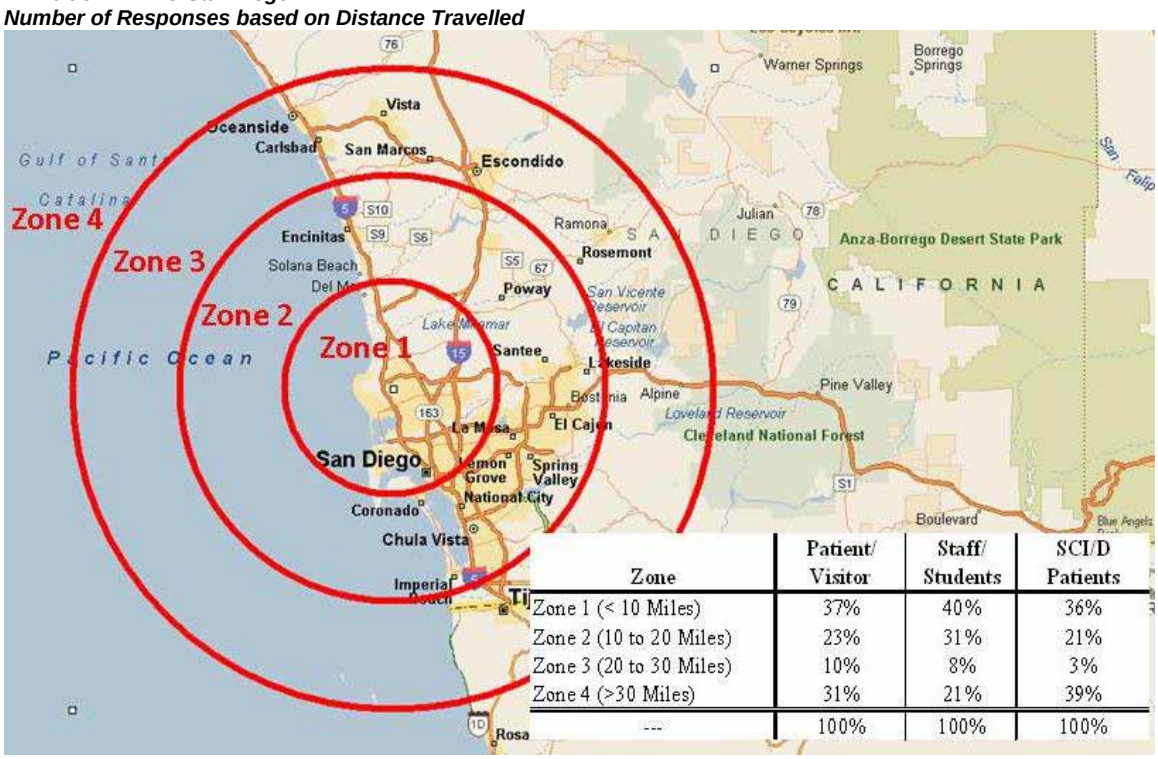
The Medical Center provides 1,427 parking spaces to its employees and visitors in various on-site and offsite locations. A parking occupancy survey conducted in February 2012 recorded a peak period occupancy of one-hundred and six percent (106%), as numerous vehicles were found parked illegally or in undesignated areas, i.e., unpaved surfaces. There we a total of 192 ADA placarded vehicles parking during the peak hour of use, which translates to thirteen percent (13%) of all parked vehicles.

A point-of-access survey was conducted to understand the mode of travel adopted and distance travelled by the VAMC employees, patients and visitors. Table 20 exhibits the travel mode characteristics based on the survey while Exhibit 37 illustrates the distance travelled based on residential zip code data, including SCI/D patient responses.

Table 20 – VAMC San Diego Auto Use and Persons per Auto Characteristics

Population Group	Auto Use	Persons per Auto
Staffing		
Full-time	74%	1.14
Part-time	83%	1.05
Physicians	74%	1.00
Service Organization	88%	1.00
Volunteers	33%	1.00
Students	37%	2.71
Patients		
Spinal Cord Injury	64%	1.10
Outpatients	76%	1.04
Inpatient Admissions	71%	1.00
ED Patients	75%	1.04
Visitors		
Inpatient Visitors	50%	1.00
Vendors	100%	1.00
Non-treatment Visitors	74%	1.12

Exhibit 37: VAMC San Diego
Number of Responses based on Distance Travelled



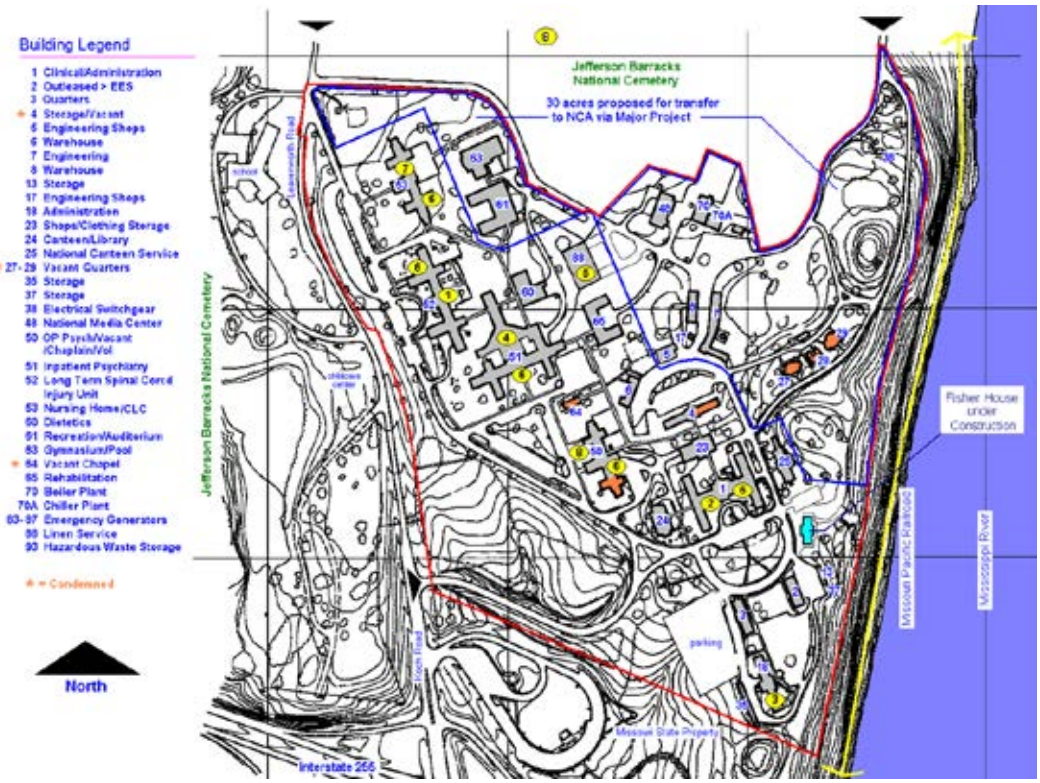
Zone	Patient/ Visitor	Staff/ Students	SCI/D Patients
Zone 1 (< 10 Miles)	37%	40%	36%
Zone 2 (10 to 20 Miles)	23%	31%	21%
Zone 3 (20 to 30 Miles)	10%	8%	3%
Zone 4 (>30 Miles)	31%	21%	39%
---	100%	100%	100%

Facility data, bed occupancy volumes, and staffing and patient annual and average daily population information was provided for both the entire Medical Center and SCI/D services.

2.12 JEFFERSON BARRACKS DIVISION, ST.LOUIS, MISSOURI (HUB)

The St. Louis VAMC is a full-service health care facility providing inpatient and ambulatory care in medicine, surgery, psychiatry, neurology, and rehabilitation, as well as over 65 subspecialty areas. It is a two-division facility that serves veterans and their families in east central Missouri and southwestern Illinois. The Jefferson Barracks Division, the subject of this investigation, is a multi-building complex overlooking the Mississippi River in south St. Louis County (see the site plan illustrated on Exhibit 38). It encompasses 122 acres, 909,000 gross square feet in 39 buildings and has 102 hospital beds, 50 domiciliary beds, 71 nursing home care units and a Fisher House with 20 family resident suites. The total number of hospital beds includes 32 SCI beds.

Exhibit 38 – VAMC St Louis Jefferson Barracks Division Site Plan



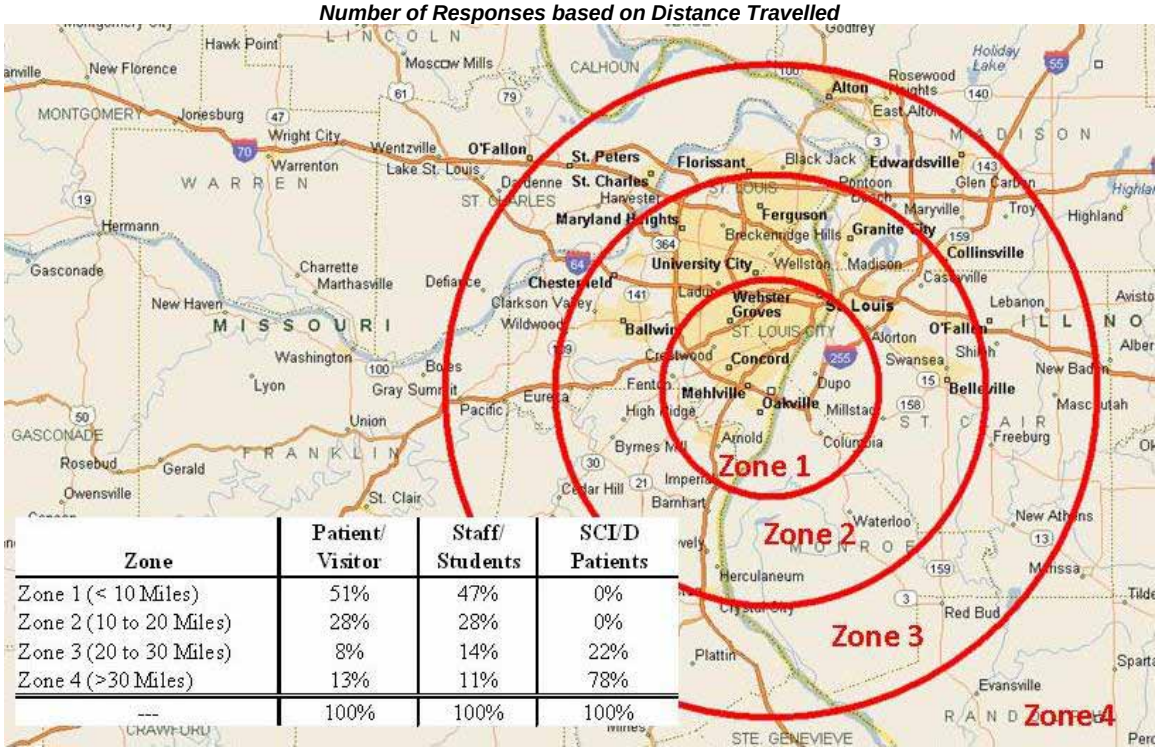
The Jefferson Barracks provides 1,412 parking spaces to its employees and visitors in 27 different lots, some as small as 4 spaces. A parking occupancy survey conducted in February 2012 recorded a peak period occupancy of eighty percent (80%), with 1,128 of the total 1,412 spaces being occupied. It must be noted that like many VA medical centers the designation, allocation, and enforcement of patient/visitor and employee spaces at Jefferson Barracks can be overly complicated and confusing. Occupancy surveys also recorded the number of parked vehicles displaying handicapped placards/hangtags. During the peak hour of parking utilization 84 vehicles displayed placards, of which 21 were found parked in non-ADA accessible spaces.

A point-of-access survey was conducted to understand the mode of travel adopted and distance travelled by the VAMC employees, patients and visitors. Table 21 exhibits the travel mode characteristics based on the survey while Exhibit 39 illustrates the distance travelled based on residential zip code data, including SCI/D patient responses. Patient and staffing volumes for Jefferson Barracks and its SCI/D department are provided in an upcoming section.

Table 21 – VAMC St Louis Jefferson Barracks Division Auto Use and Persons per Auto Characteristics

Population Group	Auto Use	Persons per Auto
Staffing		
Full-time	72%	1.08
Part-time	90%	1.00
Physicians	67%	1.00
Service Organization	77%	1.00
Volunteers	75%	1.00
Students	100%	1.00
Patients		
Spinal Cord Injury	89%	1.00
Outpatients	64%	1.09
Inpatient Admissions	40%	1.25
ED Patients	100%	1.00
Visitors		
Inpatient Visitors	88%	1.00
Vendors	92%	1.08
Non-treatment Visitors	95%	1.00

Exhibit 39 - VAMC St Louis Jefferson Barracks Division Number of Responses based on Distance Travelled



Zone	Patient/ Visitor	Staff/ Students	SCI/D Patients
Zone 1 (< 10 Miles)	51%	47%	0%
Zone 2 (10 to 20 Miles)	28%	28%	0%
Zone 3 (20 to 30 Miles)	8%	14%	22%
Zone 4 (>30 Miles)	13%	11%	78%
---	100%	100%	100%

3.0 SUMMARY OF VAMC AND SCI/D DATA

The facility data obtained through the administrator surveys forms, field surveys of supply and utilization, and surveys of employee, patient, and visitor auto use and travel patterns were combined with the less quantitative information gathered during the stakeholder interviews to form the foundation of the PDM. Information relative to SCI/D patient parking needs was also condensed to establish space recommendations for that population. SCI/D patient needs are reflected in both the broader PDM calculation and in a separate determination. Note, however, that SCI/D patient needs within the PDM are aggregated within the VAMC's overall inpatient and outpatient population data.

3.1 Population-based Parking Demand Ratios

The information gathered through the administrator survey form, parking inventories, peak occupancy surveys, and point-of-access questionnaires for each of the twenty (20) original and expanded pilot institutions was used to recalibrate the PDM that was developed in April 2011. Table 22 presents the population-based peak parking demand ratios for each of the various user groups at each VAMC facility. The data that influenced the ratios include auto utilization, persons per auto, and presence during the period of highest parking demand. Parking occupancy at the 20 pilot facilities peaks between 9AM and 11AM. Peak presence acknowledges the fact that not all VAMC population groups are on site at the same time. Generally speaking, full-time employees work in shifts and on a VA campus five percent to ten percent may work off-peak hours. Outpatients have short durations of stay and high turnover rates in comparison to inpatients and employees and forty percent (40%) of a medical center's total daily outpatient visits could occur during non-peak parking hours. Therefore, the model estimates peak hour parking demand based on average daily staffing, patient, and visitor volumes. For example, for every 100 full-time employees that work at VAMC Memphis 83 parking spaces would be occupied (0.83 factor) while 28 spaces would be needed for every 100 outpatients (0.28 factor).

Table 22 – Original and Expanded Pilot Facility Peak Population-based Parking Demand Ratios

	Expanded Pilot Facilities												Original Pilot Facilities (1)							
	Memphis, TN	Reno, NV	Bronx, NY	San Diego, CA	Jefferson Barracks Div. /St. Louis, MO	San Antonio, TX	Palo Alto, CA	Hines, IL	Cleveland, OH	Prescott, AZ	Miami, FL	Washington, DC	Augusta, GA	Houston, TX	Long Beach, CA	Milwaukee, WI	Minneapolis, MN	San Francisco, CA	Seattle, WA	Tampa, FL
Staffing																				
Full-time Employees	0.83	0.89	0.56	0.65	0.67	0.67	0.81	0.81	0.77	0.81	0.32	0.48	0.68	0.69	0.68	0.78	0.84	0.61	0.66	0.70
Part-time	1.00	1.00	0.51	0.79	0.90	0.27	0.96	0.75	0.67	0.83	0.67	0.38	0.67	0.38	0.59	0.33	0.43	0.39	0.69	0.75
Physicians	1.00	0.50	0.63	0.74	0.67	0.58	1.00	0.55	1.00	1.00	0.60	1.00	0.82	0.36	0.70	0.69	0.82	0.54	0.62	0.74
Service Organization	0.83	1.00	0.58	0.88	0.77	0.68	nc	0.60	0.76	0.78	0.47	nc	1.00	0.85	0.83	1.00	0.67	0.60	0.59	1.00
Volunteers	0.50	0.75	0.19	0.33	0.75	0.35	0.67	0.67	0.47	0.85	0.67	nc	0.20	0.31	0.15	0.32	0.36	0.24	0.20	0.17
Students	1.00	1.00	0.56	0.14	1.00	0.92	0.62	0.92	0.90	1.00	nc	nc	0.29	0.30	0.27	0.13	0.30	0.31	0.18	0.41
Patients																				
SCI/D Patients	0.32	0.15	0.46	0.35	0.53	0.37	0.39	0.14	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Outpatients	0.28	0.40	0.25	0.44	0.35	0.44	0.24	0.35	0.25	0.53	0.40	0.31	0.37	0.84	0.33	0.29	0.33	0.20	0.67	0.29
Inpatient Admissions	0.60	0.45	0.30	0.43	0.19	0.34	0.18	0.30	0.05	0.07	0.46	0.60	0.55	0.67	0.21	0.00	0.29	0.25	0.53	0.17
ED Patients	nc	nc	nc	0.43	0.60	0.15	0.10	0.60	0.22	0.30	0.60	nc	0.18	0.20	0.20	0.18	0.24	0.21	0.25	0.31
Visitors													0	0	0	0	0	0.00	0	0
Inpatient Visitors	0.38	0.60	0.33	0.30	0.53	0.42	0.40	0.49	0.30	0.55	0.60	0.60	0.27	0.61	0.33	0.22	0.26	0.26	0.72	0.21
Vendors	nc	0.30	0.13	0.60	0.51	0.30	0.51	0.24	0.60	0.38	0.60	0.60	0.67	0.88	0.40	0.29	0.33	0.33	0.45	0.65
Non-treatment Visitors	0.34	0.50	0.17	0.40	0.57	0.53	0.38	0.38	0.47	0.44	0.41	0.40	0.20	0.63	0.20	0.25	0.15	0.20	0.90	0.15

nc - Not captured or counted given particular conditions at referenced medical centers

(1) Original Pilot Facility sites included VAMC Washington DC and Bronx but the auto use/parking factors for those facilities were update under the expanded effort.

When examining parking ratios across the range of pilot VAMC facilities in Table 22 some interesting patterns develop. The employee parking demand ratio in Miami VAMC equals 0.32, or 32 occupied parking spaces for every 100 full-time employees. The Miami VAMC is located in an urban area, has limited available land, and is adjacent to a light-rail commuter station. By necessity and design, parking opportunities for Miami employees are limited. Conversely, the full-time employee parking demand ratio in Prescott, AZ is 0.81 or 81 spaces per 100. Prescott serves a rural population that is distributed over a large area, the medical center has an abundance of land, relatively speaking, and public transit service is practically non-existent. Employees have little choice but to drive and park a car. This reflects the influence of regional characteristics (urban, suburban, and rural) and the impact that public transit services has on employee and patient commuting patterns.

The selection of urban, suburban, or rural parking demand ratios is critical to the PDM effort and it has been acknowledged that this is a subjective step in the process. These terms are relative and are impossible to conclusively define using numbers and statistics. As a result, the VISN/VAMC capital asset manager and/or planner who will be utilizing the PDM will be required to objectively consider the demographics of their region and the characteristics of the patients, visitors, and employees that frequent the medical center. However, the following definitions of urban, suburban and rural as published in Webster's dictionary are offered as background.

- **Urban:** of, relating to, characteristic of, or constituting a city
- **Suburban**: an outlying part of a city or, a smaller community adjacent to or within commuting distance of a city
- **Rural:** of or relating to the country, country people or life, or agriculture

Note that definitions of urban, suburban and rural in the PDM are associated less with the geographic location of the facility and more with the demographics of the patients, visitors, and employees that the medical center serves. The following examples illustrate this point. VAMC Augusta is located in downtown Augusta which would be characterized as urban. However, its employees and patients live 30, 40, even 50 miles from the medical center in rural areas of Georgia and South Carolina. As such, VAMC Augusta is defined as rural.

