Site + Architectural Design Principles

Los Alamos
NATIONAL LABORATORY

Produced under the Direction
of the Senior Executive Team
and
Site Planning and Construction Committee
by the
Site Planning and Development Group, PM-1

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FORWARD

As Los Alamos National Laboratory enters the 21st Century, it steps forward with a progressive plan to evolve its physical infrastructure to meet new global challenges. Within the next ten years, revitalization of the core of the Laboratory and creation of several consolidation plans will be in place or in the process. Part of the success of this enormous undertaking is to ensure the highest quality and effectiveness of the investments made. The use and application of the Site and Architectural Design Principles to all development is a critical component of achieving that success.

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I. INTRODUCTION

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I. INTRODUCTION

A. RELATIONSHIP TO LABORATORY VISION AND MISSION

The vision for the physical development of the Laboratory is to create an exceptional work environment that supports the mission, and attracts and retains the quality personnel needed to meet that mission.

The Laboratory mission is to ***serve the nation by applying the best science and technology to make the world a better and safer place***.

The core missions are:

- to ensure the safety and reliability of the U.S. nuclear weapons stockpile;
- to develop technical means for reducing the global threat of weapons of mass destruction or terrorism; and
- to solve national problems in energy, environment, infrastructure, and health security, ***utilizing the investment in people and facilities implied by the first two missions.***

The Laboratory must revitalize and develop its physical assets using the standard of a world-class working environment. The *Site and Architectural Design Principles* sets the principles and guidelines for development and architectural design to achieve that vision.

B. RELATIONSHIP TO LABORATORY PLANNING DOCUMENTS

The *Site and Architectural Design Principles* document is one of a series of planning documents that guide project development and site improvements at the Laboratory.

The ***Comprehensive Site Plan*** (CSP) is the institutional long-range site development plan for Los Alamos National Laboratory. As such, the CSP portrays the large-scale concepts for site-wide development and the current activities proposed and planned to achieve them.

The ***Area Development Plans*** (ADPs) are site development plans created for each of the ten planning areas at the Laboratory. The ADPs refine the concepts of the CSP at the planning area level. The ADPs prioritize developable areas and illustrate more detailed concepts for security, safety, environmental, infrastructure and circulation development for each planning area.

The ***Specific Area Master Plans*** are master development plans for specific sites within a planning area or for diverse areas managed by a program or division.

The ***Site and Architectural Design Principles*** *(Design Principles)* establish the detailed planning principles and guidelines for site and architectural development at the project scale.

C. GOALS OF THE DESIGN PRINCIPLES DOCUMENT

This *Design Principles* document has these goals:

- Articulate the planning and design principles and guidelines to be incorporated in each Laboratory development project to continue to improve the functionality, safety, security and physical appearance of the Laboratory environment.
- Provide a basis for evaluating project designs in support of achieving the long-range physical development vision of the Laboratory.
- Provide planning and design guidance to planners, consultants, contractors and groups responsible for the physical development and maintenance of the Laboratory.

D. THE DESIGN PRINCIPLES

The following are the design principles for site-wide development and revitalization at the Laboratory.

Image and Entrance

- Establish a distinct Laboratory identity.
- Establish clear points of arrival and effective wayfinding systems for the Laboratory.

Land Use and Infrastructure

- Incorporate the land use goals from the *CSP*, *ADPs* and *Specific Area Master Plan* to organize project development.
- Utilize the land use and siting process in all development activities.
- Efficiently use available building sites and infrastructure.
- Improve functional relationships between adjacent uses.
- Identify and use utility corridors.

Security, Safety and Environment

- Incorporate security, safety and environmental needs early in project planning.
- Support the Integrated Security and Safeguards process (ISSM).

Road and Parking System

- Create a comprehensive road and parking system.
- Establish roadway easements to allow for future improvements to the road system.
- Design roadways for safe vehicular, pedestrian and bicycle use.
- Adopt road and parking development standards that incorporate transit, signage, lighting, water harvesting and landscaping.

Pedestrian System

- Establish and implement design standards for pedestrian system improvements.
- Design pedestrian sidewalks and trails as a connective looped system.
- Connect the pedestrian system to open space and lands adjacent to the Laboratory.
- Create pedestrian environments conducive to personal interaction that in turn encourages generation of creative science.

Bicycle Trail System

- Design a bike network that coordinates with road and pedestrian systems.
- Provide bike facilities to encourage bicycle use as part of a complete multi-modal Laboratory circulation network.

Transit System

- Develop a transit system that facilitates circulation within the Laboratory and links with Los Alamos County and other regional transit systems.
- Plan, coordinate, and construct transit facilities part of new Laboratory development projects.

Landscape and Site Improvements

- Establish and implement site-wide standards for landscaping and site furnishings.
- Create a landscape that is water conserving and easily maintained.

Architectural Character

- Develop a unique architectural character that is based on the Laboratory's regional context, history, function, and vision for the future. The character should reflect a science and technology image.
- Design buildings and structures to be flexible for long-term changes in use.
- Design buildings and structures to incorporate energy conservation, durability and maintenance efficiency.
- Implement a unifying design palette for architectural design.

II. IMPLEMENTATION

A. PROCESS INTEGRATION

The *Design Principles* require a method for integration into the overall Laboratory development process. The *Design Principles* integration method relies on existing and proposed project review and development procedures conducted amongst the various Laboratory organizations.

The *Design Principles* are comprehensive in scope, ranging from site-wide to site-specific development guidance, and are applicable to major line item projects, general plan projects and ongoing maintenance projects. It is important to incorporate the *Design Principles* guidelines and standards at the earliest stages of a project proposal.

B. DESIGN PRINCIPLES INCLUSION

Several entities administer and coordinate project development at the Laboratory. All project proposal, development, and review procedures should include the *Design Principles* as part of their project's criteria. The principles simplify and standardize development norms and avoid development at cross purposes.

Project Management Division (PM) is responsible for the Laboratory's comprehensive planning and development at the institutional level. The Project Management Group, PM-1 has the responsibility to administer and interpret the *Design Principles* process.

C. DESIGN PRINCIPLES UPDATES

A review of the *Design Principles* every five years is recommended to maintain the document's effectiveness. Two important evaluation criteria for updates need to be applied.

1. Major Mission or Program Changes

Changes in the Laboratory's operations or programs may render some aspects of the *Design Principles* inappropriate. When such a change occurs, the *Design Principles* should be reviewed to determine what modifications are needed.

2. Effectiveness of the Design Principles

Evaluate all completed projects to determine if the *Design Principles* and its process are improving the Laboratory environment for function, safety, security and aesthetics. If improvements are apparent, no changes may be necessary. If the results are minimal or nonexistent, evaluation of the guidelines themselves or the implementation process may be in order.