The parking demand ratios summarized on Table 22 also differentiate because of the strength or weakness of the public transit and employee car/vanpool program participation. For example, both the VAMC Houston and VAMC Minneapolis populations are generally associated with suburban origin to destination characteristics. However, the percentage of individuals in Houston that use public transportation and/or car/vanpool programs is greater than in Minneapolis, even though Minneapolis commuters have similar public transit and car/vanpool opportunities. As a result, Houston is defined as "suburban strong", while Minneapolis is defined as "suburban weak". As with the urban, suburban, or rural classification, VISN/VAMC planners will need to justify the selection of one of the three transit car/vanpool designations.

3.2 SCI/D Facility Data

The following presents the data gathered during an examination of Spinal Cord Injury/Disorder patient activity and auto/parking utilization for the HUB facilities. Table 23 summarizes the data that was collected through the distribution and collection of administrator survey forms, SCI/D department staff interviews, patient point of access questionnaires, and parking inventory and occupancy counts. The table also includes Patient Cost and Workload ProClarity Cube data on SCI/D outpatient volumes as provided by VA CFM. The table is subdivided into quantitative data provided by each SCI/D department through the administrator survey form and outpatient volumes recorded through ProClarity, qualitative data obtained during the on-site stakeholder interviews and follow-up conference calls, and the parking data obtained through field surveys. Unfortunately, because most VAMCs do not provide access controlled gate restricted SCI/D patient parking spaces, DESMAN finds that the parking inventory and utilization data cannot support or reject treatment-based estimates of patient parking demand because many of the SCI/D spaces may be used and abused by non-SCI/D patients. Also note that the bed figure presented in Table 23 includes all SCI/D beds and is not limited to licensed or staffed definitions. Furthermore, the physical therapy (PT), occupational therapy (OT), and kinesiology therapy (KT) clinic figures do not differentiate between large or small therapy clinics which can range between 800 net square feet (NSF) and 3,000 NSF.

Of particular interest in Table 23 is the comparison of ProClarity average daily outpatient stops from the quantitative data to the estimates of average daily outpatient volumes on the busiest day collected from the SCI/D interviews. With the exception of VAMC San Diego (30.2 to 75 outpatients per day) the findings from the quantitative and qualitative outpatient data is quite similar. This validates the use of outpatient data in estimating exam room and therapy unit parking demand. Note that the 75 estimated outpatient volume per day at VAMC San Diego is

based on procedures not stops and DESMAN and VA CFM were unable to verify/correct this figure prior to publication.

Table 23: Summation of SCI/D Facility Information & Observation

SCI/D Facility Information & Observations	Memphis, TN	Bronx, NY	San Diego, CA	Jefferson Barracks Div., MO	San Antonio, TX	Palo Alto, CA	Hines, IL	Cleveland, OH	Miami, FL	Average
Quantitative Data										
SCI/D Total Beds (1)	60	62	30	32	30	32	58	32	36	41.3
SCI/D Exam, Psychology, and/or Social Work Rooms (1)	3	3	8	5	5	6	5	3	3	4.6
SCI/D PT, OT, KT Clinics (1)	5	3	3	2	1	1	1	1	1	2.0
Average Daily Outpatient Stops (2)	7.6	13.1	30.2	19.2	13.1	16.1	12.6	14.1	31.9	17.5
Qualitative Data (3)										
Est. Exam Room Capacity (# of patients)	1	1	1	1	1	1	1	1	1	1.0
Est. PT/OT/KT Max. Capacity (# of patients)	11	12	10	6	5	8	10	8	10	8.9
Est. Avg. Daily Outpatient Volume on Busiest Day	8	20	75	19	15	16	NP	14	40	25.9
Parking Data (4)										
Gated/Restricted SCID Parking Inventory	30	NA	18	NA	37	12	16	10	17	20.0
Gated/Restricted SCID Peak Hour Parking Occupancy	25	NA	17	NA	17	9	15	7	17	15.3

(1) Data submitted by VAMC through administrator survey forms
(2) Data provided by VA CFM through Patient Cost and Workload Proclarity Cube
(3) Data obtained by DESMAN through SCI/D stakeholder interviews
(4) Data obtained by DESMAN through field data collection on VAMC selected weekday
NA: Not applicable as those facilities do not have dedicated/gate controlled SCI/D patient parking
NP: VAMC unable/unwilling to provide this information

4.0 PARKING DEMAND MATRIX

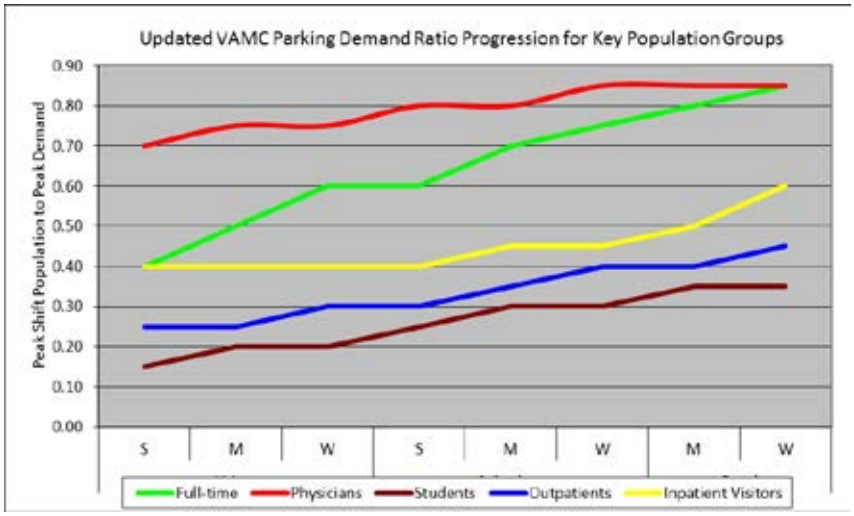
Table 24 presents the parking demand ratio matrix that is at the core of the Parking Demand Model. A capital asset manager would determine a facility's classification and its transit population (example, suburban/weak). The Model would then automatically apply those demand ratios to the population data. If, for example, VAMC San Diego has 1,000 full-time employees and the medical center is defined as serving a suburban population and having strong public transit/carpool services then the Model would calculate current parking demand at 600 spaces (1,000 multiplied by 0.60). However, if VAMC San Diego and its full-time employee demographics are classified as suburban/mixed, then the peak parking demand for those employees would equal 700 (1,000 multiplied by 0.70). These calculations would apply to all applicable population groups. Detailed instructions on how to use the PDM is referenced later in Part III of this document.

Table 24: Recommended Parking Demand Ratio Matrix

	Urban			Suburban			Rural	
Transit & Car/Vanpool Rating	*Strong*	*Mixed*	*Weak*	*Strong*	*Mixed*	*Weak*	*Mixed*	*Weak*
Staffing								
Full-time	0.40	0.50	0.60	0.60	0.70	0.75	0.80	0.85
Part-time	0.40	0.45	0.50	0.55	0.60	0.65	0.75	0.80
Physicians	0.70	0.75	0.75	0.80	0.80	0.85	0.85	0.85
Service Organization	0.50	0.60	0.65	0.70	0.75	0.75	0.80	0.85
Volunteers	0.15	0.15	0.20	0.20	0.25	0.25	0.30	0.30
Students	0.15	0.20	0.20	0.25	0.30	0.30	0.35	0.35
Patients								
Outpatients	0.25	0.25	0.30	0.30	0.35	0.40	0.40	0.45
Inpatient Admissions	0.25	0.25	0.30	0.35	0.35	0.35	0.40	0.40
ED Patients	0.30	0.35	0.40	0.40	0.40	0.45	0.50	0.60
Visitors								
Inpatient Visitors	0.40	0.40	0.40	0.40	0.45	0.45	0.50	0.60
Vendors	0.45	0.45	0.45	0.50	0.50	0.50	0.55	0.60
Non-treatment Visitors	0.40	0.40	0.40	0.40	0.45	0.45	0.50	0.60

Out of curiosity, Exhibits 41 and 42 compare in graph format the updated and original PDM ratios for the more significant staff and patient groups. It would appear that with the inclusion of VAMC Miami and an updated Washington DC, the urban strong and urban mixed ratios decreased while the inclusion of VAMC Reno, Memphis, and Prescott caused the suburban weak and rural ratios to increase.

Exhibit 41: Updated VAMC Parking Demand Progress for Key Population Groups from Urban to Rural and Strong to Weak Public Transit



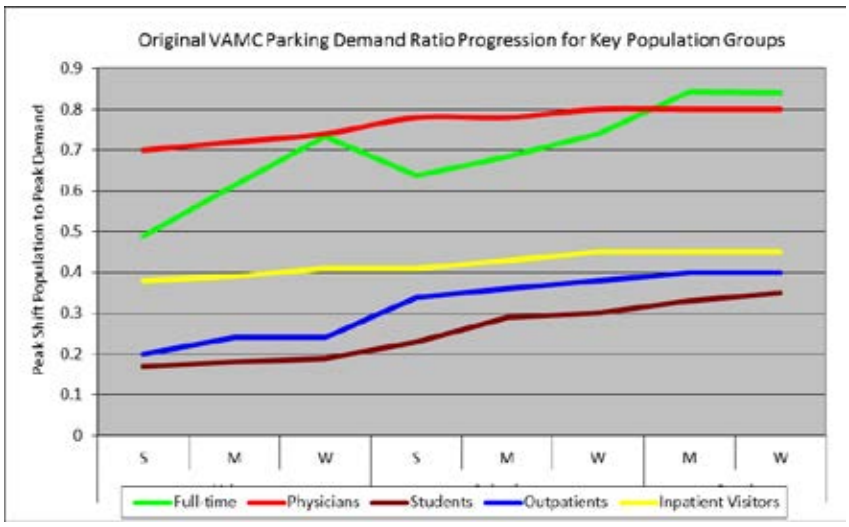


Exhibit 42: Original VAMC Parking Demand Progress for Key Population Groups from Urban to Rural and Strong to Weak Public Transit

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U.S. Department of Veterans Affairs

Using the VA Parking Demand Model Part II

Office of Construction and Facilities Management
Washington, DC

April 2013

U.S. Department of Veterans Affairs

Using the VA Parking Demand Model Part II

Office of Construction and Facilities Management
Washington, DC

April 2013

Instructions on Using the Parking Demand Model

Step 1: **Read the Preamble to the Parking Demand Model**

Step 2: Request copy of Strategic Site Plan from Office of Construction & Facilities Management and insert into Site Plan worksheet.

Step 3: Enter Facility Data (see blue and yellow highlighted cells) into Table 1. Note that the average daily census should be entered for each of the categories. (Average is defined as the sum of all the given elements divided by the total number of elements).

Step 4: Enter Population Data (blue and yellow cells) into Tables 2a and 2b. Note that for all employees, physicians, volunteers, students and other groups in Table 2 peak shift data is required. Peak shift is generally defined as weekdays between 7AM and 3PM. For all inpatient and outpatients, average daily population data is required. Full and part-time employee group categories include but are not limited to administrative staff, direct patient care givers, w/o compensation employees, canteen workers, custodial workers, lab technicians, researchers, medical school administrative and teaching staff, and any medical or non-medical employees who are assigned to work on the medical center campus on a long-term basis. Physician categories include but should not be limited to consulting/attending physicians, affiliated medical school physicians, or any physicians that was full-access working privileges at the medical center. For "other" categories (highlighted yellow) please note in the dialog box the employee classification and their associated job responsibilities. For inpatients and outpatients data (Table 2), please first include the actual average daily volumes in column I. In case the actual daily column was not recorded/available, then enter the annual inpatient, data provided by ProClarity in column G. Note that as average daily population volumes for inpatient visitors, non-treatment visitors, vendors, and other visitors are typically not recorded by VAMC/VISN systems it has been calculated automatically based on industry standards associated with the number of hospital, domiciliary, nursing home, SCI, and other beds.

Step 5: Enter current Parking Inventory (see blue and yellow cells) into Table 3. Include permanently owned/operated on and off-site parking facilities and temporary on-site facilities but exclude those off-site facilities that are leased and/or under short-term ownership/operation. For "other" VAMC parking facilities (see yellow highlighted cells) please note in the dialog box the location (on vs. off-site) and surface condition (asphalt vs. gravel). If off-site also note whether the facility or facilities have shuttle service.

Step 6:

- Select appropriate VAMC characteristic on the Current Peak Demand table (Table 4). By pressing the applicable "macro button" the peak parking demand ratios for each campus user group from the Demand Ratio Matrix tab will be automatically applied.
- Reference the Parking Demand Model addendum for background on urban, suburban, rural and strong, mixed, and weak transit and car/vanpool characteristics. VAMC/VISN representatives must include justification of the selected characteristics when submitting the PDM to CFM for review and approval. Written justification must include information on public transit opportunities, employee car/vanpool participation and where available information on employee, patient, visitor travel mode split (car, bus, light rail, walk, etc.) and commuting patterns.
- Once the appropriate characteristics macro button is selected the peak parking demand for each user group will be automatically calculated.

Note that Parking demand for fleet vehicles are already included in the employee demand figures. Furthermore, the analysis of current parking demand includes a recommendation for the provision of ADA accessible handicapped parking spaces. This recommendation is based on survey findings at the ten (10) pilot institutions that found that between 7% and 16% of vehicles parked on a VA campus during the peak hour displayed handicapped hangtags and/or license plates.

- Currently, the number of handicapped accessible spaces on a VA medical center is 3% of the total supply. While the provision of handicapped spaces should continue to meet or exceed ADA standards and should their placement should be at the discretion of VAMC/VISN planners and asset managers, the model recommends the number of spaces that should be provided under two scenarios; with patient and visitor valet service and without valet service, with the with valet recommendation acknowledging that many handicapped patients and visitors would chose to use that service.

Step 7:

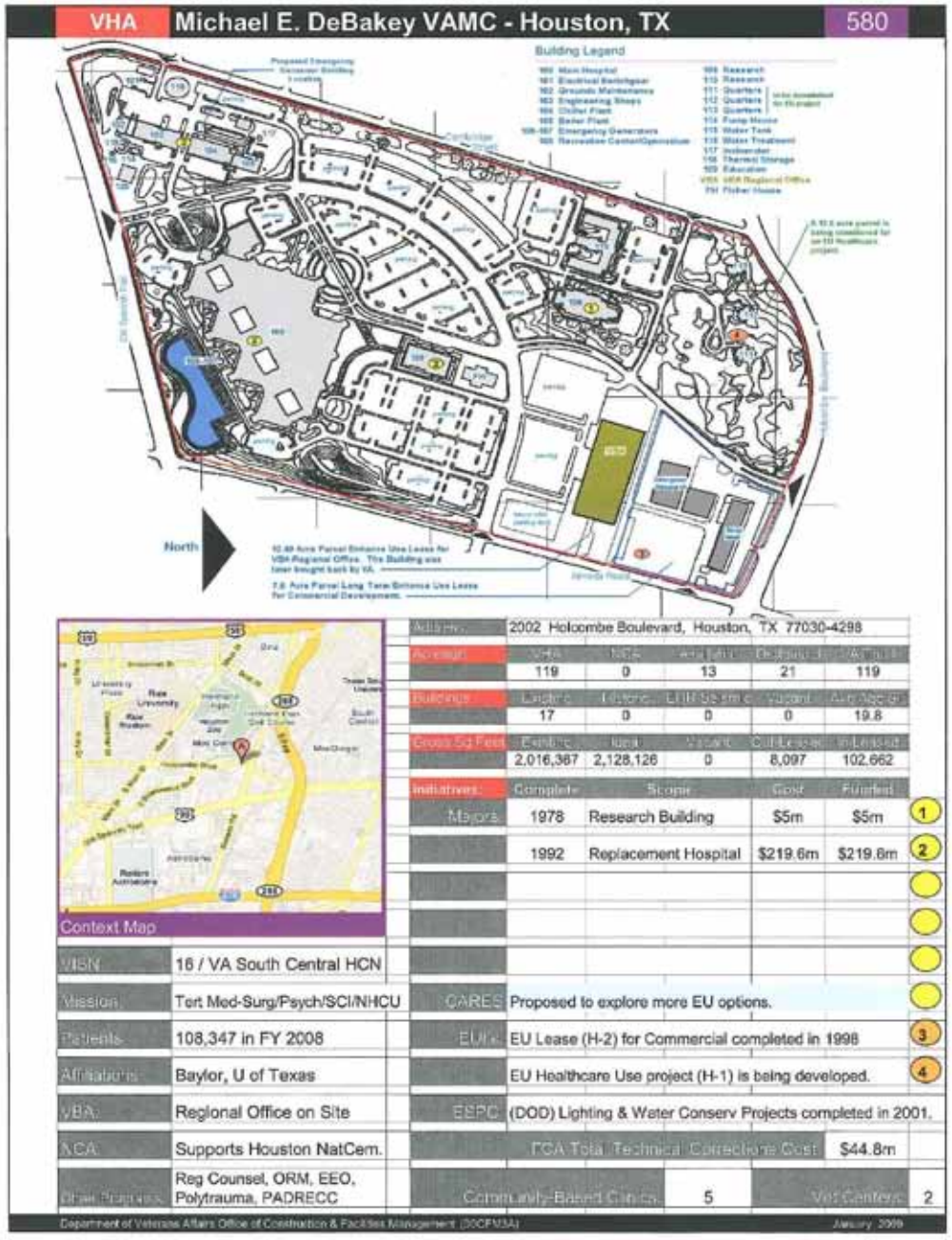
- Enter annual projections of employee, physician, and patient/visitor growth into the Future Growth table (Table 5). VAMC/VISN representatives must include justification for the annual growth rates to include source and definitions when submitting the PDM to CFM for review and approval. Future parking demand calculations (see Table 6) and ultimately estimates of future parking surplus or deficit (Table8) will be impacted by these figures.

Step 8:

- Enter annual estimates for the loss or gain of parking spaces into the Future Supply table (see Table 7a).

Note that the Demand Ratio Matrix tab of this Excel spread sheet is password protected, please do not enter any data into this tab.

Strategic Site Plan



VHA	Michael E. DeBakey VAMC - Houston, TX	580

Building Legend

North

Context Map

VISN	16 / VA South Central HCN
Mission	Tert Med-Surg/Psych/SCI/NHCU
Patients	108,347 in FY 2008
Affiliations	Baylor, U of Texas
VBA	Regional Office on Site
NCA	Supports Houston NatCem.
Other Programs	Reg Counsel, ORM, EEO, Polytrauma, PADRECC

Address	2002 Holcombe Boulevard, Houston, TX 77030-4298				
Acreage	VHA	NCA	Available	Developable	Acquired
	119	0	13	21	119
Buildings	Leased	Owned	Life Safety	Vacant	Avg Age (yr)
	17	0	0	0	19.8
Gross Sq Feet	Owned	Leased	Vacant	Out Leased	In Leased
	2,016,367	2,128,126	0	8,097	102,662
Initiatives:	Complete	Scope	Cost	Funded	
Majors	1978	Research Building	$5m	$5m	1
	1992	Replacement Hospital	$219.6m	$219.6m	2
CARES	Proposed to explore more EU options.				
EUs	EU Lease (H-2) for Commercial completed in 1998				3
	EU Healthcare Use project (H-1) is being developed.				4
EEPCI	(DOD) Lighting & Water Conserv Projects completed in 2001.				
	FCA Total Technical Corrections Cost			$44.8m	
	Community-Based Clinics		5	Vet Centers	2

Department of Veterans Affairs Office of Construction & Facilities Management (00CFM3A) January 2009

STEP 2:

- Request a copy of the facility's Strategic Site Plan from the Office of Construction & Facilities Management and insert it into this worksheet.
- For VA personnel refer to next page of this document.

Strategic Site Plan

VA Capital Asset Inventory

Users Guide? ChangePassword? Sign

Login User As : vacomc

4/26/2011 9:24

ent of Veterans Affairs | VHA | VBA | NCA | Staff | Reports

n: VHA VISN 16 - Jackson MS Station: Switch Station Seismic Map Home::Station

Summary

ation List Filter By: Station

			Owned Buildings						Leases			Land	
ails ew	Station Number	Station Name	# of Buildings	GSF	Historic	Seismic Total	Seismic EHR	80% Vacant	# of Leases	NUSF	Annual Rent	Acres	Site Plan
	502	Alexandria	43	782,727	17	0	0	0	2	17,136	$286,156.00	147.40	
	520	Biloxi	41	890,409	18	0	0	1	5	51,058	$581,823.00	125.00	
	520A0	Gulfport, MS	0	0	0	0	0	0	0	0	$0.00	0.00	-
	564	Fayetteville AR	31	491,493	13	0	0	0	13	201,257	$1,969,345.00	46.00	
	580	Houston TX	19	2,026,996	0	0	0	0	11	154,554	$3,124,022.00	119.00	
	586	Jackson	4	793,273	0	0	0	0	11	82,993	$1,224,479.00	32.40	
	598	Little Rock	2	803,790	0	0	0	0	9	46,486	$867,165.00	23.20	
	598A0	North Little Rock	90	1,481,567	28	36	0	3	1	4,000	$50,594.00	117.60	
	623	Muskogee	23	446,314	0	0	0	0	9	90,437	$1,433,269.00	14.00	
	629	New Orleans	8	864,472	2	0	0	1	30	328,893	$5,441,475.00	11.60	
	635	Oklahoma City	16	964,932	0	0	0	0	17	103,069	$881,697.00	17.24	
	667	Shreveport	15	615,733	0	0	0	0	7	57,152	$1,389,313.00	47.80	
			292	10,161,706	78	36	0	5	115	1,137,035	$17,249,338.00	701.24	

Strategic Site Plans can be accessed by opening to the VA Capital Asset Inventory page and electing the folder which addresses your facility.

Facility Data

Veteran's Affairs Medical Centers Parking Demand Model
VAMC Facility Data
Table 1

Facility Name	
Facility Address	
VISN Identification Number	
Facility Identification Number	
Date Data Provided (Mon/Day/Year)	
Name of Data Provider	
Job Title	
Contact Information (phone/e-mail)	
Facility Building Gross Square Feet	
Number of Hospital Beds	
Percent Avg. Bed Occupancy (Avg.Daily Census)	
Number of Domiciliary Beds	
Percent Avg. Bed Occupancy (Avg.Daily Census)	
Number of CLC Beds	
Percent Avg. Bed Occupancy (Avg.Daily Census)	
Number of Nursing Home Beds	
Percent Avg. Bed Occupancy (Avg.Daily Census)	
Number of Spinal Cord Injury Beds	
Percent Avg. Bed Occupancy (Avg.Daily Census)	
Other Beds (please describe below)	
Percent Avg. Bed Occupancy (Avg.Daily Census)	

Definitions | Instructions | Strategic Site Plan | **Facility Data** | Population Data | Parking Inventory | Current Peak Demand

STEP 3:

- Enter Facility Data (see blue and yellow highlighted cells) into Table 1. Note that the average daily census to be entered should reflect the average daily census percentage of occupancy for each of the categories, not a bed count. (Example: Hospital Bed
- ADC = 26; Total Hospital Beds = 30 Average Daily Census percentage would = 86.66%).
- The average daily census should be entered for each of the categories
- For “Other Beds" (highlighted in yellow) please note in the dialog box the classification/type of use

Population Data

Veteran's Affairs Medical Centers Parking Demand Model

VAMC Peak Hour/Shift Population Data

0

The model will automatically enter the facility name.

DO NOT ENTER ANY DATA INTO GRAY CELLS PLEASE

Table 2a

Employees, Physicians, Students, & Others	**Peak Shift Volumes**
Full-Time Employees	
Part-Time Employees	
Physicians	
Service Organization Emp.	
Volunteers	
Resident & Other Students	
Other Full-time Staff/Physicians (describe below)	
Other Part-time Staff/Physicians (describe below)	

Table 2b

Inpatients and Outpatients	**ProClarity Actual Annual**	**Calculated Daily Est.**	**Actual Average Daily Volumes**
Outpatients		0	
Total Inpatient Admissions of All Beds		0	
Emergency Department		0	
Other Outpatient Services (describe below)			

Visitors & Vendors/Contractors	**Actual Daily Count**	**Calculated Daily Est.**
Inpatient Visitors (determined by PDM formula)		0
Non-Treatment Visitors (determined by PDM formula)		0
Vendors (determined by PDM formula)		0
Other Visitors (quantify and describe below)		

STEP 4:

- Enter Population Data into blue and yellow cells
- For all population groups in Table 2a peak shift data is required
- For all population data in Table 2b average daily population is required. Please first include the actual average daily volumes in column I (The last Column in Table 2b) . In case the actual daily column was not recorded/available, then enter the annual inpatient data provided by ProClarity in Column G (The first Column)
- If available enter the daily visitor and vendor numbers into blue cells in column I. If not, the average daily population volumes for inpatient visitors, non-treatment visitors, vendors, and other visitors will be calculated automatically
- For “Other" categories (highlighted yellow) please note in the dialog box the employee classification and their associated job responsibilities.

Parking Inventory

	A	B	C	D	E
1	Veteran's Affairs Medical Centers Parking Demand Model				
2	VAMC Parking Data				
3	0				
4	Table 3				
5			Current		Practical
6			Inventory		Capacity
7					
8	Open/Unrestricted Parking (available to anyone)				0
10	Employee/Physician/Student Parking				
11		Open/Unrestricted			0
12		Car/Vanpool			0
13		Volunteer			0
14		Student			0
15		Handicapped Accessible			0
16		Other (describe below)			0
17	Total Employee/Student		0		0
18					
19					
20					
22	Physicians				
23		Reserved/Restricted			0
24		Open/Unrestricted			0
25		Other (describe below)			0
26	Total Physician Spaces		0		0
27					
28					
29					
31	Patient/Visitor Parking				
32		Self Park			0
33		Valet			0
34		Handicapped Accessible			0
35		Other (describe below)			0
36	Total Patient/Visitor Spaces		0		0
37					
38					
39					
41	Government/Fleet Vehicles				0
43	Total Other Parking (describe below)				0
44					
45					
46					
48	TOTAL PARKING INVENTORY		0		0

DO NOT ENTER ANY DATA INTO GRAY CELLS PLEASE

Definitions | Instructions | Strategic Site Plan | Facility Data | Populatio

STEP 5:

- Enter current Parking Inventory into blue and yellow cells
- Include permanently owned/operated on and off-site parking facilities and temporary on-site facilities but exclude those off-site facilities that are leased and/or under short-term ownership/operation
- For "Other" (see yellow highlighted cells) please note in the dialog box a description including the location (on vs. off-site) and surface condition (asphalt vs. gravel). If off-site, also note whether the facility or facilities have shuttle service

Current Peak Demand

	A	B	C	D	E	F	G	H	I	J
1	Veteran's Affairs Medical Centers Parking Demand Model									
2	VAMC Peak Parking Demand Ratios									
3	0						VAMC			
4	Table 4						Characteristics			
5							(Select One)			
6			Peak	Selected	Peak Parking		Urban			
7		Population Group	Population	Demand Ratio	Demand		Strong			
8	Staffing									
9		Full-time	0	0.49	0		Urban			
10		Part-time	0	0.49	0		Mixed			
11		Physicians	0	0.70	0					
12		Service Organization	0	0.55	0		Urban			
13		Volunteers	0	0.14	0		Weak			
14		Students	0	0.17	0					
15	Total Staffing		0	---	0		Suburban			
16	Patients						Strong			
17		Outpatients	0	0.20	0					
18		Inpatient Admissions	0	0.24	0		Suburban			
19		ED Patients	0	0.40	0		Mixed			
20	Total Patients		0	---	0					
21	Visitors						Suburban			
22		Inpatient & ED Visitors	0	0.38	0		Weak			
23		Non-treatment Visitors	0	0.54	0					
24		Vendors	0	0.38	0		Rural			
25	Total Visitors		0	---	0		Mixed			
26	Total		0	---	0					
27							Rural			
28	*Recommended Provision for Handicapped Acccessible Spaces*						Weak			
29		w/ Patient & Visitor Valet Service (3% of total demand) =			*0*					
30		w/o Patient & Visitor Valet Service (7% of total demand) =			*0*					
31										
32										
33										
34										
35										
36										

STEP 6:

- Make sure that MSExcel macro function is enabled on your computer
- Select VAMC characteristic by clicking on the appropriate button
- Make sure to place an X in the box next to the button you click
- Reference the Parking Demand Model Preamble for background on urban, suburban, rural and strong, mixed, and weak transit and car/vanpool characteristics
- VAMC/VISN representatives must include written justification of the selected characteristic when submitting the PDM to CFM for review and approval

Future Growth

Veteran's Affairs Medical Centers Parking Demand Model
VAMC Average Annual Growth Projections
0
Table 5

Numbers indicate the number of years after the current base year. Once the current base year is entered into the facility worksheet, the model would automatically revise below figures to reflect the correct year. For instance, if the current base year is 2011, then Number 1 in the fist column would automatically change to 2012 (2011+1) , Number 2 would change to 2013 (2011+2) , etc.

Population Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Staffing																				
Full-time																				
Part-time																				
Physicians																				
Service Organization																				
Volunteers																				
Students																				
Patients																				
Outpatients																				
Inpatient Admissions																				
ED Patients																				
Visitors																				
Inpatient & ED Visitors																				
Non-treatment Visitors																				
Vendors																				

STEP 7:

- Enter annual growth rate of employees, physicians, and patients/visitors

  Annual growth = (Projected Population - Current Population) / Current Population

- VAMC/VISN representatives must include justification for the annual growth rates to include source and definitions when submitting the PDM to CFM for review and approval

Future Demand

Veteran's Affairs Medical Centers Parking Demand Model
VAMC Existing and Future Peak Parking Demand
0
Table 6

Population Group	Peak Parking Demand	Future Peak Parking Demand 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Staffing																					
Full-time	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Part-time	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Physicians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Service Organization	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Volunteers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Students	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Staffing	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Patients																					
Outpatients	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inpatient Admissions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ED Patients	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Patients	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Visitors																					
Inpatient & ED Visito	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-treatment Visito	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vendors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Visitors	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Recommended Provision for Handicapped Acccessible Spaces																				
w/ Patient & Visitor Valet Service (3%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
w/o Patient & Visitor Valet Service (7%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

DO NOT ENTER ANY DATA INTO THIS TABLE PLEASE.

The model will automatically calculate the future demand figures based on the information entered in the previous worksheet

Future Supply

	A	B	C	D	E	F	G	H	I
1	Veteran's Affairs Medical Centers Parking Demand Model								
2	VAMC Existing and Future Peak Parking Demand								
3	0								
4	Table 7a, 7b & 7c								
5									
6	Existing Parking Spaces to be Displaced and/or Added								
7			Displaced	Space			Year to be		
8	Lot Name/Code	Capacity	Spaces	Allocation			Displaced		
9							2011		
10							2011		
11							2012		
12							2012		
13							2013		
14							2013		
15							2014		
16							2014		
17							2015		
18							2015		
19							2016		
20							2016		
21							2017		
22							2017		
23							2018		
24							2018		
25							2019		
26							2019		
27							2020		
28							2020		
29							2021		
30							2021		
31							2022		
32							2022		
33							2023		
34							2023		
35							2024		
36							2024		
37							2025		
38							2025		
39							2026		
40							2026		
41							2027		
42							2027		
43							2028		
44							2028		
45							2029		
46							2029		
47							2030		
48							2030		

Strategic Site Plan | Facility Data | Population Data | Parking Inventory

STEP 8:

- Enter annual estimates for the loss or gain of parking spaces
- Make sure to include space allocation types
- For the gained spaces enter a negative number. For instance, if 30 Open/unrestricted spaces will be lost to new development in year 2011 , and the same number of spaces will be gained back in 2013, you will enter +30 in the "Displaces Spaces" column (Column C) for 2011 and -30 in the "Displaces Spaces" column for 2013.

MAKE SURE TO INCLUDE SPACE ALLOCATION TYPES IN THE "SPACE ALLOCATION" COLUMN ANYTIME YOU ENTER A NUMBER

Future Supply

Space Allocation	Current Capacity	Future Supply 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Open/Unrestricted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Employees/Students	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Physicians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patients/Visitors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Government/Fleet Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Parking	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

DO NOT ENTER ANY DATA INTO THIS TABLE PLEASE.

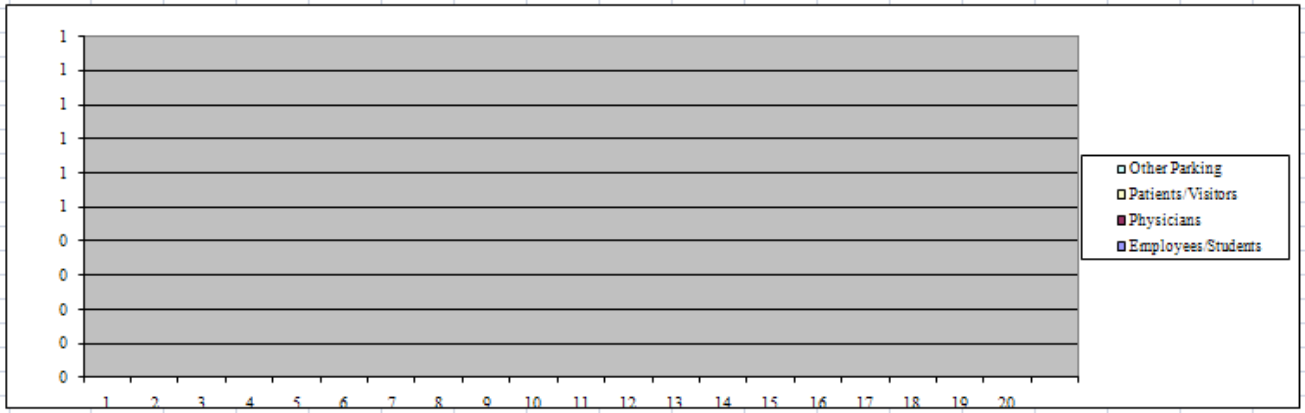
The model will automatically calculate the future supply figures based on the information entered in the previous worksheet

Surplus or Deficit

Veteran's Affairs Medical Centers Parking Demand Model
VAMC Existing and Future Peak Parking Demand
0
Table 8

The number represent will be either positive, meaning that excess parking spaces are available or negative, meaning that there is a deficit of parking

		Future Practical Surplus or Deficit																			
Space Allocation	Current	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Employees/Students	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Physicians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patients/Visitors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Parking	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Surplus or Deficit	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**



DO NOT ENTER ANY DATA INTO THIS TABLE PLEASE.

The model will automatically calculate the future surplus or deficit figures and creates a chart based on the information entered in the previous worksheets

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U.S. Department of Veterans Affairs

VA Parking Design Manual Part III

Office of Construction and Facilities Management
Washington, DC

Sect 4, Rev 11-01-2016

Sect 7, Rev 08-01-2014

April 2013

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FOREWORD

The Parking Design Guide is the culmination of a partnering effort between the Office of Facilities Planning in the Office of Construction & Facilities Management at the U.S. Department of Veterans Affairs and DESMAN Associates. The goal of the Design Guide is to facilitate the design process and to ensure the quality of VA facilities, while controlling construction and operating costs.

This document is intended to be used a basis of direction to follow and the foundation to supplement current technical manuals and other VA criteria in planning parking for medical facilities. The Design Guide is not to be used as the standard for design. Further, it does not preclude the need for a functional and physical design program for each specific project. It is the responsibility of the Project Architect and the Project Engineer to develop a complete and accurate project design that best meets the users' needs and applicable code requirements.

Since the parking facility is often the functional front door of a campus or facility, it is important to recognize opportunities for a welcoming presence. Parking structures may be utilitarian structures, but they should be aesthetically designed to enhance the campus environment.

Lloyd H. Siegel, FAIA
Associate Executive Director
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ACKNOWLEDGEMENTS

Credit is due to the following individuals whose guidance, advice and effort made this publication possible.

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We especially appreciate the cooperation and assistance of stakeholders from the ten VAMC facilities where parking operations, parking development plans, and procurement methodologies were studied as part of the development of this guide.

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SECTION 1 INTRODUCTION

This document has been developed to assist the U.S. Department of Veterans Affairs in the development of quality parking operations.

Unlike many other institutions that manage parking, VA may not be in a position to operate parking as a profit center. Given its secondary role as part of the infrastructure within a typical VA campus, the provision and adequacy of parking will not make or break the mission of individual VA centers. However, the first and last impression a patient and visitor will have of a VA center will involve a parking space. In addition, parking is oftentimes the most visually dominant element of the entire campus. If difficulty is encountered in finding or negotiating a parking space, that experience translates into a negative impression of the overall facility. Therefore, the provision of adequate and conveniently located parking should be an integral part of the design of the overall campus plan.

Parking on VA campuses must address the needs of VA patients, employees, and visitors. The goal of this document is to guide VA planners, managers, and designers in the planning, design, and management of parking provisions within VHA.

This guide has been developed by reviewing state-of-the-art knowledge gathered by parking industry associations such as the National Parking Association, American Concrete Institute, Precast/Prestressed Concrete Institute, and the Urban Land Institute, and refining this knowledge by direct observation and analysis at VA campuses. This guide should prove useful in the procurement, design, operation, and maintenance of parking systems serving Veterans at all medical centers.

This document does not apply to National Cemetery Administration (NCA) or Veterans Benefits Administration (VBA) facilities; however the contents within this document may be applied at the discretion of NCA and VBA as applicable.

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SECTION 2 CAMPUS ORGANIZATION AND ORIENTATION

The parking experience is the first and last impression that most users will have of the VA Medical Center (VAMC). Adequate provisions that are conveniently located and easily navigated are of paramount importance, and should be sufficient to support the activities of the medical center.

- **Parking Demand**

When assessing an appropriate parking supply, all factors that influence parking demand should be considered. This includes, but is not limited to population activity, outpatient volumes, support functions, mass transit options, and medical center location. These factors vary widely among individual medical centers. To assist in determining the correct parking supply for VA medical centers, VA utilizes a Parking Demand Model (PDM). The PDM is an electronic format tool for determining the required number of parking spaces for each medical center. The PDM takes variables into consideration to assist Veterans Integrated Service Network (VISN) and VAMC planners and capital asset managers in this endeavor. It is recommended that parking supply exceed demand by approximately 10 percent to account for practical capacity.

In addition to the calculation of parking demand, an individual VAMC should also conduct a parking study. Parking studies are important tools that should influence the facility master plan. A typical parking study may include the following considerations:

- Inventory of total parking spaces segregated by area and user
- Analysis of existing on-site problems
- Determination of parking demand and turnover rates
- Identifying access difficulties
- Report on condition of existing parking infrastructure
- Requirements for other service activities
- Recommendations for trip reduction to reduce parking demand
- Analysis of available alternative transportation systems

- **Employee vs. Patient/Visitor Parking**

Employees and patients/visitors are the two main user groups at VA medical centers. Each group has different parking needs. Employees, which include full-time and part-time staff, resident and attending physicians, and a multitude of nurses on different shifts, are the daily commuters. Employees typically have long durations of stay, are intimately familiar with the environment, and likely have a preference for a specific parking location. For these general reasons, employee parking activity is easier to manage when compared to infrequent users, the patients and patient visitors that do not have the same level of familiarity with the environment, and are likely to arrive and depart with some degree of stress. For this reason, it is recommended that patient/visitor parking be segregated from employee parking. Where possible, patient/visitor parking should be provided with immediate access to the medical center.