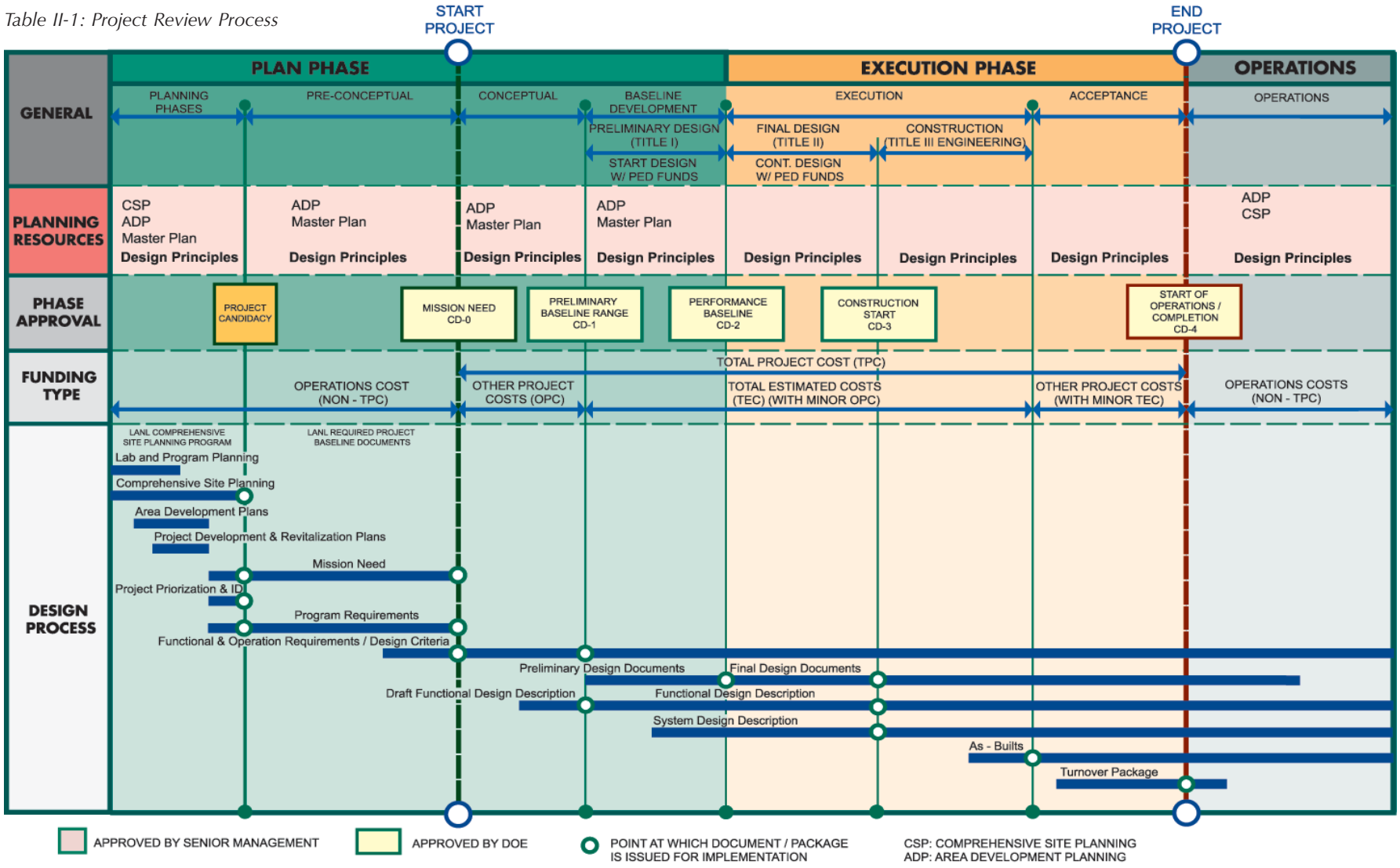
D. PROJECT DEVELOPMENT PROCESS

The following table illustrates when the *Design Principles* are applicable in the overall Laboratory development process.

Persons involved with project initiation management, design and/or construction should read and become familiar with the *Design Principles*, their application and procedures.

The PM-1 staff is available to assist with clarification of the *Design Principles* and project submittal procedures.

Table II-1: Project Review Process



III. PLANNING AS A BASIS FOR DESIGN

A. SITE PLANNING DOCUMENTS

This section of the *Design Principles* describes the Laboratory's three major categories of physical planning documents and how they coordinate Laboratory development into a cohesive design. The three documents are:

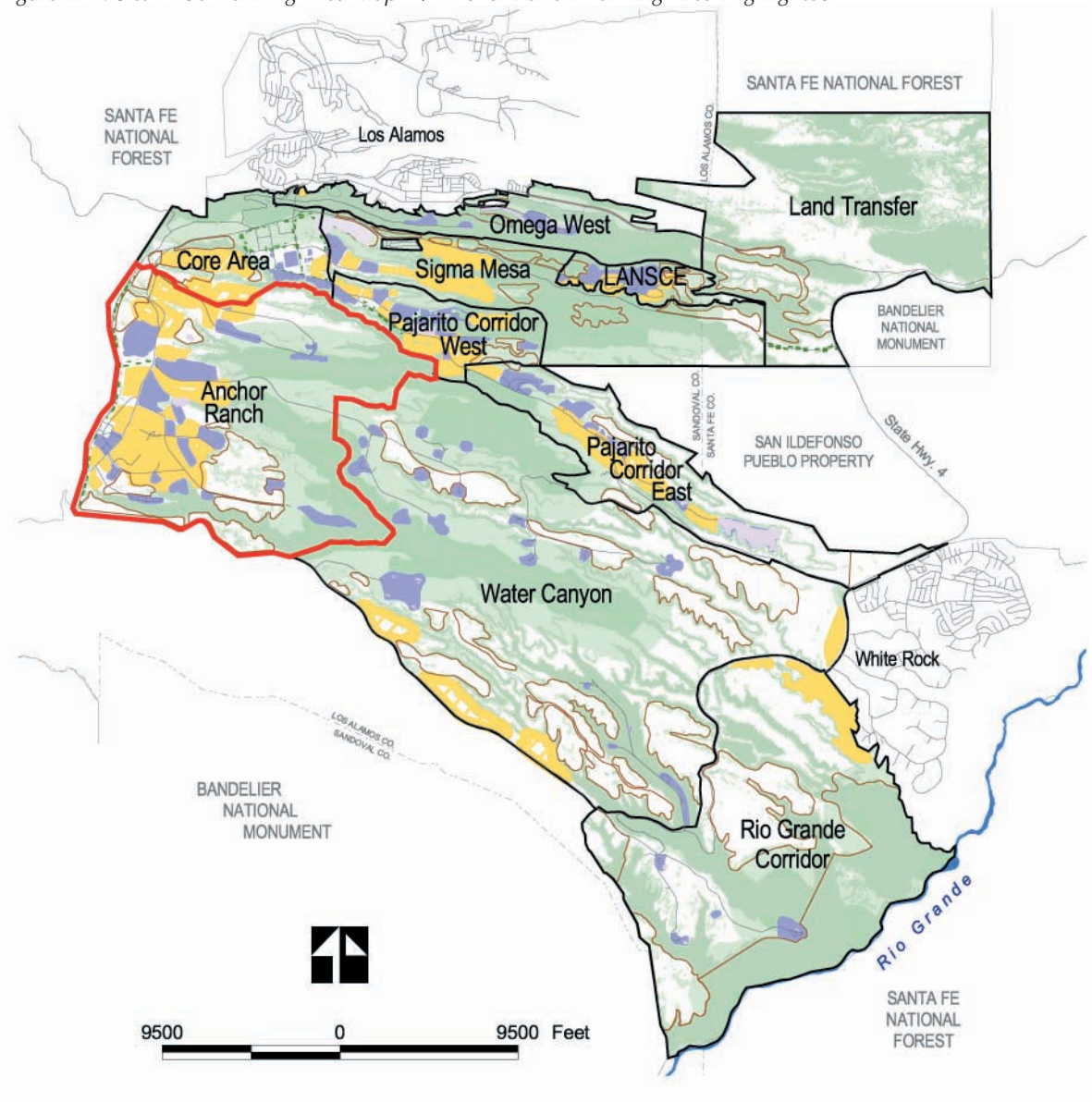
- *Comprehensive Site Plan*
- *Area Development Plans*
- *Specific Area Master Plans*

The documents provide the larger planning and development context within which the *Design Principles* should be applied.

Each document addresses planning and design at a different scale of development. The following pages show examples from each document as it relates to the Anchor Ranch Planning Area or a subarea within that planning area. The examples indicate the range of information available in each document.

PM-1 is responsible for the development, review and updates of physical planning at the Laboratory. The planning documents and maps are available through PM-1.

Figure III-1: Site Wide Planning Area Map w/ Anchor Ranch Planning Area Highlighted



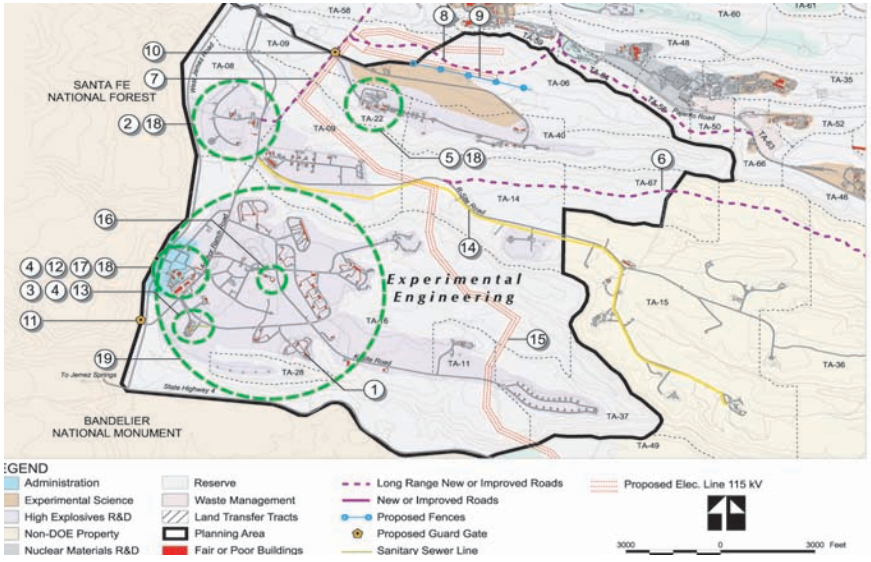
B. COMPREHENSIVE SITE PLAN EXAMPLE

The *Comprehensive Site Plan (CSP)* is the Laboratory's institutional site-wide physical planning document. It presents the Laboratory's future project development programs and infrastructure improvements, and incorporates planning information from programmatic, administrative and support groups at the Laboratory.

The *CSP* provides a snapshot of the major long-range planning and programmatic initiatives that may affect the design and development of specific projects. The Anchor Ranch Planning Area example in *Figure III-2* provides information on:

- land use preferences or changes
- specific programmatic initiatives
- major infrastructure improvements
- site-wide transportation/circulation improvements
- major security upgrades
- environmental, cultural and landscape projects

Figure III-2: Comprehensive Site Plan 2000 Example for Anchor Ranch Planning Area



C. PHYSICAL CONSTRAINTS MAP EXAMPLE

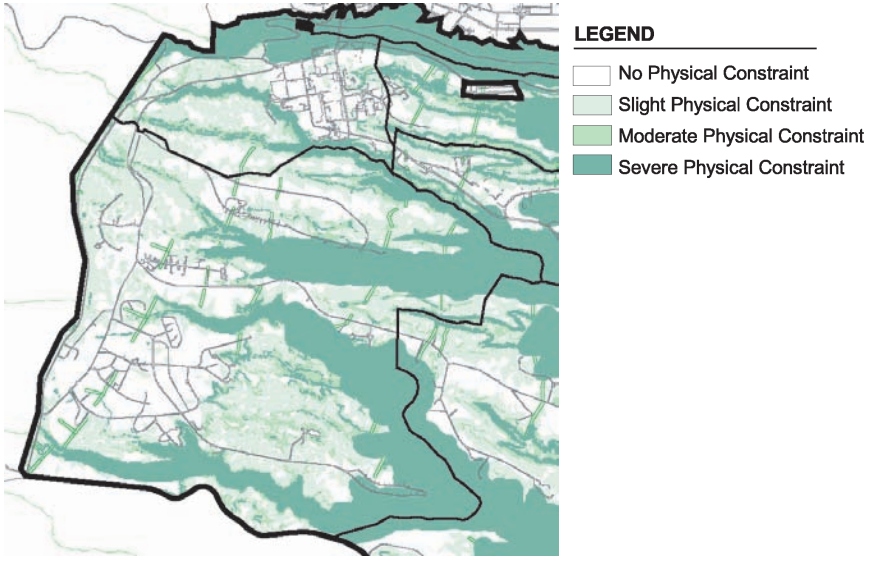
Two types of site analysis maps exist for the Laboratory: physical constraints maps and operational constraints maps.

The constraints maps are useful in the pre-conceptual project scoping and siting. Preliminary studies of site options can be evaluated and initial selections made for more detailed study.

Physical constraints maps incorporate physical and environmental site data and summarize them into four levels of constraint categories. The data compiled in the four constraint categories noted in *Figure III-3* are:

- topography
- seismic potential and fault lines
- slope analysis
- floodplains and wetlands
- wildlife habitat and buffer areas
- other cultural, ecological, or environmentally sensitive areas

Figure III-3: Physical Constraints Map Example for Anchor Ranch Planning Area



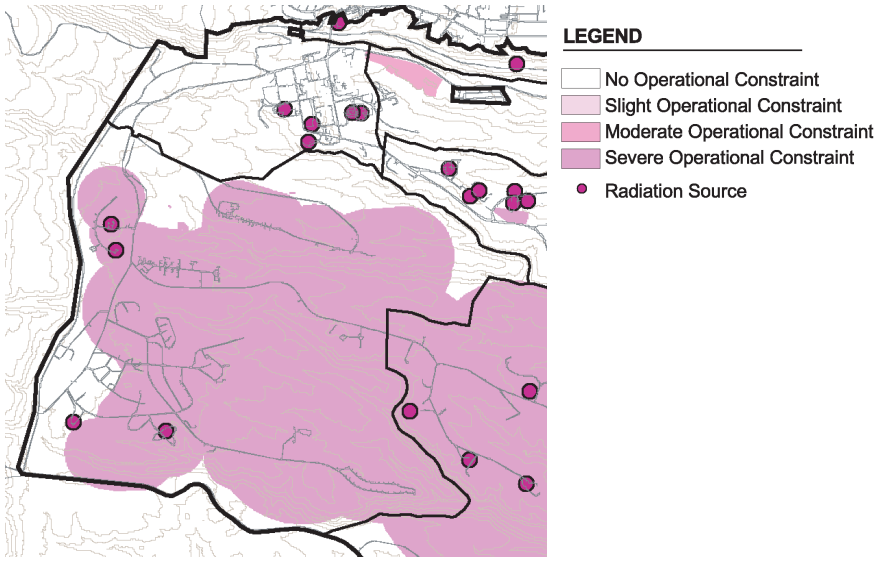
D. OPERATIONAL CONSTRAINTS MAP EXAMPLE

Operational constraints maps depict operations-based restrictions on development. The restrictions vary depending on the unique activities or conditions associated with the programs at each site.