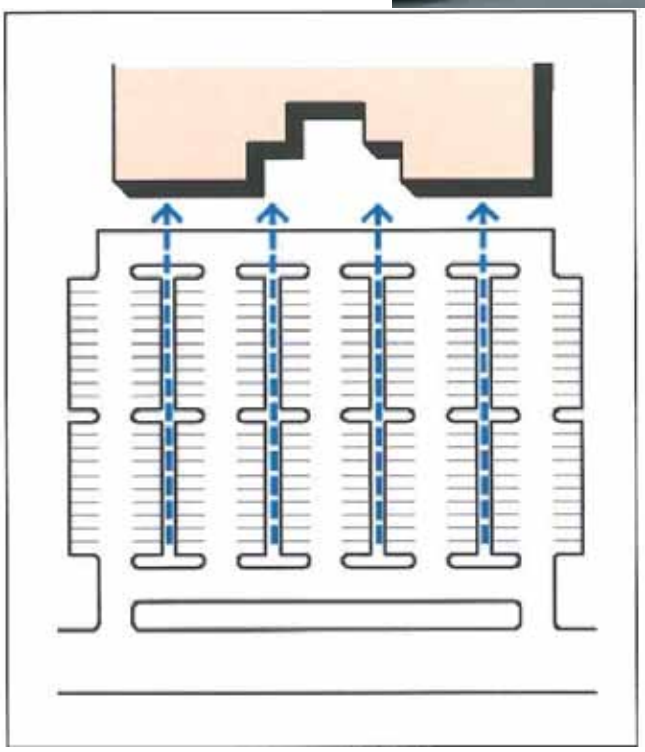
As a general guide and with an acknowledgement that patients and visitors should be allocated the most convenient spaces, the following employee/student priority space assignment program is recommended.

1. Mobility impaired faculty, staff, and students
2. Temporary disabilities
3. Vanpool (6 or more passengers)
4. Full-time direct patient caregivers
5. Part-time direct patient caregivers
6. Full-time staff
7. Part-time staff

8. Residential students
9. Student commuters
10. Non-VAMC employees, such as contractors

- **Relationship to Center**

Drive aisles should be oriented perpendicular to medical center entrances as shown in the photo and diagram below. This will reduce conflict between pedestrians and drivers navigating the parking fields, and will create strong sight lines to the entrance. In accordance with the recommendations of the Physical Security Design Manual, no parking should be placed within 50 feet of the medical center. Where possible, locate parking so that grading is minimized.



- **Off-Site Considerations**

Some VAMC's cannot provide remote or off-site parking for employees, as required by Federal legislation. This is unfortunate because, for many medical centers, off-site parking can represent a low-cost, traffic-reducing alternate to constructing additional parking on site. As an alternative, some VAMCs provide off-site parking and express shuttle service for outpatients and patient visitors. While accepted as a solution to on-campus parking shortages, this approach is quite unusual as patients and visitors should, in practice, receive the most convenient parking spaces; while employees, who are generally willing to accept longer commuting times, should be assigned to the peripheral locations.

If off-site parking is desired, it is recommended that only employees utilize it. Some modification to existing Federal legislation may be required to fund employee off-site lots which are either leased or owned and employing shuttle service to ferry staff to and from the medical center. Alternatively, existing public transit subsidies for employees should be used to support public or privately operated satellite parking programs and express shuttle services. The off-site lot must be linked to the medical center by a regularly scheduled shuttle service with 6 to 8 minute headways during peak commuting periods.

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SECTION 3 CONSTRUCTION METHODOLOGIES

There are three primary construction delivery methods commonly used by VA to design and construct parking structures. The three primary delivery methods which will be discussed are Traditional, Design Build, and Turn Key delivery. Although the choice of construction delivery will largely be beyond the authority or responsibility of those utilizing this design manual, it is nonetheless useful to understand the methods, so that the design may supplement the construction choice.

In the Traditional method of project delivery, VA selects and contracts with a lead designer (Parking Consultant or Architect as Prime Consultant). The Prime Consultant then represents VA in defining the project and preparing technical drawings and specifications. The prepared plans and specifications are then used either by the VA to bid the full project (General Contract Delivery) or by a Construction Manager to bid individual trade subcontracts (Construction Manager Delivery).

In the Design-Build delivery method, VA selects and retains a single entity (usually a construction firm because of insurance restrictions) that is responsible for both the design and construction of the facility.

In the Turn-Key delivery method, VA selects and retains a third party developer that controls a parcel deemed useful for VA construction, or to whom the VA deeds property for development. Once selected, the developer independently selects and retains the designer and builder.

Regardless of the construction delivery method chosen, the project's Special Conditions should prohibit the following activities within parking facilities under construction:

- Parking for construction workers personal vehicles;
- Delivery and storage of construction materials;
- Parking for contractor and sub-contractor company vehicles.
- Installation of elements using on-road vehicles

This step will ensure delivery of a clean parking facility to the parking user at construction completion.

The VA will stipulate the type of construction delivery model to be used.

- **Traditional Delivery**

Traditional construction delivery methods offer VA the advantage of full control throughout the design and construction process. Because the designer and constructor are both contracted directly with VA, the Department enjoys immediate access to both parties, and has immediate input in all design and scheduling decisions.

However, that control comes at a cost in terms of time and project harmony. Project time must be budgeted for VA to procure both design and construction services. Project Manager's time and energy must be allocated to ensure that the two organizations carry out their duties in a manner that is productive for the full project.

- **Design-Build Delivery**

In recent years there has been a strong movement in Federal procurement to deliver construction using the design-build approach. This approach generally will save VA overall project delivery time and overall project costs (especially in terms of VA project management). By the very nature of the relationship (the designer working with a constructor), the VA can benefit from value engineering services provided by the Design-Build team. Because the final definition of the project and the technical scope of the project are prepared by the team, VA's risk may be reduced and the potential for additional costs during construction lessened.

Many within VA have experienced difficulty in properly engaging a Design-Builder once the decision has been made to deliver a project by that method. This difficulty is largely due to inadequate project and/or procurement definition, which can be avoided if Design-Build projects include the following steps:

1. Retain experienced design professionals (the A/e shall retain a parking consultant) to author Design-Build criteria documents. This team will assist in defining the quality of the project, and will advise VA on whether the developed design and construction meets the quality standard established by the criteria documents.

2. Develop a transparent selection process. Publish the scoring criteria for the design-build community. A scoring system should, at minimum, include the technical abilities of the design team, the technical abilities of the construction team, quality of proposed design, proposed schedule, and cost presented on a per space added basis.

3. Issue a full public Request for Qualifications (RFQ). Based on the experience demonstrated (previous parking structure and VA experience is paramount) in the qualifications statements, the VA will develop a short list.

4. Complete the criteria documents. These documents should include the proposed contract, general conditions, and special conditions. The procurement procedure should be fully defined. The project should be defined in terms of the minimum quality of construction materials with due consideration given to achieve a lengthy service life under severe conditions. A recent site and utility survey, a report of subsurface conditions, and a preferred parking solution must be provided to the competing Design-Builders.

5. Issue the criteria documents to the shortlisted Design-Builders as a Request for Proposals (RFP). Encourage the design-build community to submit alternatives, but utilize the design criteria as a basis of selection. Prior to final selection, an interview with the potential Design-Builder(s) should be conducted, so that any questions may be addressed. This gives VA an opportunity to interact directly with the Design-Builder. The Design-Builder should have the proposed Project Manager; Lead Estimator, Design Manager, and Site Superintendent at the interview.

Following this process will ensure that all viewpoints within VA regarding project procurement are represented, and will greatly reduce potential protests.

- **Turn-Key Development**

In some instances, the VA may find it advantageous to develop parcels controlled by others for its use. There are also some facilities where adjacent land owners offer attractive opportunities for real estate transfers. Even if a parking project is not developed on VA property, the end user will most likely be a VA employee and/or a VA patient. Therefore, VA should take an active role in defining the project by establishing design criteria in much the same manner as described above for a design-build project. Instead of being used as a basis for an RFP, the design criteria are made part of the Developer's Agreement for the project under consideration.

Here again, VA will utilize the services of qualified design professionals to define the project, author the criteria, and monitor the design and construction for conformance with the Developer's Agreement.

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SECTION 4 PARKING GEOMETRICS

Parking stall layouts will be generally influenced by three factors: the size of automobiles currently in production; the economics of parking; and the users.

It may be an over-simplification, but recent trends have shown that the size of automobiles preferred by consumers roughly parallels the relative cost of gasoline. Today, there are a wide range of automobiles on the road from the “minis” and “micros,” through light trucks and sport utility vehicles, to conversion vans and multi-passenger pick-up trucks. A designer must understand the typical vehicle to be driven by the likely user. That typical vehicle can and will vary by region.

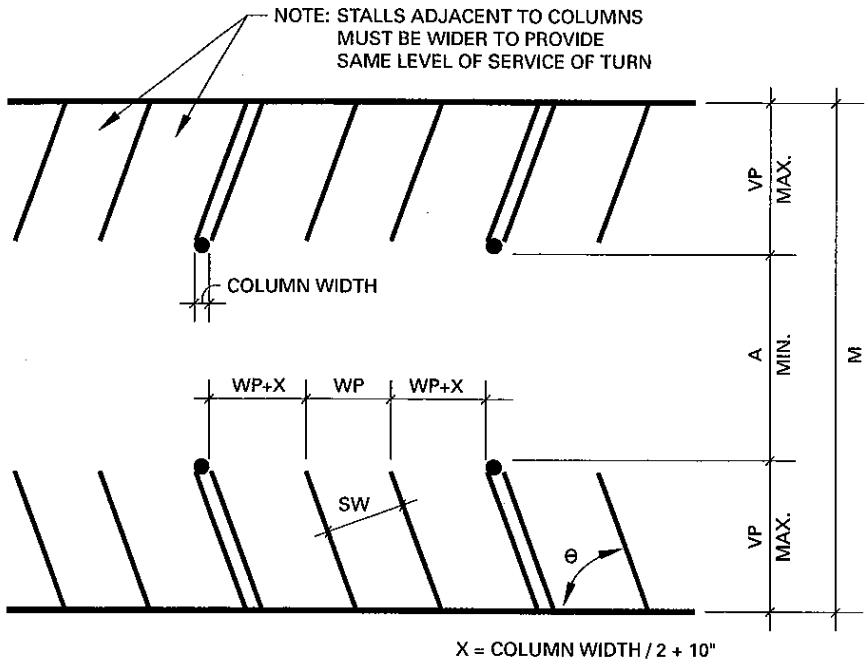
The economics of parking directly relate to the initial cost of construction. As VA commits to an infrastructure cost, which will be static on a square foot basis (meaning the cost of construction for a given area of building), it behooves planners and designers to maximize the number of spaces provided in a given area (called efficiency). A new design should utilize 300 to 325 square feet per parking space provided.

Generally speaking, VA parking spaces will serve two groups of users: patients and visitors; and employees. Employees should be familiar with the parking area. These users (the employees) arrive at work and their automobile will likely stay in the same parking spaces for the full day (“long term” parking). Patients and visitors will not have the same familiarity with the environment.

- **Space Width and Length**

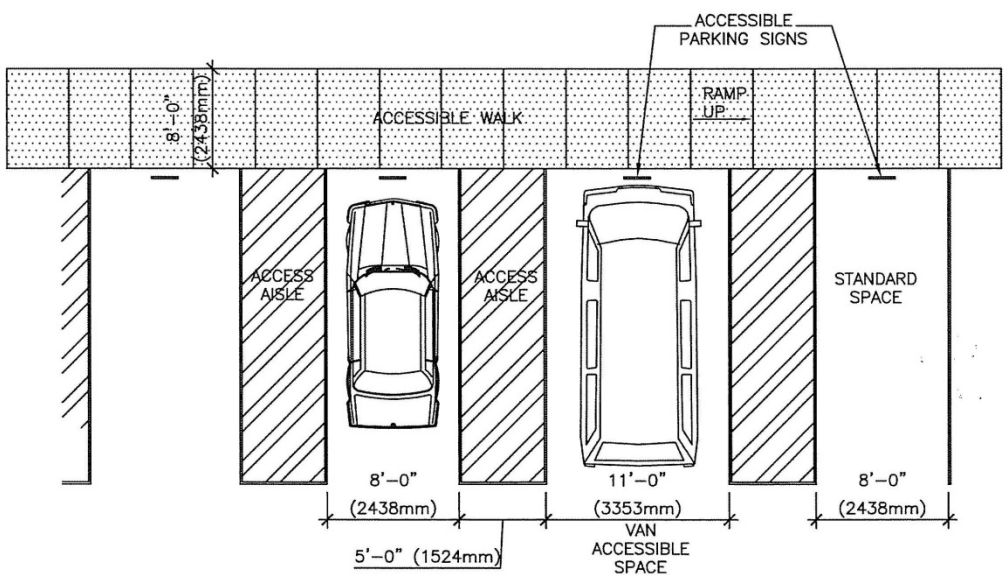
The critical elements of parking space dimensions are stall width to vehicle width, and the ease of maneuvering into and out of the parking space. Given the typical VA patient and visitor, it is recommended that a 9’-0” wide by 18’-0” long parking stall be used throughout VA facilities. Some regions of the country may be able to use a narrower stall, and a narrower stall may be justified for employee parking. However, using the wider stall can simplify future reallocation of employee parking for visitor parking, should that need arise. Use of reduced width “small car” or “compact car” spaces is discouraged.

Structured parking facilities should be designed so that columns are not located in the same field as parking spaces. In some mixed-use facilities, the designer may choose to ignore this desirable feature. If that occurs, the width of parking stalls located immediately adjacent to columns should be increased 10” to provide greater maneuverability. Refer to the following figure from the National Parking Association.



ADA Considerations

With regards to accessible parking spaces, VA follows the requirements of ABAAS (Architectural Barriers Act Accessibility Standards). Note that parking space requirements may be found in the Architectural Barriers Act Accessibility Standards dated May 8, 2006. A parking stall width of 8'-0" shall be used for standard accessible spaces and a width of 11'-0" for van accessible spaces. Provide a 5'-0" wide access aisle **on each side** of the standard and van accessible spaces. Accessible parking should be placed as close to the actual user destination as possible.



Note: Location of walkways shall preferably eliminate the need to walk or wheel behind parked vehicles.

Accessible paths from parking spaces are preferably located so that they do not share parking drive aisles, and are not located behind parking spaces. Vehicular traffic should be prohibited from these “safe lanes,” and vehicular traffic should yield to individuals utilizing the “safe lanes” between the parking spaces and the facility destination. In surface parking lots, place truncated dome tactile warning strips at the ends of all curb ramps, or at any point where a pedestrian walks into a vehicular area with a walkway surface flush to the vehicular surface.

The number of appropriate accessible spaces will vary depending on the services provided at the particular medical center. VA’s basic parking guidelines, which differ from the International Building Code and most Federal documents, amends ADA-ABA minimum requirements to suggest that three percent (3%) of total parking provided in a facility be accessible spaces for handicapped patrons. A table showing accessible parking requirements at the time of this writing is presented below.

Total Number of Parking Spaces Provided in Parking Facility	Minimum Number of Required Accessible Parking Spaces Excluding SCI Facilities
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	9
301 to 400	12
401 to 500	15
501 and over	3 percent of total

Hospital Outpatient Facilities: Ten percent (10%) of patient and visitor parking spaces provided to serve hospital outpatient facilities shall be accessible.

Rehabilitation Facilities and Outpatient Physical Therapy Facilities: Twenty percent (20%) of patient and visitor parking spaces provided to serve rehabilitation facilities specializing in treating conditions that affect mobility, and outpatient physical therapy facilities, shall be accessible.

Conditions that affect mobility include the use or assistance of a brace, cane, crutch, prosthetic device, wheelchair, or powered mobility aid; arthritic, neurological, or orthopedic conditions that severely limit one's ability to walk; respiratory diseases and other conditions that may require the use of portable oxygen; and cardiac conditions that impose significant functional limitations.

Hands-on experience with current parking conditions at VA campuses indicates that the above percentages may not reflect actual needs. It is recommended that accessible parking needs be evaluated for each facility depending on the services provided at that medical center, rather than accepting a rote percentage. As a starting point, it is suggested that five percent (5%) of the total number of parking spaces provided for a medical center be ADA accessible. Of the total accessible spaces, 1 in 6 should be van accessible.

- **Spinal Cord Injury Guidelines Overview**

Provide dedicated surface and/or structured parking with accessible parking spaces specifically for SCI/D patients that provides safe and easy access to SCI/D outpatient clinic, SCI/D inpatient unit, and SCI/D long-term care units. Separate parking facilities may be required if SCI/D units are not contiguous.

- **Dedicated SCI/D Parking Requirements:**

1. Provide **0.2 accessible spaces per SCI/D inpatient bed** and ***specifically dedicated for SCI/D patients*** as indicated within the SCI/D Center Design Guide and PG 18-13 Barrier Free Design Guide.

2. For SCI/D Long-Term Care (LTC) facilities not having a SCI/D outpatient clinic provide **0.50 cars per inpatient LTC bed**.

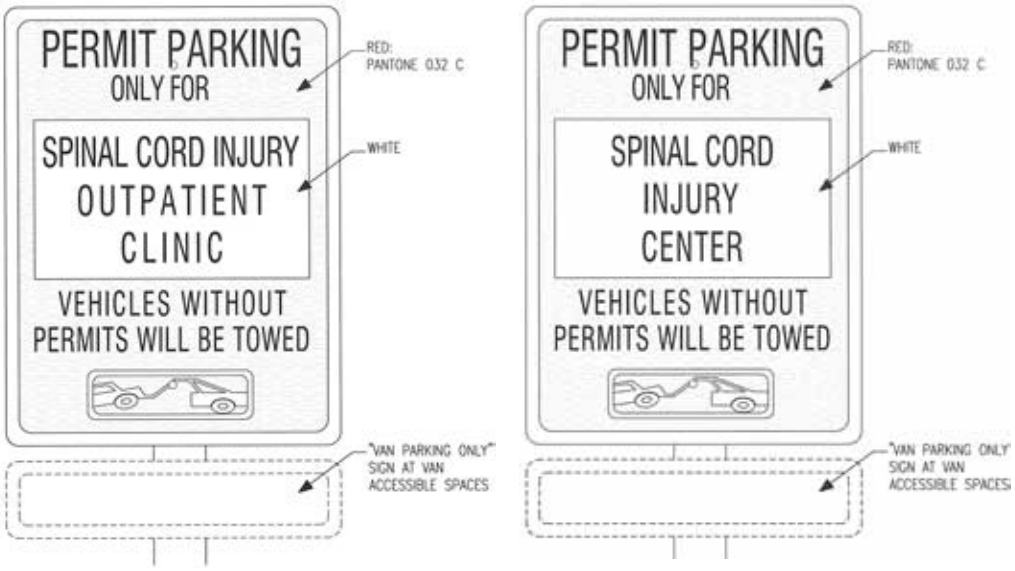
3. For each SCI/D clinic exam room, provide **5.6* parking spaces**.
   **(Note: this factor accommodates all therapy and rehabilitation spaces utilized by SCI/D outpatients).*

4. Sixty percent (60%) of accessible parking spaces shall be designated as van accessible (9'-6" tall).

5. Access aisles 5'-0" (1524 mm) wide on each side of accessible spaces
   a. Regular spaces are 8'-0" (2438 mm) wide by 18'-0" (5482 mm) long.
   b. Van spaces are 11'-0" (3352 mm) wide by 18'-0" (5482 mm) long.

6. Pavement surface flush with adjoining walk with a maximum surface slope of 1:50 (two percent)

7. "SCI/D Patient Parking Only" for identification of SCI/D accessible spaces for both SCI/D Centers and SCI/D Clinics in "HUB" facilities shall be as indicated:



8. The top of signs shall be 72” above grade

9. Signage pursuant to *TIL - Design Guides, Signage Design Guide, (PG-18-12).*

10. Minimum clear width of 8’-0” (2438 mm) for adjacent walkways abutting parking stalls to allow for vehicle overhang.

11. VAMC SCI/D spoke facilities need not comply with these requirements. SCI/D patient parking will be accommodated within the mix for all handicapped parking spaces.