Restrictions shown in operational constraints maps fall into four constraint levels as depicted in *Figure III-4* below. The elements evaluated to determine the category of restriction are:

- safety buffers
- hazardous areas
- sanitary landfills
- blast zones
- White Rock Canyon Reserve boundaries

Figure III-4: Operational Constraints Map Example for Anchor Ranch Planning Area



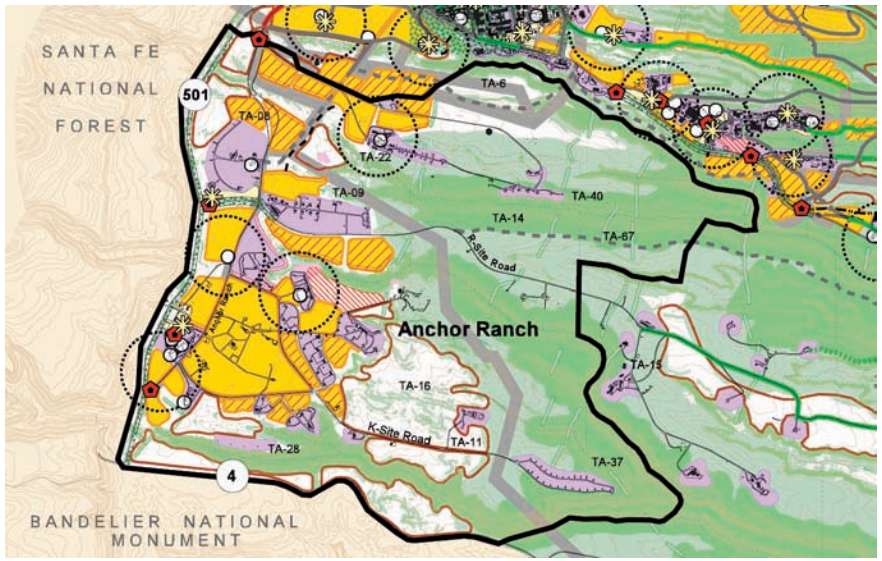
E. AREA DEVELOPMENT PLAN EXAMPLE

Area Development Plans (ADPs) are conceptual physical development plans for each of the Laboratory's 10 planning areas. The *ADPs* rely on an infrastructure perspective to meet the long-range programmatic missions in the planning area. The *ADPs* expand on the development potentials identified in the *CSP*. See *Figure III-5* below.

Plan elements include:

- developable parcels and their priority for development
- reserved and sensitive environmental areas
- primary utility corridors and facilities
- building development zones
- roads and parking development
- transit facilities
- pedestrian and bike systems
- conceptual arrangement of major safety and security improvements

Figure III-5: Area Development Plan Example for Anchor Ranch Planning Area



F. SPECIFIC AREA MASTER PLAN EXAMPLE

Before a specific area begins development or revitalization, a *Specific Area Master Plan* should be prepared.

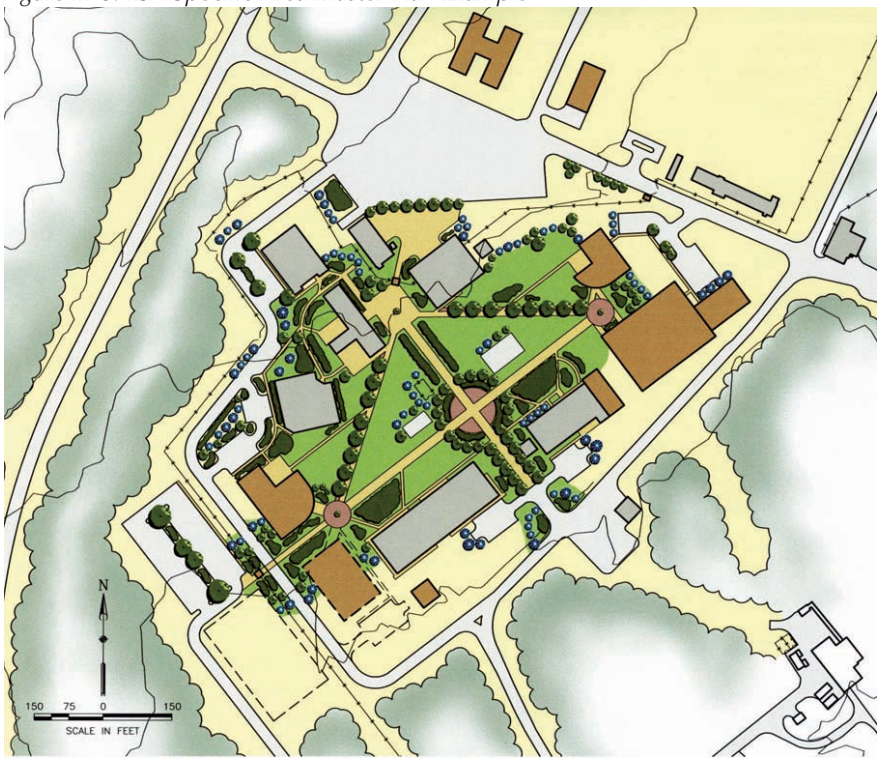
The *Specific Area Master Plan* schematically arranges the existing and proposed facility needs of a particular area. The master plan should align with the goals of the *CSP* and the relevant *ADP,* and incorporate the *Design Principles* siting and development guidance in the following areas:

- land use consolidation and efficiency
- security
- safety
- environmental and cultural requirements
- utility corridors and improvements
- road system
- parking system
- transit system
- bike system
- pedestrian system
- open space
- site furnishings and landscape

Image III-1 and *Figure III-6* are examples of the *Specific Area Master Plan* for the Engineering Sciences and Applications (ESA) location within the Anchor Ranch Planning Area.

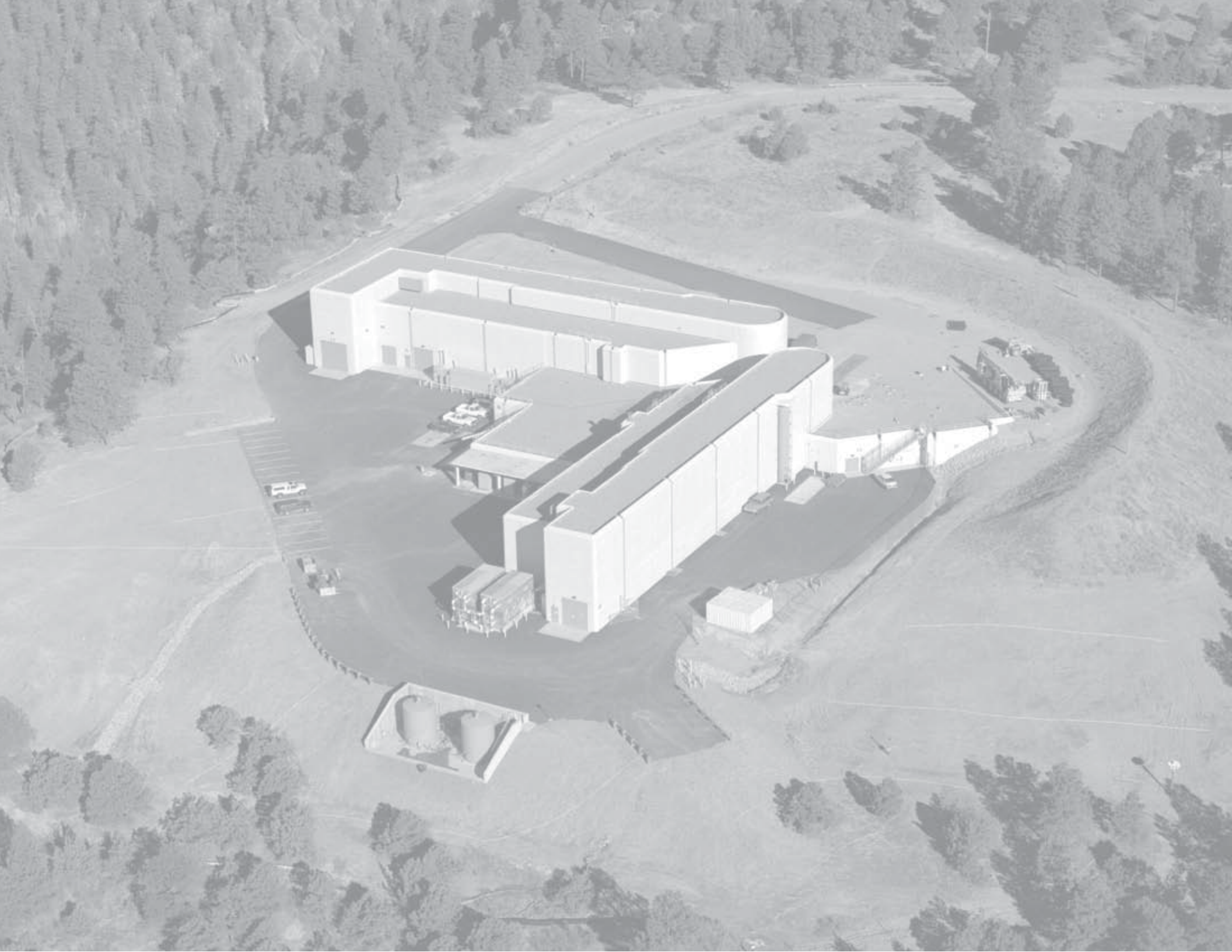
Image III-1: Existing Site Photo Example

Figure III-6: ESA Specific Area Master Plan Example



IV. GUIDELINES FOR SITE DESIGN

A. SITING



IV. GUIDELINES FOR SITE DESIGN

A well designed site results in cost-effective, resource conserving, safer, more secure and visually appealing development. The *Design Principles* identify clear guidelines for site development as part of implementation actions to achieve well designed sites at the Laboratory.

This section presents the major facets of site design. First is siting - the selection of a site and the arrangement of improvements on that site. Second is circulation - the connective systems that allow vehicular and pedestrian access and movement within the Laboratory and beyond.

Third is landscape elements - the detailed site improvements that humanize a site. All three facets require careful integration during the design process to create a distinct sense of place and a world-class environment for the Laboratory.

Siting Coordination

The thoughtful and thorough placement of improvements is fundamental to good site design. The *Design Principles* focus on general concepts, procedures and issues related to siting improvements including:

- Siting notification process
- Accountable design
- Building orientation and site design
- Site development program checklist
- Site analysis
- Security development issues
- Safety development issues
- Environmental /cultural resources development issues
- Utilities and utility corridors

Circulation

Circulation is the connective component of site design. It determines how and where people access and move about a site. A complete, connective, multimodal circulation network is the objective for this section. Five systems make up the circulation network. Those systems include:

- Road system
- Parking system
- Transit system
- Pedestrian system
- Bicycle system

Landscape Elements

Landscape elements are individual components of site design that make the site inviting, usable and visually interesting for staff and visitors. Landscape elements bring a human scale to site development.

The landscape elements addressed in the site design section include:

- Security elements
- Signage elements
- Exterior lighting
- Paving
- Site furnishings
- Planting design

A. SITING

Introduction

Siting incorporates land use, circulation, infrastructure, security, safety and environmental, cultural and quality issues into a project program. The siting process must be thorough and complete as it directly affects the cost, function and aesthetics of development.

Applying the guidance in this section of the *Design Principles* will create sites that are well designed, functional and safer for visitors and Laboratory staff.

Principles

Principles for the Laboratory siting process are:

- Implement the land use goals in the *Comprehensive Site Plan*, *Area Development Plans* and S*pecific Area Master Plans.*
- Use a consistent and complete site analysis and siting process for all development projects.
- Efficiently use existing land and infrastructure to improve the organization and function of the Laboratory.
- Use developable areas within and adjacent to existing development to take advantage of existing infrastructure.
- Incorporate security, safety and environmental and cultural requirements at the earliest stages of project development and siting.
- Identify and use utility corridors.

References

Other Laboratory and industry documents to be referenced are as follows:

CSP 2000
Comprehensive Site Plan 2000 and supplement CSP 2001

ADP
Area Development Plans

SSSP
Site Safeguards and Security Plan

SS LIR
406.00.01.0 General Security
406.00.020 Classified Security
406.00.030 Nuclear Safeguards

DOE
Design Basis Threat Policy Document
Publication SAND 87-1926
Publication SAND 87-1926/2 Access Delay
Technology Transfer Manual, Volumes I and II
DOE 64.30.1A
DOE M5632.1C-1

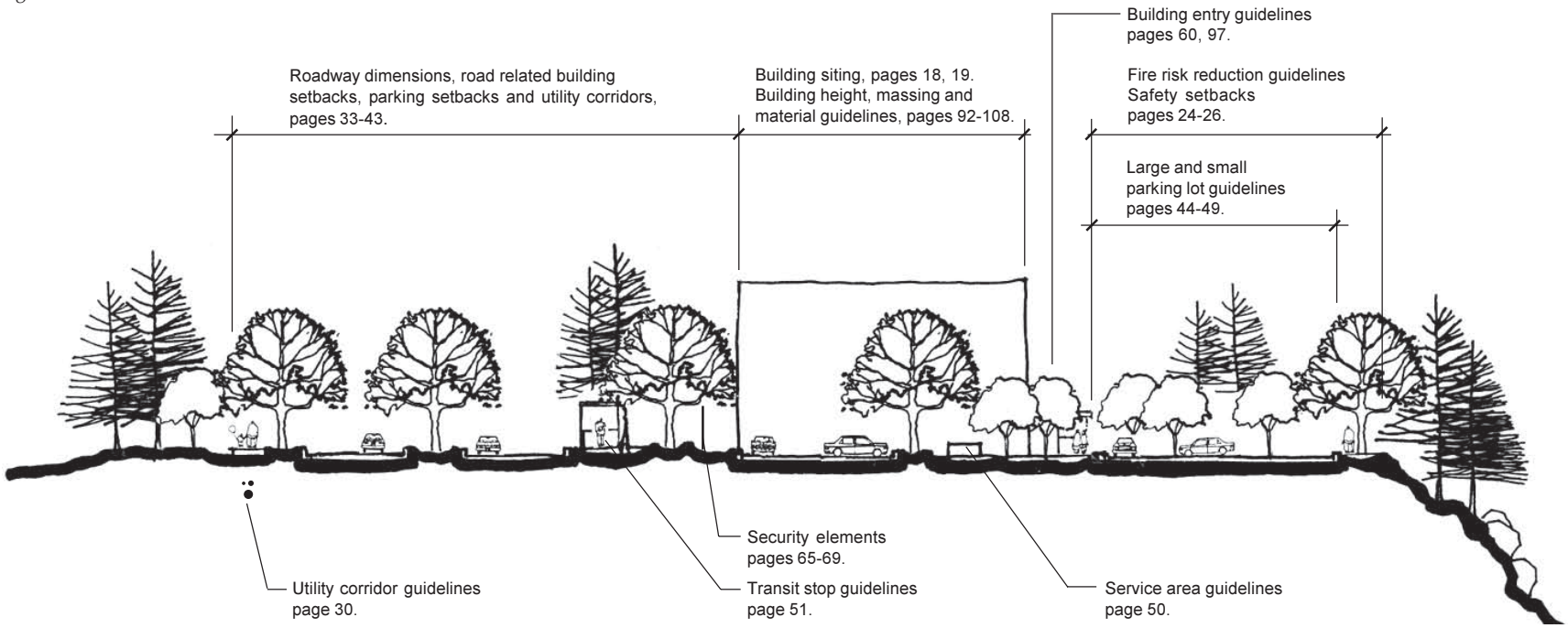
LIR 220-01-01.4
Construction Project Management LIR

LIR 210-01-01.0
Site Planning LIR

1. Siting Notification Process

The siting notification process applies to siting of all facilities and infrastructure within the Laboratory's boundaries. The siting notification process supports the principles of the Laboratory's *Comprehensive Site Plan* and maximizes the proper and effective use of developable land. The process is implemented by PM-1 and coordinated with all facility management units. The PM-1 staff is responsible for this process. *Figure IV-1* illustrates locations in the *Design Principles* where specific information can be found.