- **Community Living Center**

Community Living Centers (CLC) located on VAMC campuses are referenced in the PDM, and parking demand is aggregated into the employee and patient/domiciliary per bed parking demand calculations. However, the PDM does not address parking needs at a stand-alone CLC facility.

Each CLC is typically composed of a Community Center (administration and recreation building) that has approximately ten (10) FTE’s during the day, and two (2) FTE’s for second and third shifts. Each residential unit generally has ten beds, and up to four (4) out of ten (10) residents may have a vehicle. Staffing for each unit consists of two (2) FTE staff and 0.5 registered nurses (one RN for every two units). Typically the first staff shift would encompass fifty-five percent (55%) of this total, the second shift would encompass twenty-five percent (25%) of the total, and the third shift would encompass twenty percent (20%). With an acknowledgment of parking needs during shift overlap, it is recommended that the staff demand ratio be adjusted by a factor of 0.8 (fifty-five percent plus twenty-five percent). The following estimates should be used to determine the user group-based population demand ratios for CLC parking needs

Parking for Patients:	0.4 spaces per bed
Parking for Visitors:	0.2 spaces per bed
Parking for Community Center staff:	0.8 spaces per FTE
Parking for CLC Unit staff:	0.8 spaces per FTE
Service Vehicle & Other Parking:	0.5 per 10 resident beds

For example, a CLC facility with a Community Center and 40 resident beds would require 16 resident, eight (8) visitor, eight (8) community center staff, eight (8) CLC unit staff, and two (2) service vehicle spaces.

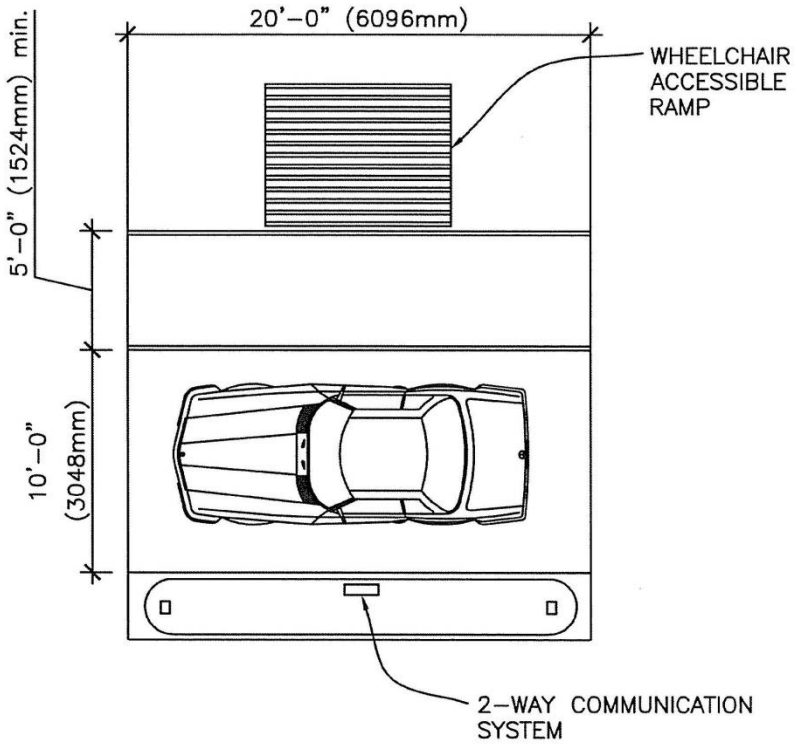
- **Leased Clinic Properties**

Community-based Outpatient Clinics (CBOCs) and large Home Health Care (HHCs) facilities are not part of the Parking Demand Model (PDM). Community based Outpatient Clinics are freestanding facilities of 10,000 sf (930 m2) or less however larger Hospital without Beds (HHCs) these larger facilities can be as great as 150,000 sf (14,000 m2) or more.

Parking requirements for these leased facilities should be in accordance with the local Authority Having Jurisdiction (AHJ) and is typically found in zoning regulations or at a rate of five (5) parking spaces per 1,000 building gross square feet whichever is greater.

Where facilities are larger than 150,000 sf (14,000 m2) consideration should be given to utilizing the VA Parking Demand Model tool for calculating parking demand and need.

- **Passenger Loading Zone**



Provide a designated accessible passenger loading zone located away from other traffic patterns.

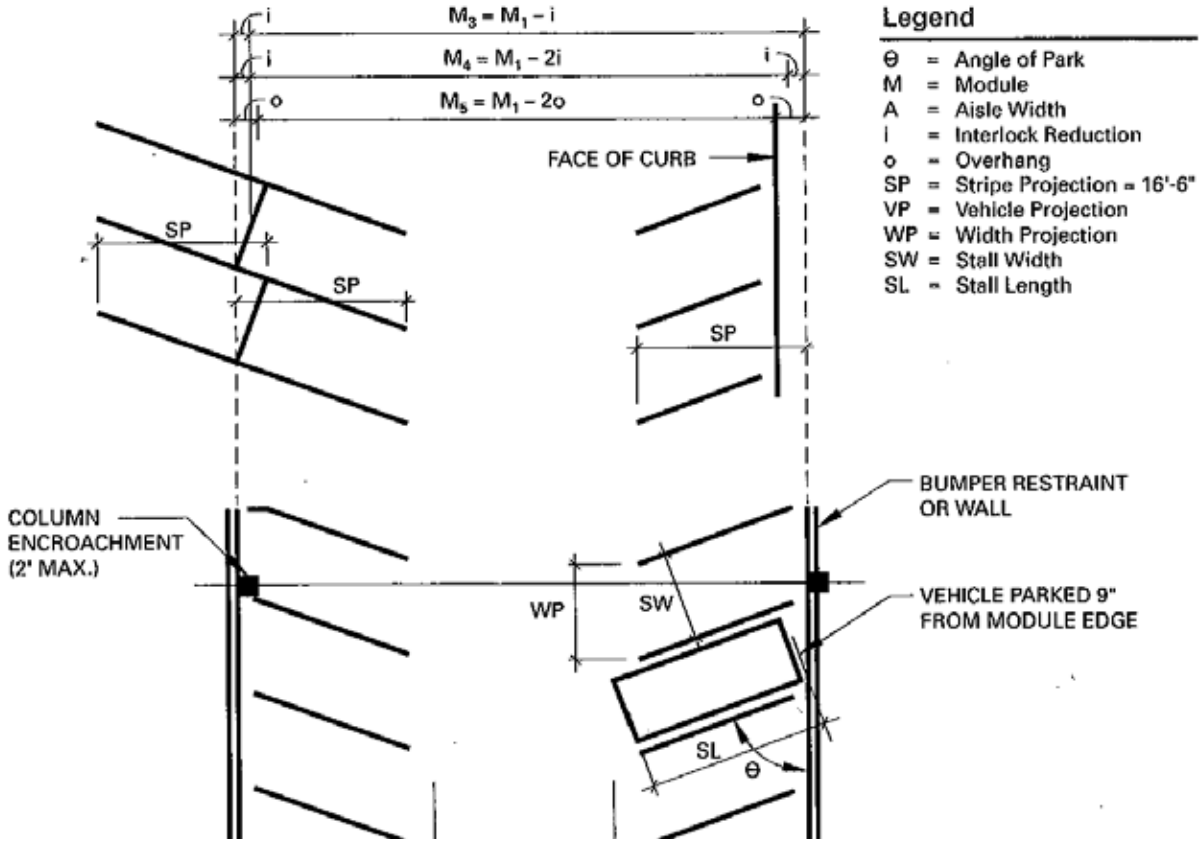
- **Requirements:**
  - Adjacent to accessible entrance
  - Curb ramp to sidewalk level
  - Canopy or roof overhang for protection
  - Communication system for assistance
  - Access aisles, measuring at least 5'-0" (1524 mm) wide by 20'-0" (6096 mm) long, and parallel and level with the vehicle pull-up space

- **Circulation Systems**

In general, one-way drive aisles will provide better traffic flow than two-way drive aisles because it is easier for users to enter and exit parking spaces, and there is less circulation conflict. Some employees may prefer the increased options provided by a two-way system, and may not respect one-way traffic flow. Two-way traffic offers wider drive aisles, making for a safer environment for pedestrians and passing vehicles. Generally speaking, it is preferred to not combine one-way and two-way traffic flows within a single facility. **Do not use angled parking with two-way traffic!** A circulation element, whether a drive aisle in a surface parking lot or a ramp between elevated floors in a parking structure, should not be designed without parking stalls. The temptation by designers to incorporate speed ramps which have greater slopes but are devoid of parking spaces should be avoided. Regardless of circulation system selected, dead end parking conditions should be avoided in both surface lots and structured parking facilities.

Aisle Widths and Turning Radii

For two-way traffic, a 24-foot wide drive aisle should be utilized. One-way drive aisles, at minimum, should follow the guidelines presented in the most recent edition of "The Dimensions of Parking" published by the Urban Land Institute. The figure presented below is shown in Guidelines for Parking Geometrics, published by the National Parking Association. It presents common terminology and dimensional relationships for parking layouts, with additional dimensions provided in the table that follows



Common Parking Dimensions

Angle	Base Module M1	Veh Proj VP	Aisle Width A	Single Loaded Module M2	Wall to Interlock M3	Interlock to Interlock M4	Curb to Curb M5	Over-hang o	Width Proj WP	Inter-lock I
30	42’2”	15’1”	12’0”	27’1”	38’3”	34’4”	39’8”	1’3”	18’0”	3’11”
35	44’0”	16’0”	12’0”	28’0”	40’4”	36’8”	41’2”	1’5”	15’8”	3’8”
40	45’10”	16’11”	12’0”	28’11”	42’5”	39’0”	42’8”	1’7”	14’0”	3’5”
45	47’2”	17’7”	12’0”	29’7”	44’0”	40’10”	43’8”	1’9”	12’9”	3’2”
50	48’6”	18’2”	12’2”	30’4”	45’7”	42’8”	44’8”	1’11”	11’9”	2’11”
55	50’0”	18’8”	12’8”	31’4”	47’5”	44’10”	45’10”	2’1”	11’0”	2’7”
60	52’0”	19’0”	14’0”	33’0”	49’9”	47’6”	47’8”	2’2”	10’5”	2’3”
65	54’0”	19’2”	15’8”	24’10”	52’1”	50’2”	49’6”	2’3”	9’11”	1’11”
70	56’0”	19’3”	17’6”	36’9”	54’6”	53’0”	51’4”	2’4”	9’7”	1’6”
75	58’0”	19’1”	19’10”	38’11”	56’10”	55’8”	53’2”	2’5”	9’4”	1’2”
90	60’0”	18’0”	24’0”	42’0”	60’0”	60’0”	55’0”	2’6”	9’0”	0’0”

At the ends of the parking rows, sufficient space must be provided to allow drivers to negotiate the turn. A minimum recommended inside vehicular turning radius is 15 feet, with a minimum outside turning vehicular radius of 30 feet. Larger dimensions should be used in higher speed conditions.

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SECTION 5 ACCESS CONTROLS

The concept of parking access control is similar to building access control, already in place at many (if not all) VA facilities. Implementation of parking access controls gives the medical center the ability to organize its parking operation (refer to Section 2 Campus Organization and Orientation discussion). Access control installation can be a first step in VA achieving revenue for use of its parking resource as a means to deter unwanted/unauthorized use by non-VA users.

- **Desirability**

Most VA facilities provide open, unrestricted parking access to the medical facilities. As a result, some facilities struggle with use and abuse of the parking resource by long-term parkers, commuters to adjacent properties, and/or employees of entities affiliated and not affiliated with VA. Parking resources can become overwhelmed, and some VA facilities have resorted to expensive temporary solutions such as valet parking and parking enforcement.

With limited space and an expanded scope of services, parking today at VA medical centers is mainly about the efficient use of real estate. Access control allows VA to dictate the parking user and to direct that parking user to the correct location. Understanding that policies within VA may prevent parking revenue collection, access controls can be an inexpensive method of organizing a parking system.

Once access into a given parking area is controlled, secondary benefits may be provided for users in the form of “lot full” signs or “spaces remaining” signs. Car counting mechanisms may be tied to detection loops or overhead sensors at parking access points. Generally, use of these devices is often limited to larger parking lots and structures.

- **Levels of Sophistication**

Based on activity level and operational speed, alternative methods for access controls include the following configurations listed from least complicated to most sophisticated:

- Apron
- Key Card with Barrier Gates
- Ticket Issue Machine with Validation
- Automatic Vehicle Identification System
- License Plate Recognition

<u>Apron</u>

The apron technique involves stationing of personnel at parking area entrances. The attendant checks identification and allows access into the facility. This technique is commonly used at Federal installations for general access. Implementation of the apron technique on an individual lot basis has obvious negative connotations regarding personnel costs and very low speed of operation. However, given the level of staffing required, the apron technique offers a high degree of customer service.

Key Card with Barrier Gate

This technique adapts easily for employee parking. An employee badge can be coded for parking in a specific area. The gate rises only if the key card is recognized, allowing access rights. A loop located immediately after the gate activates gate closure, so that only one vehicle per key card can enter. It is recommended that anti-pass back measures be implemented into the system that prevents the key card from being used at the entrance until after that key card is used to exit.

Designers must be aware of the automobile turning radii required to properly orient drivers with card readers, and provide queuing areas for both entering and exiting traffic.

This technique can be implemented for employees and frequent patient users. For visitors and infrequent patient users, a more nimble method of access control is needed.

Ticket Issue Machine with Validation

This is the traditional approach to transient parking at private and municipal parking operations. The user takes a ticket upon entrance, and pays a fee when exiting. The suggested VA access control method would be to replace the fee upon exiting with a validation strategy. The user would present his ticket to the facility's Welcome Desk, where the ticket could be exchanged for a token allowing the user to exit. An interloper (an employee or an unauthorized user) would be granted a token only after a fee or penalty is paid.

A combination of this technique, along with the key card technique for employees, would be an adequate approach for most VA facilities.

Automatic Vehicle Identification (AVI)

This technique is commonly used throughout the country for highway toll roads. An overhead reader validates transponders located within passing automobiles. Such a vehicle identification program can be used for employee parking, allowing greater speed of access (approximately twice that of key card access). However, AVI would represent an additional layer of computer coding, and an additional piece of equipment for VA to track as compared to the key card operation.

License Plate Recognition

This technique is based on the initial photographic recording of license plates at the point of initial entry. An employee's plate would be recognized by the computer, and access into the parking area granted. The recognition data for patients and visitors is recorded and stored in a computer for use at the time of exiting. A patient or visitor would need to check in with the Welcome Desk as described under Ticket Issue Machine. However, instead of issuing a token, personnel at the Welcome Desk would enter the license plate information into the parking system to allow for exiting.

This technique is in use at multiple airport locations throughout the country. The transaction rate is superior to all other access control systems, in terms of transaction speed and accuracy of reporting and auditing. The cost of initial application, due to the cameras and computer software needed, may prove too high for use at many VA facilities.

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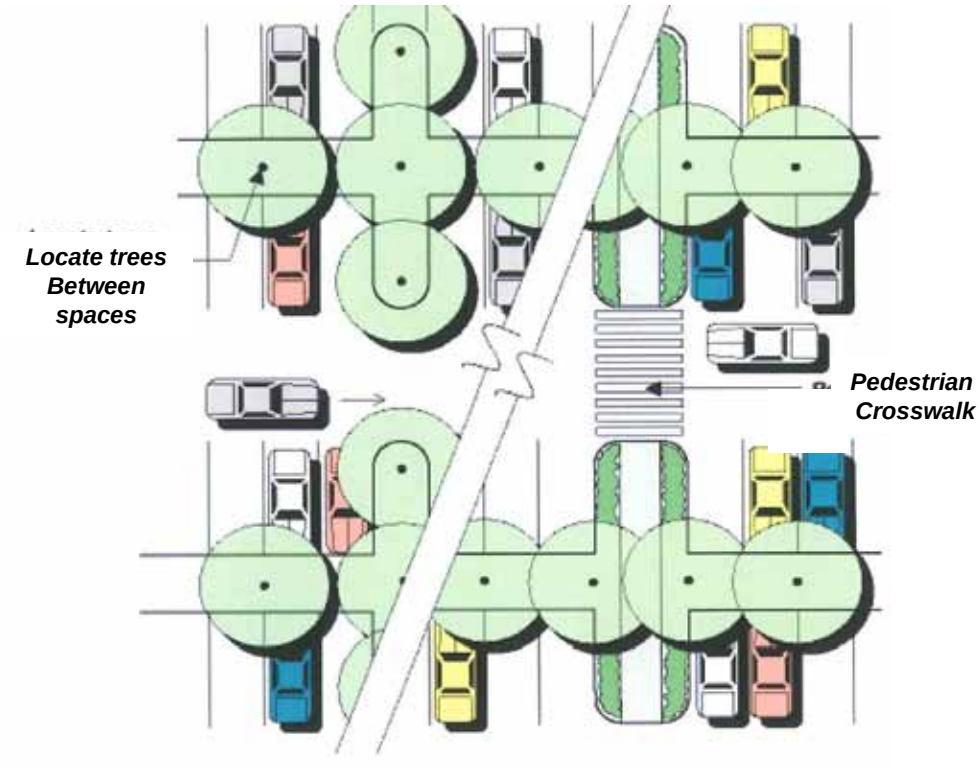
SECTION 6 SURFACE LOT DESIGN

The vast majority of parking on VA campuses, and the majority of parking solutions in general, are provided by surface lots. The proper design of surface lots should provide VA with long-term infrastructure to facilitate ease of access to the medical center.

In addition to convenience, surface parking lots should be designed to provide a strong aesthetic through the use of high quality landscaping, lighting, and paving materials. The number of entrance and exit points should be limited to reduce internal conflict. Pedestrian walkways should be an integral part of the design to safely separate pedestrians from vehicular traffic. As an enhancement, consider placing pedestrian-friendly features, such as benches, trash receptacles and lighting, along the pedestrian path between surface lots and buildings. Place truncated dome tactile warning strips (24" width) at the ends of all curb ramps or at any point where a pedestrian walks into a vehicular area where the walkway surface is flush with the vehicular surface.

Individual parking spaces, and allocation of accessible parking spaces, should be in accordance with recommendations presented in previous Sections.



- **Pavement**

The durability and serviceability of a surface parking lot largely depends on the quality and type of surface material. Both concrete and asphalt have been successfully used in surface lot construction. It is recommended that surface lot design be in conformance with local DOT standards for street construction, using AASHTO HS-15 as a minimum design standard.

Proper sub grade preparation is mandatory. It is recommended that a geotechnical engineer be consulted to ensure proper compaction of the sub grade to guard against future differential settlements and potholes.

The perimeter of the surface lot should be edged with a 6" high concrete or granite curb. If local techniques exist, the concrete curb can be placed integral with a concrete gutter pan.

- **Stormwater Management**

All Federal projects are required to comply with EPA NPDES Phase 2 stormwater regulations. Any project disturbing 1 or more acres of land is required to obtain a NPDES surface discharge permit. Under Phase 2 regulations, EPA delegates authority to some states to implement the regulatory permit programs. EPA remains the permitting authority in a few states, territories, and for some Federal land. A state permitting authority or municipal separate storm sewer systems (MS4s) may have requirements that are more stringent than the federal requirements. Therefore, the designer should check with state and local agencies before starting a surface or structured parking project, and follow the most stringent requirements.

In addition, Under Section 438 of the Energy Independence and Security Act of 2007 (EISA), Congress requires federal agencies to provide national leadership to reduce water quality problems from stormwater runoff. Section 438 specifically calls for federal developments that exceed 5,000 square feet to maintain or restore pre-development hydrology. EPA, in close coordination with other federal agencies, has written Technical Guidance (December 2009) to help federal agencies in implementing EISA Section 438. The Section 438 Technical Guidance provides two options for meeting the performance objective of preserving or restoring the hydrology of a site: **Option 1 (retaining the 95th percentile rainfall event)** calls upon site designers to design, construct, and maintain stormwater management practices that manage rainfall on-site, and prevent the off-site discharge of stormwater from all rainfall events less than or equal to the 95th percentile rainfall event. **Option 2 (site-specific hydrologic analysis)** provides site designers with a process to design, construct, and maintain stormwater management practices using a site-specific hydrologic analysis to determine pre-development runoff conditions, instead of using the estimated volume approach of Option 1.