Figure IV-1: Setback Reference Section



2. Accountable Design

Executive Order 13123 states that: *"The Federal Government, as the Nation's largest energy consumer, shall significantly improve its energy management in order to save taxpayer dollars and reduce emissions that contribute to air pollution and global climate change."* To meet the challenge of the Executive Order, the Laboratory must be accountable in its designs with regard to energy and resource conservation and efficiency.

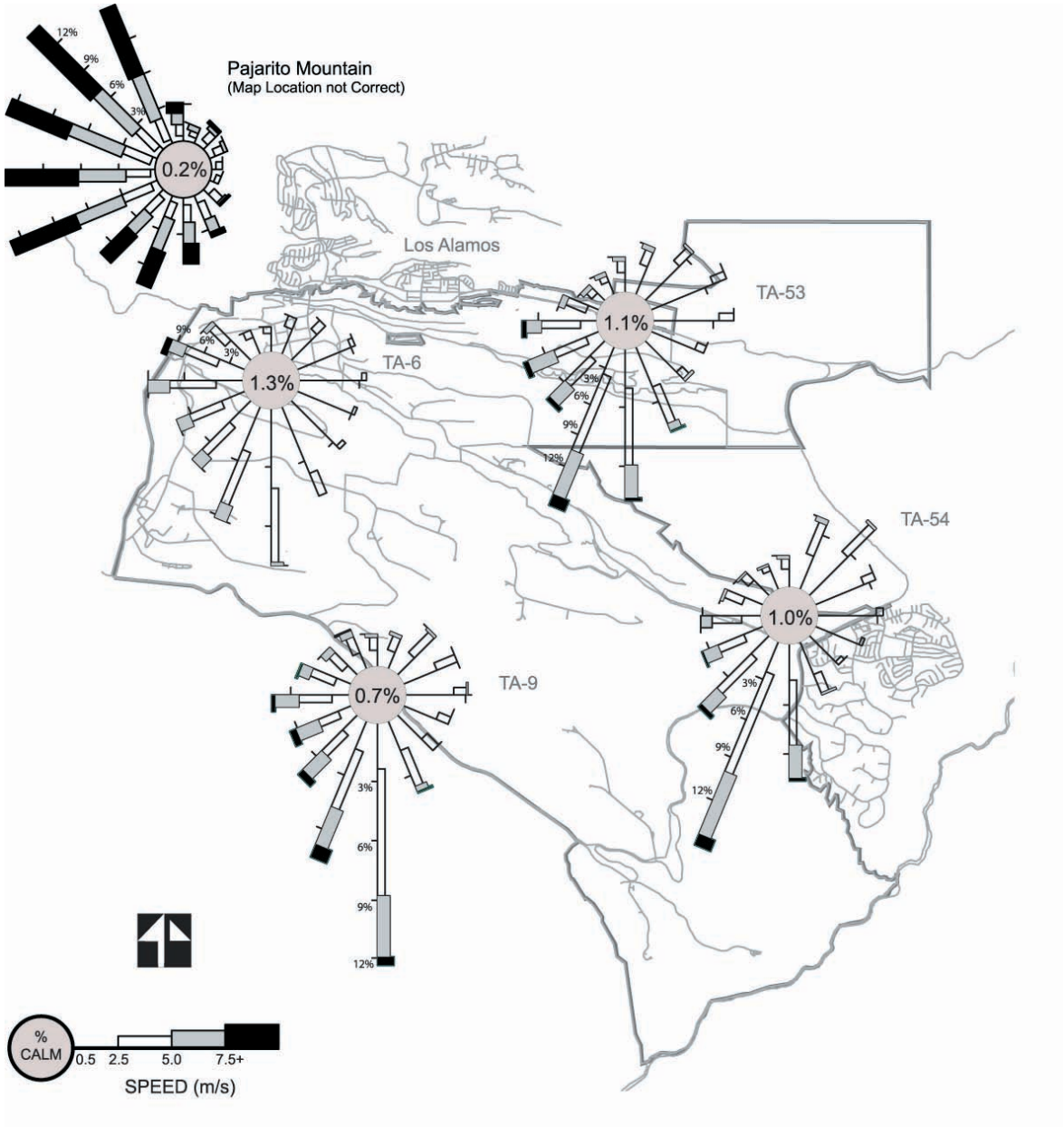
New structures and facility upgrades at the Laboratory should follow the Leadership in Energy and Environmental Design (LEED) system for environmental accountable design. Siting and constructing buildings in an environmentally sound manner improves the work environment. Using the LEED program as a standard, designers may select the environmental design or performance level that best suits their specific structures and sites.

Project managers should select standards from the following five LEED categories:

- Sustainable sites
- Water efficiency
- Energy and atmosphere
- Materials and resources
- Indoor environmental quality

All new structures, renovations, and additions should conform to the minimum LEED certification level within the rating system or a project manager selected level.

Figure IV-2: Los Alamos Wind Conditions Summary 2000



3. Building Orientation and Site Design

a. Building Solar Orientation

Building siting should use solar orientation to:

- Set building orientations that increase human comfort and safety from sun, snow, rain and wind.
- Provide optimum internal building comfort and energy conservation (*Figures IV-3, IV-4 and IV-5*).

b. Passive Heating/Cooling

Building designers should use solar "direct gain" analysis as an evaluation tool in order to:

- Control solar heat gain on building surfaces (*Figures IV-3, IV-4 and IV-5*).
- Control and direct sunlight for interior building daylighting as well as passive heating and cooling opportunities.

c. Exterior Building/Space Organization

Other siting considerations are:

- Avoid restricting the solar access of neighboring structures in building design and orientation (*Figure IV-6*).
- Consider orienting building views to prominent vistas of the mountains and the Rio Grande Valley.
- Design outdoor spaces between buildings to take advantage of winter sun and summer shade.
- Create buffers using landforms, structures and plants to mitigate summer heat gain, glare and wind (*Figure IV-7*).