The designer of VA surface or structured parking storm water design must comply with state and local NPDES implementation, as well as Federal Section 438 regulations.

Because of the regulations discussed above, water quantity and water quality measures must be implemented as part of the lot's overall drainage strategy. Surface lots should be crowned a minimum of 2 percent toward drain inlets, catch basins, or curb inlets. Drainage structures should not be located in drive aisles. The lot designer should consider use of pervious paving materials in parking spaces as a means to decrease the volume of storm water runoff due to the surface lot. This is one of many techniques that designers have for meeting the requirements of Section 438 and local NPDES regulations.

- **Landscaping**

Development of a landscape plan visually enhances surface parking lots, providing a more attractive and user friendly site feature. Vegetation can also effectively reduce runoff. Leaves, stems and branches intercept rainwater, which then evaporates. A significant amount of stormwater can evaporate from beds of tall grasses, wildflowers, shrubs and trees. Shade from trees helps reduce the urban heat island effect and increases pedestrian comfort. Note than when utilizing trees in the landscaping scheme they should be "low sap" generating.

High quality landscape materials should be used to define lot boundaries, and to screen storage and utility areas. Care must be taken so that the plantings do not unduly screen the surface lot from the vision of security patrols, and/or reduce sight distances for drivers. Designers should specify hardy materials tolerant of salt and urban conditions. Xeriscaping strategies, such as the specification of native materials which do not require irrigation, should be implemented.

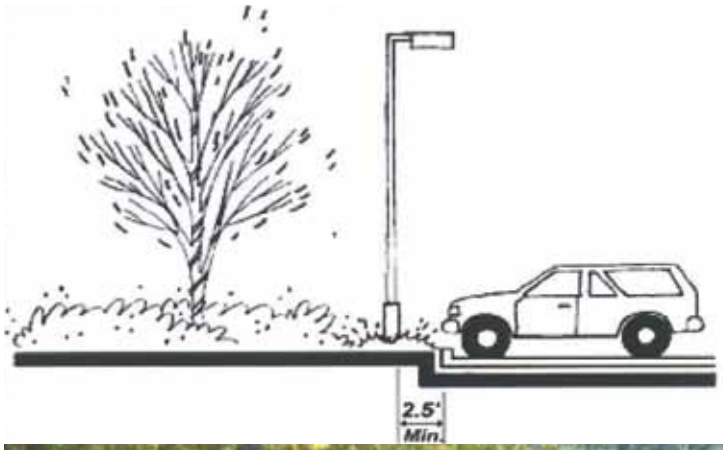
The width of planted parking lot islands should be, at a minimum, 8 feet in width. Ideally, designers should aim to have canopy trees at maturity cover at least 50 percent of paved area. Since tree height and spread will generally be smaller than normal in parking lot growing conditions, compensate by planting more trees closer together. Plant trees along the south side of an east-west walkway, so that the shadow pattern is cast on the pedestrians. Select deciduous trees to provide shade in the summer, and allow warming sun rays to filter through in the winter to melt snow and ice.

During construction, compaction of planting areas should be avoided. When possible, try to avoid driving on planting areas. After construction, loosen soils in planting areas to a depth of 24 inches, to a maximum compaction of 85 percent standard proctor density, and incorporate topsoil by tilling the upper 10 inches of soil.

- **Lighting**

VA parking areas shall comply with the Electrical Design Manual (EDM) Section 6.12 Exterior Lighting.

Light standards should not be located inside the parking field. Locate the standards outside parking lot edges and island curbs as shown in the diagram and photograph below. Common fixture types may include high pressure sodium, metal halide, and LED. Consider using photovoltaic power sources.



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SECTION 7 PARKING STRUCTURE DESIGN

This section establishes parking functional design criteria and minimum design standards for parking structures located on VA medical center sites. In the event of a discrepancy between Code-regulated minimum standards and standards presented herein, the more stringent shall apply.

Future maintenance costs should be considered when designing and building new structures. Maintaining low life cycle costs is secondary only to the safety of VA patients, employees, and visitors.

- **Building Codes, Standards and Manuals**

All parking structures shall be designed in accordance with current building codes and any standards (VHA Program Guide, Seismic Design Requirements for military facilities, executive orders, etc.) adopted by VA. When designing parking structures, the design professional shall use the latest edition of the International Building Code. Where there are conflicts between codes and/or standards, the stricter provision(s) shall govern. The architect/engineer has the responsibility for ensuring conformance with applicable Codes, design guides, and zoning ordinances.

The following design manuals and Codes apply to the design of parking structures.

VA Design Manuals:

- Architectural
- Electrical
- HVAC
- Plumbing
- Site Utilities
- Auto Transport
- Interior Design
- Structural

Codes and Standards: Utilize the most current editions of the following codes:

- NFPA 13: Standard for the Installation of Sprinkler Systems
- NFPA 70®: National Electrical Code®
- NFPA 72: National Fire Alarm and Signaling Code
- NFOA 88A: Standard for Parking Structures
- NFPA 101®: Life Safety Code®
- ICC International Building Code
- ICC International Electrical Code
- ICC International Energy
- ICC International Mechanical Code
- ICC International Plumbing Code

- **Parking Functional Design**

It is preferable that parking structures are located to serve as "intercept" storage facilities, keeping traffic from penetrating into the campus core. Given this strategy and the principles discussed in Section 2, intercept parking structures will most likely serve employees.

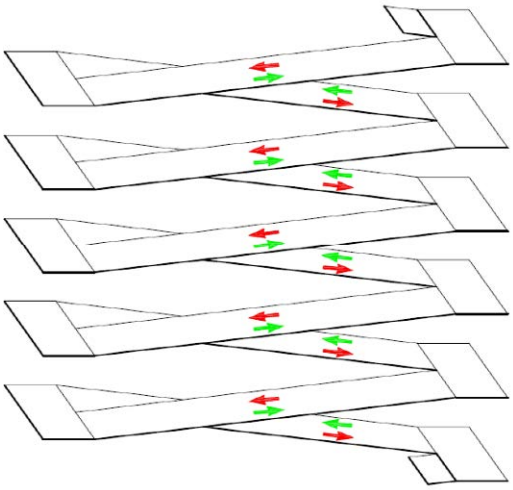
Access lanes should be oriented with the main drive aisles of the parking facility, so that immediate turns are not required. The access control system should be capable of processing a minimum existing peak hour traffic volume of 800 vehicles.

Ramping between floors should be oriented to slope down toward the medical center. Parking should be provided on the ramps between levels. Maximum ramp slope should be 5.6%. Where absolutely necessary, speed ramps may be provided at a maximum ramp slope of 12.5%.

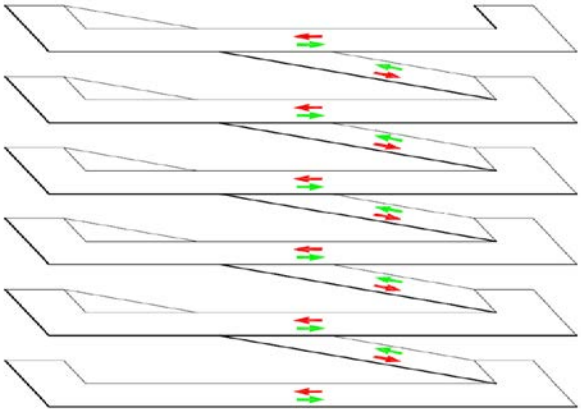
Widths of drive aisles should depend on the angle of parking proposed. Refer to the discussion of parking geometrics presented in Section 4. At end bays, a striped buffer no smaller than 3'-0" shall be provided between the last parking stall and the drive aisle.

The most common vertical circulation pattern used in parking structures is the continuous ramp where sloping floors, with parking on each side of the drive aisle, provide access to both the parking spaces and the circulation pattern. The basic continuous ramp, sloping floor configuration is called the single-helix. It is used for 90-degree parking and two-way traffic. Several other systems use variations of the single-helix ramp: the single-helix with one level bay; the two-bay double-helix; the side-by-side helix; and helixes with flat bays. Isometric diagrams of various circulation options are show below.

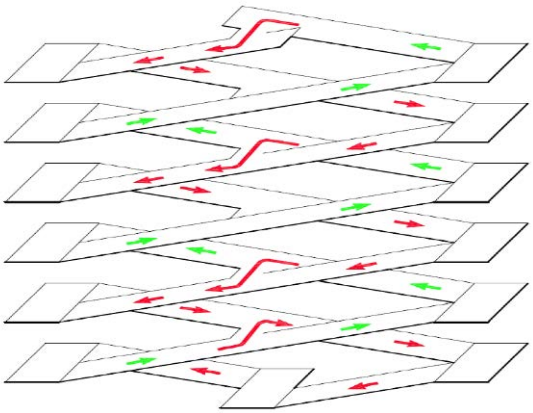
Single-Helix



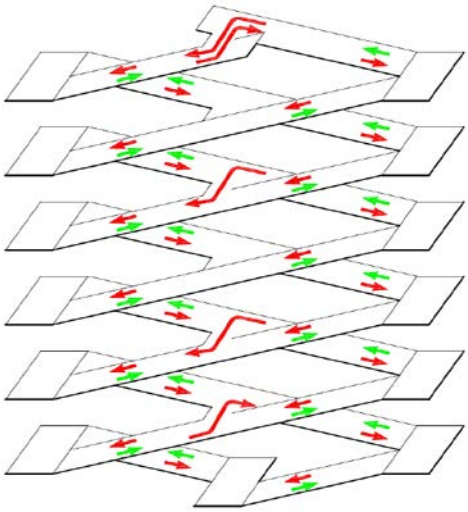
Single-Helix with Flat Bay



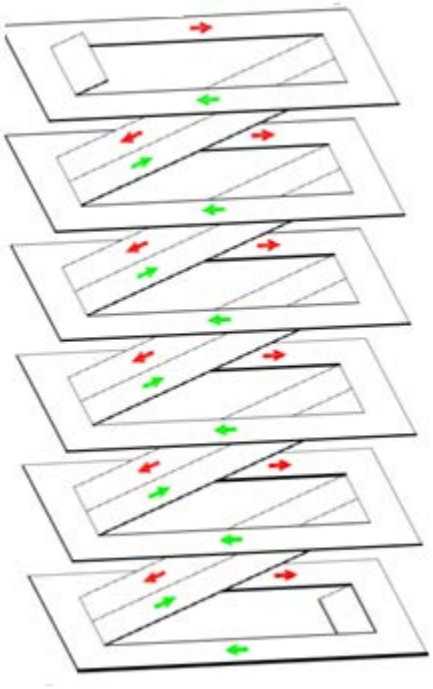
One-Way Double-Helix



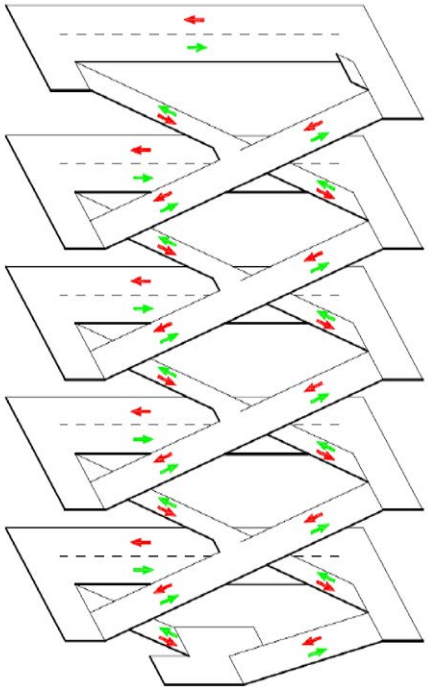
Two-Way Double Helix



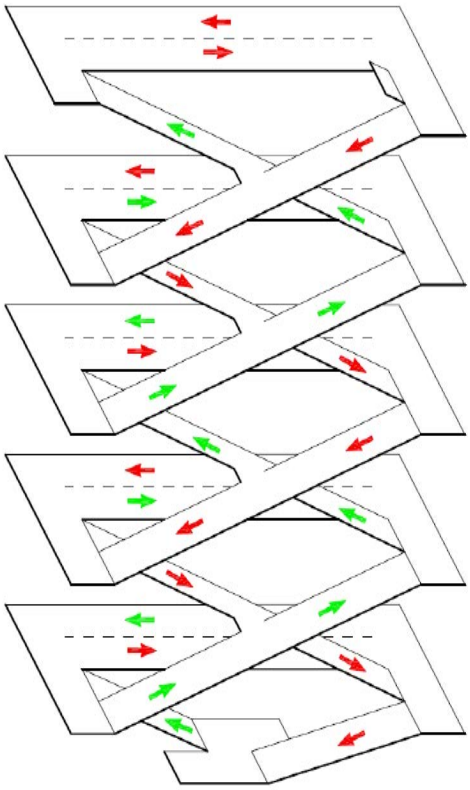
Side-by-Side Single-Helix



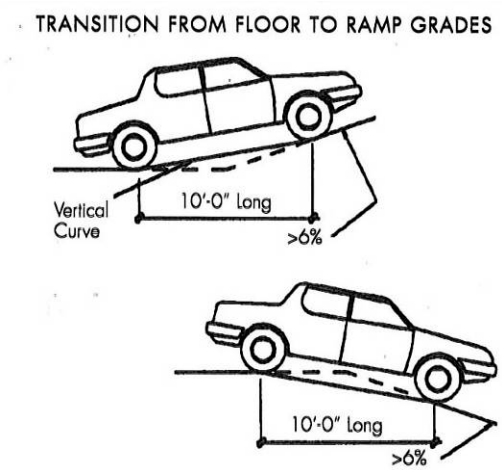
Single-Helix with Flat Bays

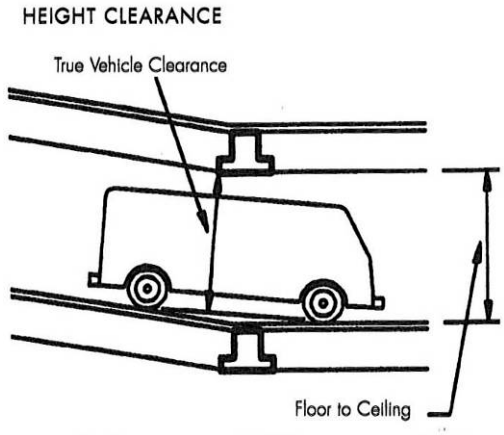


Double-Helix with Flat Bays



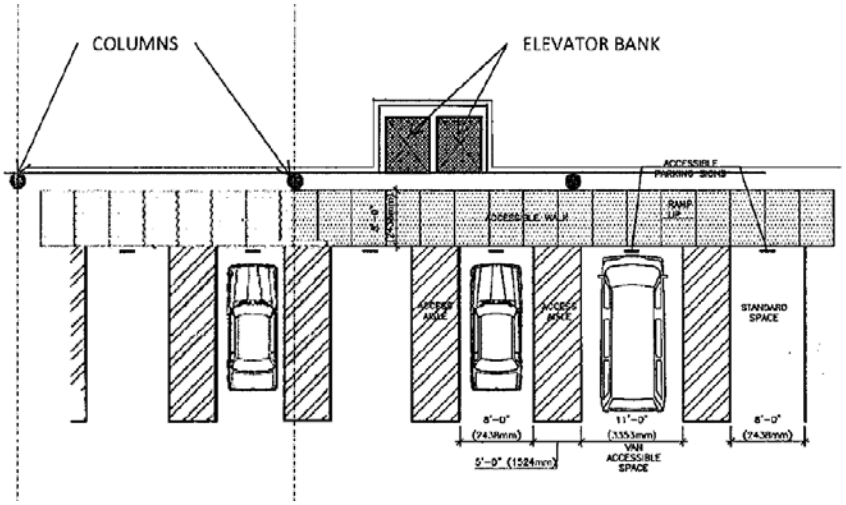
When transitions between adjacent slopes (typically between “level” floors and ramps) exceed eight percent (8%), a vertical curve transition as shown in the figure below should be used. Special attention should be given to height clearances at ramping breaks, which should be checked from the wheel line and not the floor surface.





Provide 8’-4” minimum structural vertical clearance at all locations in the parking facility. This clearance will allow VA to place parking for accessible vans at any location within the parking facility. Care should be taken to ensure accessible routes allow movement between the parking structure and the egress.

In general, parking structures should be limited to passenger vehicles. However, there may be instances at congested sites where wider and/or taller vehicles (such as some SCI vans) will need access to the parking structure. The designer should be aware of the need to accommodate these larger vehicles, and should design access points, turning bays, supporting structure, and user separation, accordingly. Parking for oversized vehicles (including 9’-6” high SCI/D vans) should be provided on the street level only. Street level SCI/D and other handicap van spaces shall have convenient access to vertical transportation where needed with vertical transportation located central to van spaces (see below).



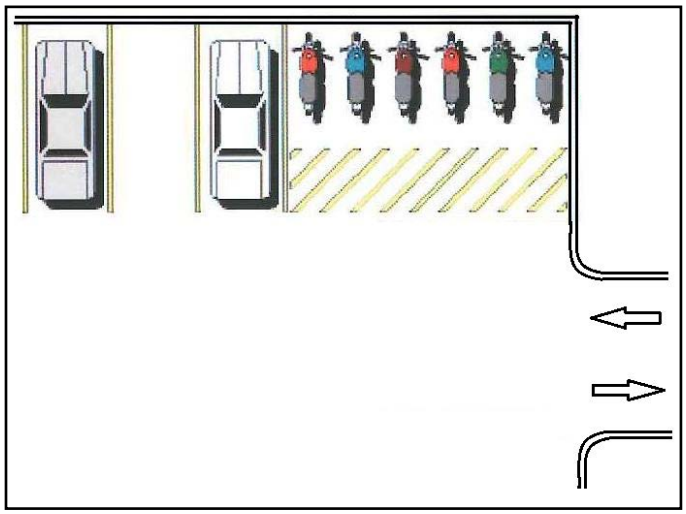
Care shall be taken to ensure that elevators are provided in the path of the predominant pedestrian destination. Generally speaking, this direction will be toward the main medical center entrance. Provide egress stairs in accordance with the requirements of the building code.

Columns, pipe guards, and risers should not encroach into parking spaces. Should a design condition result in a vertical element (column or otherwise) located within the parking module, the minimum space width shall be increased by 10" to account for the difficulty that drivers will encounter.

- **Motorcycles and Scooters**

In addition to automobiles and vans, motorcycles and scooters can be located in surface lots or structured parking facilities. In such instances, parking areas for motorcycles and scooters should be segregated from the automobile traffic and parking. Consult with the facility's chief engineer to determine historical needs for motorcycle, scooter and bicycle parking spaces. Bicycles may need to be located in secured enclosures to deter thief.

Since motorcycles, scooters as well as bicycles employ a kickstand for support when parked, a rigid surface such as concrete should be provided to ensure stability while minimizing potential pavement damage in summer months or at warm climate installations.



Some standard parking dimensions for motorcycles and scooters are:

Description		**Dimension**	
Motorcycles and scooters	Parking space width	60 inches	150 centimeters
Motorcycles and scooters	Parking space length	96 inches	250 centimeters
Bicycles	Parking space width	30 inches	80 centimeters
Bicycles	Parking space length	70 inches	180 centimeters

- **Site Work**

Coordinate all site work with the VA Site Development Manual and this section.

The desirable minimum site for structured parking is a rectangular area with 22,000 square feet and a minimum width of 110 feet. Local requirements regarding parking structure set backs from public right-of-way should be reviewed. The parking structure should be no closer than 50 feet from the main medical center.

Construction staging areas will generally be located in adjacent surface parking lots and/or grassy areas. All contractor parking and offices should be within the staging area. All features of the staging area should be documented prior to construction, so that any feature damaged by construction should be restored to its pre-construction condition.