Figure IV-3: Sun Angle Diagram 36 North Latitude

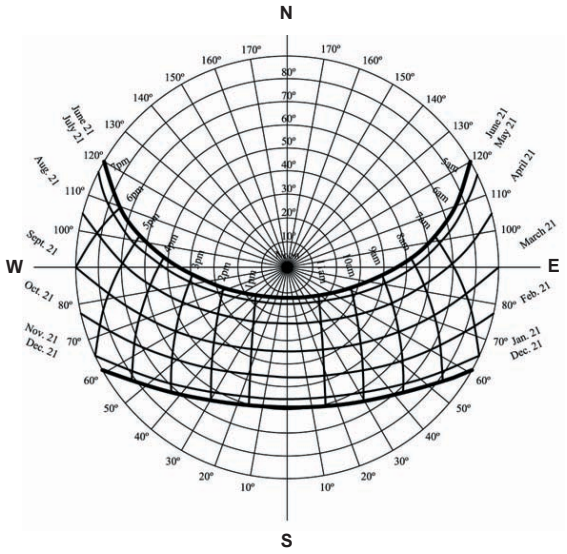


Figure IV-4: Optimum Solar Orientation - Los Alamos

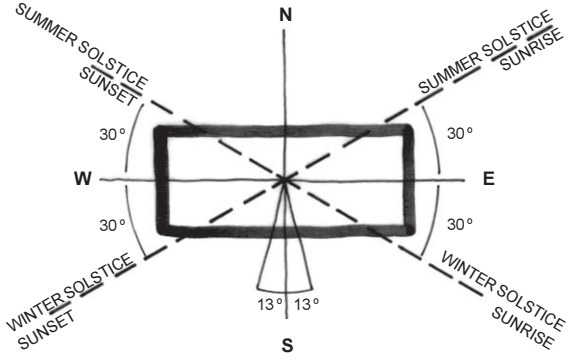


Figure IV-5: Solar Sun Angles - Los Alamos

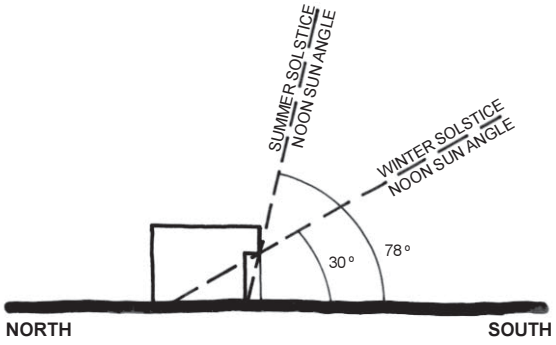
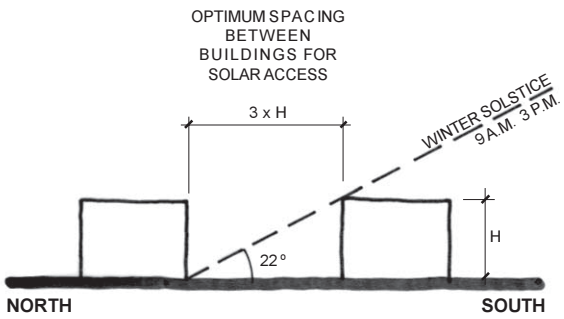


Figure IV-6: Building Spacing for Solar Gain - Los Alamos



d. Access

Sites should be designed to:

- Provide clear routes for vehicular and pedestrian access that connect buildings to roadways, parking areas, walkways and trails.
- Separate service and maintenance access from primary pedestrian routes and areas.
- Meet the guidelines for accessibility established in the Americans with Disabilities Act (ADA) and Uniform Federal Accessibility Standards (UFAS).

e. Site Grading

Sites should be graded to:

- Balance their cut and fill to within 10% unless there are extenuating circumstances related to the site or building use.
- Provide positive drainage away from structures.
- Maintain on-site road grades that do not exceed 8%.
- Limit retaining walls to a maximum height of 6 feet (*Figure IV-8*).
- Retain 100-year storm runoff on-site where practical.

Buildings on sloped sites should:

- Berm into the slopes where practical to reduce the buildings visual impact.
- Step the building's massing to follow the site's slope.

Site grading should avoid:

- Fill slopes of greater than 3:1.
- Cut slopes of greater than 2:1.
- Continuous fill or cut slopes of longer than 20 feet.
- Abrupt grading changes at the bottom or top of slope (*Figure IV-9*).

Figure IV-7: Methods To Reduce Summer Solar Gain

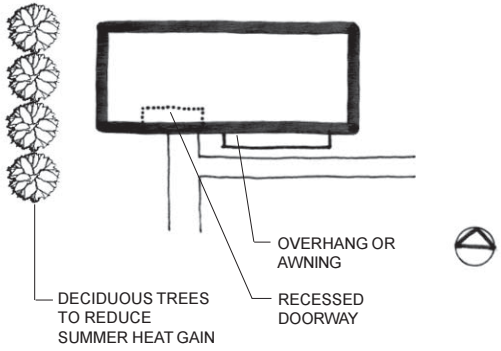


Figure IV-8: Slope Grades And Retaining Walls

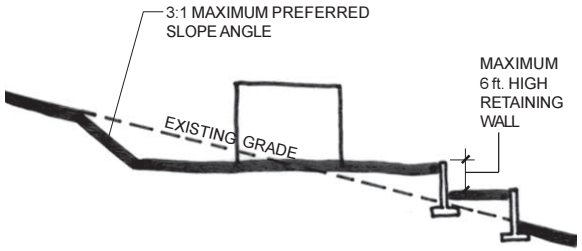
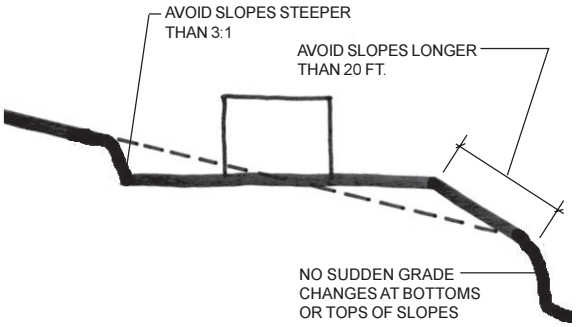


Figure IV-9: Grading Problems



4. Site Development Program Checklist

A Site Development Program checklist should be created and included in the initial programming of every project. The checklist should coordinate the project's site development program with the overall planning guidance in the *Comprehensive Site Plan (CSP)*, the relevant *Area Development Plan (ADP)*, the related *Specific Area Master Plans* and the guidance in the *Design Principles*.

The checklist should include all siting issues regardless of the project's scale. A sample checklist is presented to the right.

SAMPLE
SITE DEVELOPMENT PROGRAM CHECKLIST

Land Use

- Long-range land use goals ☐
- Physical constraints ☐
- Operational constraints ☐
- Developable sites ☐

Security/Safety Requirements

- Security requirements ☐
- Safety requirements ☐

Environmental/Cultural Requirements

- Environmental/cultural requirements ☐
- Drainage and terrain management ☐

Utilities Infrastructure Requirements

- Utility corridor alignments ☐
- Utility sources ☐

Circulation Requirements

- Road system ☐
- Parking system ☐
- Pedestrian system ☐
- Bicycle system ☐
- Transit system ☐

Landscape Elements Requirements

- Security/safety elements ☐
- Signage elements ☐
- Exterior lighting elements ☐
- Paving elements ☐
- Site furnishings ☐
- Planting / water harvesting ☐

5. Site Analysis

Site analysis is the first step in development planning. The analysis evaluates a proposed project in context with the physical and operational constraints of a site. A thorough site analysis identifies development potentials, restrictions and the supporting institutional investments that may be needed to meet a project's schedule and budget.