Water service should be provided to the project site only if needed for irrigation or support spaces within the parking structure. If water service is desired, provide a Water Service Room to include, at minimum, a water main and backflow preventer.

Coordinate all sewer connections with the local agency having jurisdiction. Reconstruct all features disturbed by the sewer routing.

Coordinate the provision of electrical service to the parking structure with the in-place infrastructure of the medical center. The construction contractor is responsible for providing temporary service during construction. The contractor is further responsible for all charges for electrical energy consumption used by the temporary facilities.

Should the project be delivered using the design-build format, specify that all project excavation shall be considered Unclassified. Design-Builder should dewater the site at no additional cost, and unsuitable soils removed and legally disposed.

- **Exterior Appearance**

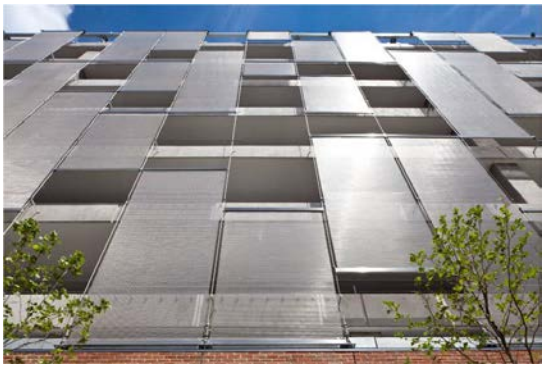
The designer should take cues from existing on-campus buildings when considering the exterior vocabulary for the parking structure. Generally speaking, the parking structure will be a background building. The building's height, massing, and skin should reflect that status**. In the event that the parking structure becomes a foreground or gateway building, it is important to recognize opportunities for a welcoming presence.** Parking structures may be strictly utilitarian, but any structure can serve to enhance the campus environment. Use the VA emblem, and perhaps other graphics, in a prominent location if the facility is a gateway building. Place a dedication plaque near the main pedestrian access point. Consider additional landscaping, along with signage, to further soften the parking structure and provide interest.

At the perimeter of elevated floors, provide a bumper wall designed for automobile impact, in accordance with the current building code. The use of wheel stops at the head end of the parking space is discouraged. When designing the perimeter barrier, consideration should also be given to preventing an individual from causing harm to himself. A barrier could be designed, for both aesthetics and safety. The heights of barriers should not be less than 72" above the finished floor. Where a parapet can be utilized to boost an individual, the height of the barrier should be increased to not less than 96" above the finished floor. The designer should consider that vehicles may be parked adjacent to and parallel with parapets, barriers and similar appurtenances. Other parking elements that may pose a risk include steep ramps between floors, improperly guarded or open stairwells, and ventilation openings.

There are numerous aesthetically designed solutions that address suicide abatement. Vertically mounted stainless steel cables may be utilized to seal off the ventilation openings and exit stairwells, while still allowing air and light. Cables may also be used on the upper perimeter of the ramp, if properly secured at the top and sides. When it comes to addressing the open area between floors, one can implement treillage, grillage, metal screening, or stainless steel cabling similar to the "Luminous Veil". Slanting the vertically-mounted cable, or other barriers, slightly inward towards the top of the parking ramp would make climbing more difficult. All safety options have advantages and disadvantages, though all are expensive solutions.

Illustrated below are some suggested elements that enhance security.

Currently-available or previously implemented roof level deterrent devices, that inhibit self-inflicted harm on exposed parking garage roof levels, are difficult to identify and standardize.



- **Structural Systems**

The following systems have been successfully used to construct parking structures. Regardless of system chosen, column-free parking bays should be provided.

- Cast-in-place post-tensioned concrete system
- Pre-cast concrete
- Structural steel framing

An explanation of these systems, along with design considerations, is included below.

Cast-in-place post-tensioned concrete systems can be used effectively in tight sites, or when excessive warping of the parking decks is not conducive to precast. Other advantages include its adaptability to a wide range of façade treatments, its peripheral and internal openness, and its lower long term maintenance costs due to greater durability. Disadvantages include longer construction site period, a need for technical expertise for proper detailing and constructing of the system, and increased construction inspections costs. Ducted and grouted post-tensioning systems should not be used. If selected, the column grid spacing should conform to the selected parking space module (column grids shall- fall on parking striping).

Precast concrete is preferably “pre-topped”, using 12’ wide or 15’ wide double tees. The precast system may require less site time, provided a fast-track construction approach is selected. Other advantages of precast, prestressed concrete frame include competitive initial costs, and greater concrete durability. Disadvantages include the system’s relative inflexibility regarding dimensions and finishes, inadequate floor slab fire proofing in larger footprints and mixed-use applications,

and increased maintenance costs due to the presence of sealed joints. If precast, prestressed concrete is selected, column grids shall coincide with the double tee module of the precast concrete manufacturer. Concrete shear walls shall not be installed at the top or at the bottom of the ramps between floors. Maximum column intrusion into an individual parking space shall be a two-foot width by a one-foot depth.

Structural steel framing shall utilize a precast concrete or cast-in-place, post-tensioned concrete deck slab. In some markets, structural steel can save significant labor expense. The system also offers a great deal of design flexibility. Disadvantages of a structural steel frame include the vibration generated by the frame itself, the potential cost of fire rating the frame, and the increased cost of maintaining the coatings system. The use of stay-in-place metal decking is discouraged.

- **General Structural Requirements**

The VA Project Manager should insist that a life cycle cost analysis accounting for local conditions of structural framing options be presented during schematic design, to ensure an informed decision is made concerning the structural frame.

Regardless of the structural system selected, all volume change effects, including but not limited to drying shrinkage, elastic shortening, creep, and temperature change, must be accounted for in the design and detailing.

In the case of below-grade structures, the superstructure frame should not be rigidly attached to the foundation walls. Lower levels will not have a “basement” effect, and there will be no dead ends.

All columns that extend above the roof level slab should be fully checked for cracking prior to final completion. For exposed columns, consider applying a protective coating.

Provide sleeves through all beams and double tee stems that span the garage structure at ¼ points for future conduit installation (a total of three per member spanning the parking bay). Provide a single sleeve through all girders.

Parking structures should be located on VA campuses in accordance with the recommendations of Section 2 Campus Organization and Orientation of this Parking Design Guide and with the Physical Security Design Manual. Properly sited free-standing parking structures should not be required to be hardened to prevent progressive collapse.

VA’s structural design requirement manuals can be reviewed on the TIL website at http://www.cfm.va.gov/til/seismic.asp

- **Drainage Requirements**

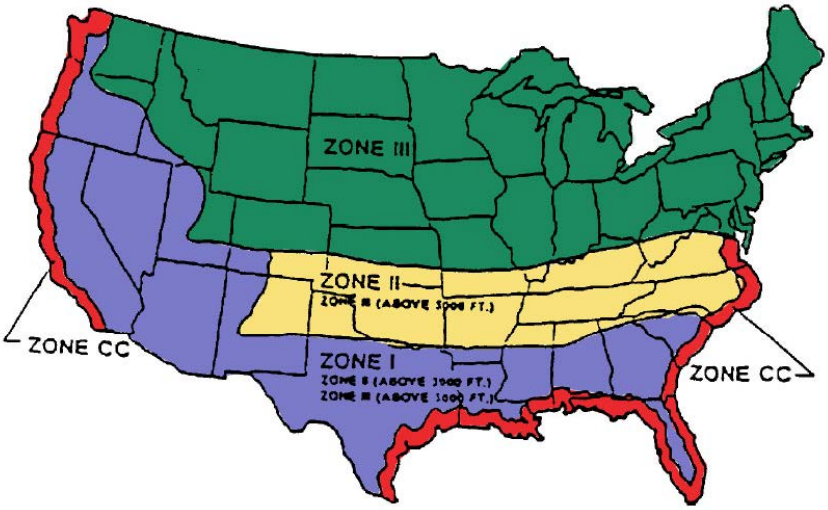
All floor surfaces should be positively sloped for drainage. Two percent (2%) measured from the high point to the drain should be the minimum acceptable cross slope. In a precast system, take into account the camber of double-tees. Furthermore, warping stresses of the members should be reviewed. Flood test the floor surfaces prior to final completion, and provide additional drains in areas of ponding water, if needed. Drains should not straddle two adjacent double tees.

Floor drain locations are determined by the circulation system, number of bays, and structural system. The top level drain system should be designed to accept a 10-year design rainfall or as determined by local historical climatology. Sleeves through structural elements and handrails should be appropriately detailed and sealed to prevent structural deterioration. Following installation embeds and lifting points for precast elements should be patched and protected.

- **Durability Requirements**

Durability is the ability of concrete to resist weathering action, chemical attack, and abrasion while maintaining its desired engineering properties. Concrete ingredients, their proportioning, interactions between them, placing and curing practices, and the service environment determine the ultimate durability and life of the concrete. The table presented at the end of this section is published by the Portland Cement Association (PCA). It shows important exposure conditions and deterioration mechanisms in concrete structures. It should be noted that several of the presented mechanisms will act simultaneously.

Parking structures, by definition, are exterior buildings exposed to corrosive environments. As such, the design of these facilities must meet the standards established for corrosive conditions in American Concrete Institute 318-05 Building Code Requirements for Structural Concrete and American Concrete Institute 362-97 Guide for the Design of Durable Parking Structures. The facility designer should determine the durability zone, as defined by the American Concrete Institute, and meet the minimum design standards. Note that the American Concrete Institute defines durability zones for both precast and cast-in-place concrete. Durability zones defined by other organizations should not be used. The Durability Zone Map, as it appears in ACI 362-97, is reproduced here. The tables addressing design elements also appear in ACI 362-97.



For durability of concrete structures, ACI 318 defines several exposure conditions and sets durability measured for each.

These exposure conditions are:

- Concrete intended to have low permeability when exposed to water. (This is interpreted to apply to all parking structures not covered by the subsequent criteria.)
- Concrete occasionally exposed to moisture prior to freezing and where no deicing salts are used.
- Concrete exposed to deicing salts, brackish water, sea water, sea water or spray from these sources and may or may not be subject to freezing.

To assist in identifying these exposure conditions, five exposure zones are defined and approximately illustrated on the map.

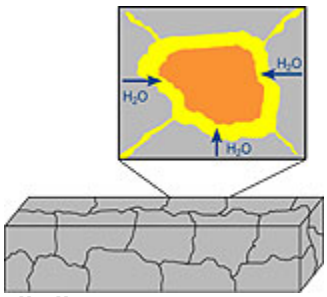
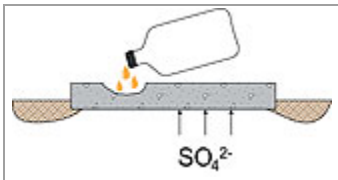
- Zone I represents the mildest conditions where freezing is rare and salt is not used. This area is generally defined as all areas south of Zone II and south and west of Zone III except those areas above an elevation of 3000 feet where freezing occurs.
- Zone II represents areas where freezing occurs and deicing salts are not or rarely used. This area is generally defined as the area south of Zone III and within 100 miles south of interstate highway 40 from the Atlantic Ocean west of the Continental Divide, plus all areas in Zone I above an elevation of 3000 feet and below an elevation of 5000 feet, plus areas in the State of Oregon and Washington west of the Cascade Range except for those areas above an elevation of 5000 feet.
- Zone III represents the areas where freezing and deicing salts are common. This area is generally considered to be areas north of and within 100 miles south of Interstate Highway 70 from the Atlantic Ocean west to Interstate Highway 15, then north to Interstate Highway 84, then northwest to Portland Oregon then west to the Pacific Ocean plus areas with Zones I and II above an elevation of 5000 feet when deicing salts are used.
- Coastal Chloride Zone I (Zone CC-I) represents areas with Zone I and within 5 miles of the Atlantic Ocean, Gulf of Mexico, Pacific Ocean, and the Great Salt Lake.
- Coastal Chloride Zone II (Zone CC-II) is areas within zones I and II and within one half mile of the salt water bodies described in Zone C-I.

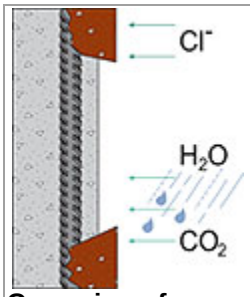
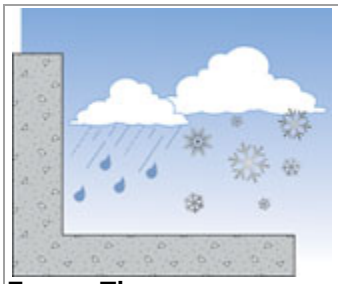
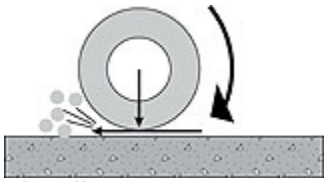
* Where deicer salts are used.

It is intended that the local exposure conditions and actual use of deicing salts be used to determine the appropriate exposure zone. The map is only a guide to assist in the application of the zone definitions outlined above.

Characteristics of design elements for parking structures will vary according to the Durability Zone and the type of structure proposed. The responsible design team member, typically the structural engineer of record, shall take a leadership role in determine the appropriate durability design.

The recommended minimum considerations for durability are presented in the following Tables.

Durablility Aspect/Exposure	Mechanism	Test Methods	Resources
 **Alkali-Aggregate Reaction**	Alkali-Silica Reaction Alkali-Carbonate Reaction	ASTM C227 ASTM C289 ASTM C441 ASTM C586 ASTM C856 ASTM C1260 ASTM C1105 ASTM C1293 ASTM C1567 Los Alamos Method More..	Publications Research Reports PowerPoint presentations/ Images Links
 **Chemical Resistance**	Sulfates - DEF Seawater Acids	ASTM C1012 ASTM D516 ASTM C1582	Publications Links

Durablility Aspect/Exposure	Mechanism	Test Methods	Resources
 **Corrosion of Reinforcement**	Corrosion Corrosion Resistance Carbonation	ASTM C1202 AASHTO T 259 ASTM C1556 AASHTO T 260 ASTM C1152 ASTM C1218 ASTM C1524 AASHTO TP 11 AASHTO TP 22 AASHTO TP 26 AASHTO TP 55	Publications Links
 **Freeze-Thaw**	Freezing and Thawing Deicer Scaling D-Cracking	ASTM C666 AASHTO T 161 AASHTO TP 18 ASTM C457 ASTM C672	Publications Links
 **Miscellaneous**	Abrasion Erosion Fire Resistance Efflorescence	ASTM C131 ASTM C535 ASTM C3744 ASTM C1137 AASHTO TP 58	Publications Links

(source: www.cement.org/tech/cct_durability.asp)

Cast-in-Place Reinforced Concrete Table

Design Element		Durability Zone		
		I	II / CC-I	III / CC-II
Concrete	Strength (psi)	3500	4000	5000
	Air (%)	Not Required	4.5-8.5	4.5-8.5
	Max. w:c ratio	0.45	0.40	0.40
Cover to Reinforcing (inches)	Slab Top	1 ½	1 ½	2
	Slab Bottom	¾	¾	1
	Beam	1 ½	1 ½	1 ½
	Column	1 ½	1 ½	1 ½
	Walls (Ext. Face)	1 ½	1 ½	1 ½
Floor Protection		Sealer – Roof Only	Membrane – Roof; Sealer – All Floors	Membrane – All Floors and Roof

The parameters presented in the Table above apply to reinforced concrete deck slabs supported by steel frames, as well as mild-reinforced concrete structures. The use of concrete frames in structured parking facilities is discouraged because of the resulting parking inefficiencies, the amount of anticipated cracking, and the relative high cost of long term maintenance. The use of

this structural system should be limited to mixed-use buildings, with parking provided as a building base. (See earlier discussion.)

Cast-in-Place Post-Tensioned Concrete Table

Design Element		Durability Zone		
		I	II / CC-I	III / CC-II
Concrete	Strength (psi)	3500	4000	5000
	Air (%)	Not Required	4.5-8.5	4.5-8.5
	Max. w:c ratio	0.45	0.40	0.40
Cover to Reinforcing (inches)	Slab Top	1 ½	1 ½	2
	Slab Bottom	¾	¾	1
	Beam	1 ½	1 ½	1 ½
	Column	1 ½	1 ½	1 ½
	Walls (Ext. Face)	1 ½	1 ½	1 ½
P/T Tendons		PTI Specification	Encapsulated	Encapsulated
Floor Protection		Sealer – Roof Only	Sealer – All Floors and Roof	Sealer – All Floors and Roof

The parameters presented in the Table above apply to post-tensioned concrete deck slabs supported by steel frames, as well as concrete frames. Numerous studies regarding the frame of free-standing parking structures completed over the past 20 years show that owners receive best value if post-tensioned concrete is specified. However, VA will need/realize additional time in construction and increased expense for applied facades and construction testing. Proper construction of this system involves specialized managing and concrete placement techniques that may not be available in some areas of the country.

Precast, Prestressed Concrete – Pretopped Table

Design Element		Durability Zone		
		I	II / CC-I	III / CC-II
Concrete	Strength (psi)	5000	5000	5500
	Air (%)	Not Required	4.5-8.5	4.5-8.5
	Max. w:c ratio	0.45	0.40	0.38
Cover to Reinforcing (inches)	P/C top of flange	1 ½	1 ½	2
	P/C sides of TT	1 ½	1 ½	1 ½
	Beam	1 ½	1 ½	1 ½
	Column	1 ½	1 ½	1 ½
	Walls (Ext. Face)	¾	1 ½	1 ½
P/C Flange Edge Connectors	1” Min. Top Cover	Liquid Galvanized	Hot Dipped Galvanized or Stainless Steel	Stainless Steel
P/C Exposed Plates		Rust Preventive Paint	Epoxy Coated or Hot Dipped Galvanized	Epoxy Coated or Hot Dipped Galvanized
Floor Protection		Sealer – Roof Only	Sealer – All Floors and Roof	Sealer – All Floors and Roof

Precast, prestressed concrete is currently the structural system most commonly used in the construction of free-standing parking structures. Do not allow precast concrete manufacturers to dictate parking layouts or any compromises to the design elements. The concrete covers for top

of precast double tee flanges listed above may be reduced by ½", if the precast concrete manufacturer utilizes carbon fiber for flange reinforcement or a corrosion inhibitor additive (min. 3 gallons per cubic yard).

In some areas of the country, the local precast concrete manufacturers are not capable of providing a uniform driving surface between adjacent double tees. Depending on soil conditions and the precast frame layout, a cast-in-place topping may better enable the structural frame to respond to horizontal loads such as wind and seismic activity. When placing topping on a precast element, it is vital that a control joint be placed in the topping to correspond with joints between the underlying individual precast concrete members.

Parking structures in all durability zones, except Zone I, must be considered "prone to corrosive effects" as defined by the American Concrete Institute. The structural engineer must recognize and specify proper coated reinforcing steel and concrete covers. Specify a light broom finish for concrete floor slabs. Do not allow the addition of water on the job site, and do not allow the concrete surface to become over-finished.

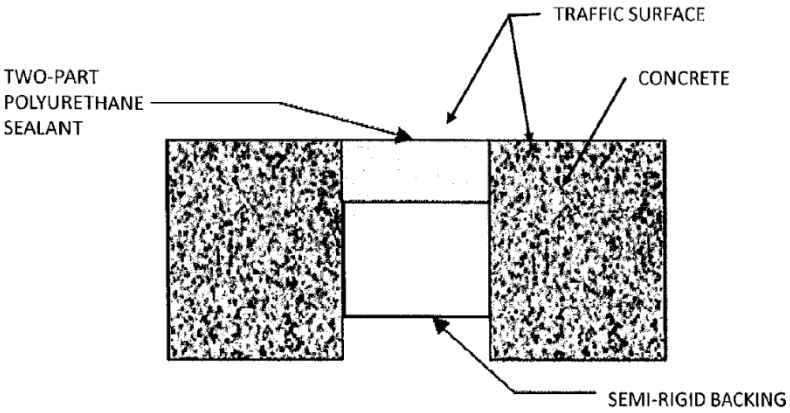
Precast, Prestressed Concrete – Cast in Place Topping Table

Design Element		Durability Zone		
		I	II / CC-I	III / CC-II
Topping Concrete	Strength (psi)	3500	4000	5500
	Air (%)	Not Required	4.5-8.5	4.5-8.5
	Max. w:c ratio	0.45	0.40	0.40
Precast Concrete	Strength (psi)	5000	5000	5000
	Air (%)	Not Required	4.5-8.5	4.5-8.5
	Max. w:c ratio	0.45	0.40	0.38
Cover to Reinforcing (inches)	CIP Topping	1 ½	1 ½	2
	P/C sides of TT	1 ½	1 ½	1 ½
	Beam	1 ½	1 ½	1 ½
	Column	1 ½	1 ½	1 ½
	Walls (Ext. Face)	¾	1 ½	1 ½
P/C Flange Edge Connectors		Liquid Galvanized	Hot Dipped Galvanized	Stainless Steel
P/C Exposed Plates		Rust Preventive Paint	Epoxy Coated or Hot Dipped Galvanized	Epoxy Coated or Hot Dipped Galvanized
Floor Protection		Sealer – Roof Only	Sealer – All Floors and Roof	Sealer – All Floors and Roof

Concrete Sealer:
Use a concrete sealer, containing forty percent (40%) solids, over all parking deck floor surfaces except in areas of traffic bearing membrane application. The sealer's application will create a deep, hydrophobic layer preventing water and waterborne contaminants from entering the concrete substrate and causing premature deterioration. Check with local code requirements regarding VOC compliance (suggested maximum volatile organic carbons 400 gallons per liter), and with the product manufacturer regarding minimum coverage rate. Testing should be done on repellency and penetration. VA should receive a warranty signed jointly by both the product manufacturer and the installation contractor, guaranteeing product effectiveness for a period not less than 5 years.

Traffic Bearing Membrane:
Install traffic bearing membrane over occupied spaces (i.e. storage rooms, mechanical rooms, switch gear rooms, telecommunications rooms). A standard membrane system will consist of a primer, a basecoat, a seed coat, and a top coat. Check with local code requirements regarding VOC compliance (suggested maximum volatile organic carbons 400 gallons per liter), and with product manufacturer regarding minimum coverage rate. VA should receive a warranty signed jointly by the product manufacturer and the installation contractor, guaranteeing product effectiveness for a period not less than 5 years.

All cracks in the concrete floor slab shall be routed in a V-groove, not less than 3/8" wide by 3/8" deep, and sealed with a two-component polyurethane sealant (see detail below). Use self-leveling and non-sag sealants, where appropriate.



- **Security**

Passive security is characteristic of the parking structure design that may incorporate the following:

- Glassed backed elevators and glass enclosed stair towers to allow clear visibility not only from the inside out, but from the outside in;
- Openness around the perimeter to allow maximum natural light;
- Minimize interior walls or corners, which could be areas where people can lurk; and
- Use a well-lit and well-distributed lighting system. (See recommended illumination, as stated in the lighting recommendations in this section.)

Active security components should be provided as follows: (bullets)

- CCTV cameras monitor stair and elevator landings, security phone locations, elevator cars, and vehicle access points. Coordinate camera locations with on-campus security, and provide as needed.
- A minimum of two "Blue light" security phones per floor.

Please review physical security design manuals on VA's TIL website: http://www.cfm.va.gov/til/spclRqmts.asp#PHS

- **Miscellaneous Metals**

Specification of metals should consider placement of materials in an exposed, exterior environment. Therefore, it is recommended that steel be galvanized and field painted. Should aluminum materials be used, provide neoprene or other isolation material between the aluminum and the attached concrete structure.

Provide bumper guards at all plumbing leaders, downspouts or exposed electrical conduit are susceptible to contact. Consider providing elevator pit ladders, and concrete-filled steel pipe bollards to protect access equipment.

- **Expansion Joints**

The project's structural engineer should conduct an analysis of anticipated horizontal movement, as part of the basic structural design. Expansion joints must be provided, and appropriately designed, in the floor deck where structurally necessary to control thermal shrinkage and creep movements. In the case of a post-tensioned structure, solid elevator wall elements should be isolated from the main building structure.

Place expansion joints at relative high points of the parking deck surface, so that runoff does not flow over the gland. Use double columns at expansion joints, and continue the separation down to the supporting substructure. Stiffen structural members on each side of the joint.

Provide expansion joint material that can accommodate the anticipated movement. Expansion joints should be a proven system for the hostile environment of an open parking facility. The adjacent photograph shows a sample of a winged-type expansion joint, which have a strong track record of success.

- **Sealants**

Provide control joints, construction joints, and cove joints, as necessary. Construction joints between elevated slab placements should be tooled and sealed with a two-component polyurethane sealant. Use self-leveling and non-sag sealants, where appropriate.

- **Graphics and Wayfinding**

An identification system utilizing colors for both vehicles and pedestrians, consisting of floor graphics, columns graphics, and signage, should be incorporated into the design. Signage design and construction must conform to the Manual of Uniform Traffic Control Devices and the VA Signage Design Guide, as found on the technical Information Library website: http://www.cfm.va.gov/til/spclRqmts.asp#SIGN. In cases of conflict, VA Signage Design Guide shall apply.

Provide a traffic wayfinding system consisting of painted floor graphics and overhead signs to guide traffic through the parking facility. Overhead signs should be placed with care to be visible to drivers. In the case of precast parking facilities, signs generally should not be attached directly to double tee stems.

- **Elevators**

All multi-level parking facilities, regardless of user, should include a minimum of two passenger elevators. Elevators and adjacent stairs should be located in the logical pedestrian path, between the parking area and the medical center entrance. Where possible, stairs should be placed in a more prominent and visible location than elevators to encourage persons without disabilities to use stairs. Depending on the size of the parking facility and the presence of oversized vehicles within it, it may be desirable to locate van spaces so they are centered on the elevator bank. The number of elevators provided will depend on the travel patterns of the users of the parking facility.

Parking structure elevator design and specifications shall be in conformance with VA Transport System (Elevators) Design Manual. Note that this manual prohibits the specification of proprietary elevator equipment and tools. ADA elevators must be provided in all installations. High-capacity elevators should be specified since these elevators will be located in an outdoor, exposed environment. Other design considerations include the following:

- Provide traction elevators, with stops at all levels of parking structures. Overhead machine rooms should be conditioned, as required by the Elevator Code.
- Provide glass-backed cabs and hoist ways. Provide a temperature-driven shaft fan in each hoist way.
- Provide stainless steel frames and doors at all lobbies. Interior finishes shall include stainless steel walls, vandal-resistance lighting, and rubber flooring.
- Door operators shall be closed loop.
- Traveling cables should include capabilities for telephone and CCTV (2 coaxial cables required).
- Coordinate call buttons with floor identification for parking levels.
- If required, the fire alarm panel shall be located in the first floor lobby.

- **Plumbing**

For specific information regarding the design of parking garage plumbing system, refer to the current VA Plumbing Design Manual for Parking Structure Projects.

1. Drain heads should be large, with large net free areas. Use sediment bucket, where possible.
2. Horizontal plumbing lines should not decrease the head room design of the facility.
3. All vertical utility lines, including risers, shall be protected by a steel pipe guard designed to resist bumper impact.
4. Generally speaking, parking deck drains should be tied to the local storm sewer system. Check local requirements. Provide all needed water quality (such as oil separation) and quantity measures, as required.
5. At project closeout, provide documentation that drain lines are clear.

- **Fire Protection**

1. Fire protection design shall comply with NFPA 88A Standard for Parking Structures.
2. Install dry standpipe system, where applicable.
3. Coordinate location of Siamese fire department connection with local fire officials.
4. Provide active fire suppression, mechanical ventilation, and a fire alarm system as required in sections of the parking structure that do not meet the requirements of open parking, in accordance with the referenced standard.

- **Ventilation**

As stated earlier in this Design Guide, design teams, program managers and on-site engineers should make every effort to ensure that parking structures are open without mechanical ventilation. Should ventilation become necessary due to site limitations and/or multiple uses within a single building structure, it shall be provided in accordance with IBC and NFPA as well as the International Mechanical Code.

- **Electrical**

All electrical designs must conform to the National Electrical Code and the VA Electrical Design Manual. All control panels, switches, controls, thermostats, etc. shall be protected from unauthorized access or use. Size the incoming electrical service to permit future charging stations for electric and hybrid vehicles. Verify electrical load requirements with VA Medical Center Facility Engineer. For the design of both the conduit system and the structural frame, consider future installation of solar panels above the roof level. Where EV charging stations are considered a selected number of spaces shall be provided as such, at a quantity to be determined. Though California is mandating EV charging stations the VA shouldn't summarily accept these mandates as the cost implications are huge. The matter of collecting fees for this service is problematic and requires further study.

For durability and maintenance reasons, exposed, rigid, galvanized metal conduits are preferred. If, however, the designer prefers an encased conduit system, then plastic conduit with a grounding wire should be considered.

One GFCI electrical outlet (20 amps, 120 volts) should be provided in each stair tower, at each floor landing, with one in the elevator pit and one in the elevator control closet. Provide two outlets in each support room.

- **Lighting**

The VA Electrical Design Manual (EDM) contains guidance for lighting parking facilities. The project's electrical engineer should perform an energy life cycle analysis of competing light fixture types, on a case by case basis, to ensure maximum value for VA lighting investment. Light sources that may be considered include metal halide, induction, T8 florescent, or LED fixtures. An advanced control system allowing VA to harvest daylight and to power down fixtures when the parking facility is not in active use is desirable

In general, the criteria listed below, as recommended in the IESNA Guideline for Security Lighting for People, Property, and Public Spaces (latest edition), shall govern the lighting design. Fixture Housing must be designed for exterior applications. Lighting fixtures should aid in limiting spill light and excessive glare on adjacent properties. Note the difference in light levels between elevator lobbies, stairs, and adjacent parking areas. Light levels can be used for wayfinding, and can assist in identifying vertical circulation elements.

Required levels of illumination for parking structures may be found in the VA Electrical Design Manual (EDM) Section 6.11.3. Required levels of illumination for parking lots and exposed roofs of parking structures may be found in the VA Electrical Design Manual (EDM) Section 6.12.

- **Sustainability**

Parking provides several challenges to the achievement of VA's sustainability goals:

1. The need for additional parking highlights a deeper problem for VA facilities, in that facilities are too often located in remote areas and require the use of private automobiles to access the facilities.
2. The need for parking reduces the amount of property available for other mission-focused facility space.
3. Poorly designed parking lots contribute significantly to heat island effect. Heat island effect is caused by the absorbance of solar radiation by low-reflectance materials such as asphalt. The heat emitted by this absorbed radiation increases cooling demand in nearby facilities, further increasing energy consumption.
4. Parking lots often cause an increase in stormwater runoff and pollution.

To abate the negative impacts caused by these challenges, the following guidelines should be followed for all parking projects.

1. Parking designed in conjunction with a major facility construction or renovation project must follow the requirements outlined in the VA Sustainable Design Manual.

2. If a parking project is not being designed or constructed in conjunction with a facility and can be classified as a major project (>$10M) on its own (i.e. large parking structures), it must comply with the VA Sustainable Design Manual.

3. If the parking project cannot be classified as a major project, the project should follow the principles outlined in the VA Sustainable Design Manual to the extent practical.

4. Third party rating systems.

    a. Major facility construction or renovation projects pursuing third-party green building certification must include all associated parking in the design and certification processes. Third-party rating can be done using either the *Leadership in Energy and Environmental Design* (*LEED*) or *Green Globes* rating systems.
    b. For parking structures being built on their own, project teams should consider using either the *Green Globes* rating system or the *Envision* rating system offered by the Institute for Sustainable Infrastructure (ISI).
    c. For parking lot projects, the project team should consider using the *Envision* rating system.

Some additional considerations for parking projects are:

- During the planning phase, consider locating new facilities in areas near existing public transportation networks.
- Locate new parking facilities on existing brownfield (previously developed) sites.
- Any driving surfaces exposed to the sun should have a Solar Reflectance Index (SRI) of 29 or greater.
- Maximize the use of daylighting in parking structures.
- Concrete materials should incorporate flyash to the maximum extent possible.
- If lighting is needed, install low energy lighting with dark sky features and daylight sensors.
- Consider the use of porous pavement or other runoff abatement technologies.
- Ensure good ventilation of parking structures, preferably through the use of natural ventilation techniques.
- Plant low-sap trees throughout parking areas to provide shade. Local plant species should be preferred to avoid the need for landscape irrigation.
- If installing covered parking, consider integrating solar panels into the cover(s). Solar power could be used for nighttime lighting, electric vehicle charging, or to feed nearby facilities.
- Install electric vehicle charging stations.
- Provide preferred parking for van pools and low-greenhouse gas (GHG) producing vehicles (i.e. electric vehicles).
- Use recycled materials to the maximum extent possible.
- Use local and regional materials to the maximum extent possible.
- Provide recycling containers near entrances and exits.

- **Support Spaces**

If the parking structure includes a staffing component, then a finished parking office with windows into the garage should be provided near the main access point. Access control conduits will be run to this office. Provide a maximum 600 square feet of space, plus an ADA-compliant unisexual restroom and a Janitor's Closet with a hose bib, utility sink, and floor drain. Climate control should be incorporated into these spaces.

Acentral telecom room should be located adjacent to the medical center. Recommended minimum room dimensions should be ten feet by twelve feet. Conduits for cameras and emergency telephones should be run into this room.

- **Commissioning**

Commissioning is the process of achieving, verifying, and documenting the performance of facility systems in accordance with the design intent and with VA functional and operational needs. This is accomplished in the initial design phase, documenting design intent, and continuing through construction, acceptance, and the warranty period, with actual verification of performance. Commissioning is a team effort and requires cooperation by all parties to succeed efficiently.

VA requirements and procedures are described in the document Whole Building Commissioning Process Manual (http://www.cfm.va.gov/til/spclRqmts.asp#Cx). Designers and managers should note that this manual has been prepared for complex buildings with multiple mechanical systems. Given that parking structures have limited electrical and mechanical equipment, the commissioning process may be streamlined for parking structures.

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SECTION 8 OPERATIONS AND MAINTENANCE

Parking structures differ from other buildings in that there is no building envelope (roofing, façade, etc.) to protect the building interior from environmental damage. In addition, corrosive elements such as de-icing roadway salts and airborne salts will be brought into the parking facility by automobiles. Water containing deleterious materials will drip off of parked cars, and if unchecked, will damage embedded metals contained within the concrete of the parking structure.

Designing the parking facility in accordance with the recommendations of Section 7 is the first step in achieving a long-lasting parking facility. A maintenance program must be established (preferably before construction has been completed), so that the need for significant repairs is delayed, if not eliminated, by taking preventive measures or replacing malfunctioning items on a regular basis.

Similar to a piece of mechanical equipment, VA should receive operational instructions specific to the parking facility. In order to receive final payment, the parking facility contractor should deliver to VA a bound operations and maintenance manual, reviewed and accepted by the parking design professional. This manual should contain operational instructions for all elements, contact names and phone numbers for all trades, and warranties for all materials. In addition, the manual should contain recommendations regarding the care of elements specific to the parking facility.

Parking elements should be cleaned on a daily basis, if only to maintain an appropriate environment for the facility's users. Floor surfaces should be cleaned under high pressure at least once (and preferably twice, once in April and once in October) to remove debris from the floor surface, and to check the effectiveness of the drainage system.

A design professional, experienced in the design and maintenance of parking structures, should visit the parking facility on an annual basis. The purpose of the visit is to ensure all elements are working properly through visual observation of floor surfaces, building frames, moving equipment, and floor surface protectants, as appropriate. The engineer should document the visit in a letter report, noting all findings with special attention paid to areas of water leakage, areas of ponding, joint systems, and connections.

Repairs and Restoration. When potential problems are identified, a specialty contractor under the guidance of the experienced restoration design professional should be retained to perform corrective measures. Typical work includes repair of deteriorated concrete, sealing of cracks and joints, repair of expansion joints, and application of sealers and traffic deck membranes. Sealants and sealers have a finite life, so even the most effective will need to be replaced periodically.

Sealer performance cannot be evaluated through field observations. Concrete cores should be taken from representative areas of the concrete slab, and laboratory tested beginning in the third year of service and continuing on a 2-year cycle thereafter. Many sealer manufacturers will perform this testing as part of their warranty.

When any element of a parking structure is not performing as intended, it should be repaired or replaced as soon as practical.

The National Parking Association produces an informative guide entitled Parking Garage Maintenance Manual. It is recommended that all VA facilities with structured parking obtain this document.

The maintenance of surface parking lots with trees, shrubs, flowers, and ornamental grasses requires special expertise. The more sophisticated the planting, the more horticultural knowledge is needed to guarantee proper conditions. It is, therefore, important to consider the level of resources and expertise available on an ongoing basis to provide sufficient maintenance and care.

Because of potential liability and possible damage to trees from ice storms, especially in Northern climates as well as Alaska, regular inspection by a certified arborist may be necessary. In the short term, this may seem burdensome. However, in the long term, well-maintained trees are safer, enhance the parking experience, and can prevent expensive liability.

Where snow is prevalent, snow removal is an important part of parking-lot management. Because parking lots provide necessary storage space, excessive snow generally is not problematic. When designing a surface parking lot, the layout should accommodate snowplow operators, allowing them to easily push the snow into holding areas. Where parking is at a premium, it may be necessary to haul snow off the site. If that is the case, entrances and exits to the parking lot should be wide enough to handle the extra demands of snow-removal vehicles. If crews use chemicals to melt snow and ice, it is important to keep harmful salts away from plant material. Instead, select salt-tolerant plants.

Checklist for Structural Inspection of Parking Structures

Decks

- Are there any cracks? Do they leak?
- Is the surface sound, or are there areas of surface scaling?
- Does a chain-dragging test reveal a hollow sound in any areas?
- Is there any evidence of concrete delamination?
- Is there any evidence of corrosion of reinforcing steel or surface spalling?
- Are there any signs of leakage? Describe conditions and note locations.
- If there is a traffic bearing membrane, does it have any tears, cracks or loss of adhesion?
- Are there low spots where water ponding has occured?
- Are there water stains on the underside (soffit) of the deck?
- Has the concrete been tested for chloride-ion content? When was it last tested?
- Are records of previous inspections available?

Exposed Steel

- Are there any signs of corrosion on the beams or columns? Is the corrosion a surface effect or is there a significant loss of section?
- Is there any other exposed steel (handrails, door frames, barriers, cable, exposed structural connections) where corrosion is visible? Is it surface corrosion or is there significant loss of section?
- Is repainting required?
- What is the condition of the interface or attachment point between the steel and the surrounding concrete?
- Is there any staining that would indicate deck leakage adjacent to the steel member?

Stair and Elevator Towers

- Are there any signs of a leaking roof?
- Are there any cracks in the exterior finish?
- Are there any signs of corrosion-related deterioration of stairs or railings?
- Are any other corrective actions required?

Expansion Joints

- Are there leaks through isolation-joint seals?
- Are leaks related to failure of the seals or the adjacent concrete?
- Could the cause be snowplows?
- What type of isolation joint/expansion joint seal is installed?
- Who is the manufacturer?
- Is there a warranty in force?
- Consult the manufacturer for repair recommendations if applicable.

Joint Sealants

- Are there any signs of leakage, loss of elastic properties, separation from adjacent substrates or cohesive failure of the sealant?
- Are there failures of the concrete behind the sealant (edge spalls)?

Drains

- Are drains functioning properly? When were they last cleaned?
- Are the drains properly located so that they receive the runoff intended?
- Are seals around the drain bases in good condition?

Previous Repairs

- Are previous repairs performing satisfactorily?
- Are the edges of previous patches tight?
- Do the patches sound solid when tapped?

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