The site analysis can be depicted on a summary map or series of maps that present all development issues affecting the planning and construction of a project (*Figure IV-10*). The map should incorporate existing conditions data and long-range site development and infrastructure goals from the *CSP*, *ADP's* and *Specific Area Master Plans*. Include the following information in the analysis:

- topography / slope
- soil types
- vegetative cover
- geologic and seismic data
- adjacent land uses
- buildings and structures
- utility easements or corridors
- utility lines and sizes
- road system
- parking network
- pedestrian network
- bicycle network
- transit network
- security improvements
- safety improvements and buffers

Figure IV-10: Sample Site Analysis for TA-66

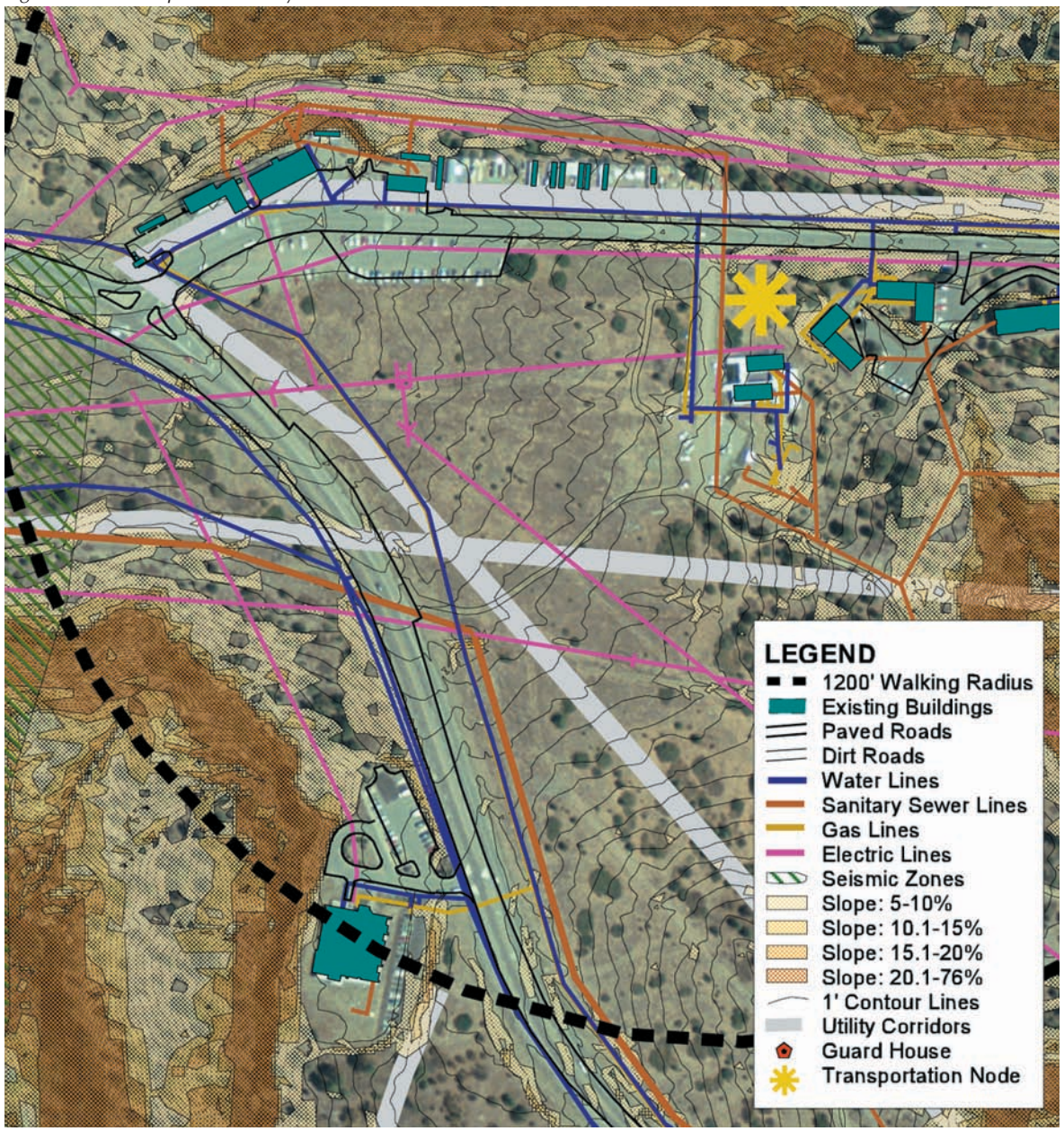
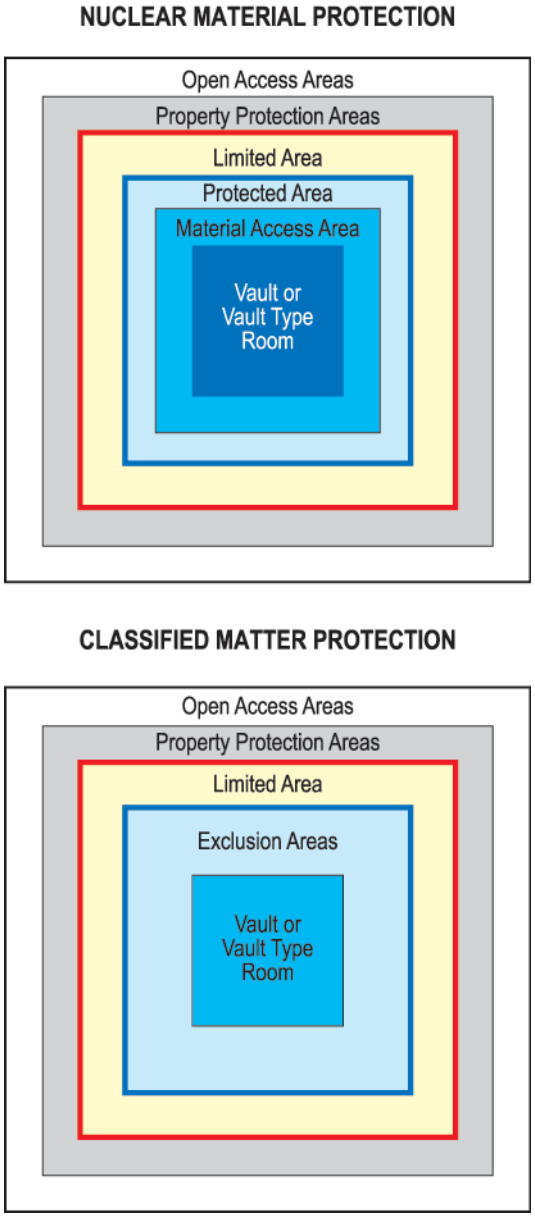


Figure IV-11: Site Security Concept



6. Security Site Development Issues

Security considerations are critical when siting new facilities or redeveloping existing sites.

Site development goals related to security are:

- Provide site improvements that are appropriate to the security needs of the project area and the health and safety of employees, the public and the environment.
- Provide security improvements that are aesthetically integrated into overall site development.
- Promote personnel security by providing well lighted, "defensible-space" site and building designs.
- Incorporate effective and efficient protection measures into the design programs for new development.

Specific security requirements are defined for every project. This section identifies general security factors that affect site design.

a. Integrated Safeguards and Security Management (ISSM)

The Laboratory's Integrated Safeguards and Security Management (ISSM) emphasizes a Laboratory-wide security culture and enhanced security performance, and establishes a unified management model for achieving cost-effective operations. The goal of ISSM is to achieve excellent safety, health and environmental performance and to meet business imperatives without violating safeguards and security requirements. The *Design Principles* support the goals of ISSM.

b. Security Principles

The Laboratory's security principles are:

- Consolidate secure and hazardous functions and interests.
- Minimize public proximity to secure interests and safety areas.
- Limit public access to secure interests and safety areas.
- Enhance awareness of physical security and safeguard threats through education of all Laboratory personnel.

c. Security Siting Impacts

High levels of security have greater impacts on site planning. Security requirements affecting the site design can include:

- specific location within a planning area
- size of development site
- buffers and setbacks from structures, parking and circulation routes
- physical relationship of structures and facilities on site
- circulation for pedestrians, vehicles and emergency services
- perimeter fencing and access controls
- utility corridor location and protection
- redundancy of utility distribution and source
- design of buildings and structures
- security interest housed or contained in a facility
- terrain management and landscaping
- exterior lighting requirements
- exterior signage

d. Site Security Concept Description

Physical security is based on a "protection in-depth/graded protection" concept. This concept physically places the most important data, material, or persons in a highly controlled center surrounded by areas of decreasing levels of security. *Figure IV-11* illustrates the concept for both nuclear materials and classified matter.

e. Security Designations / Locations

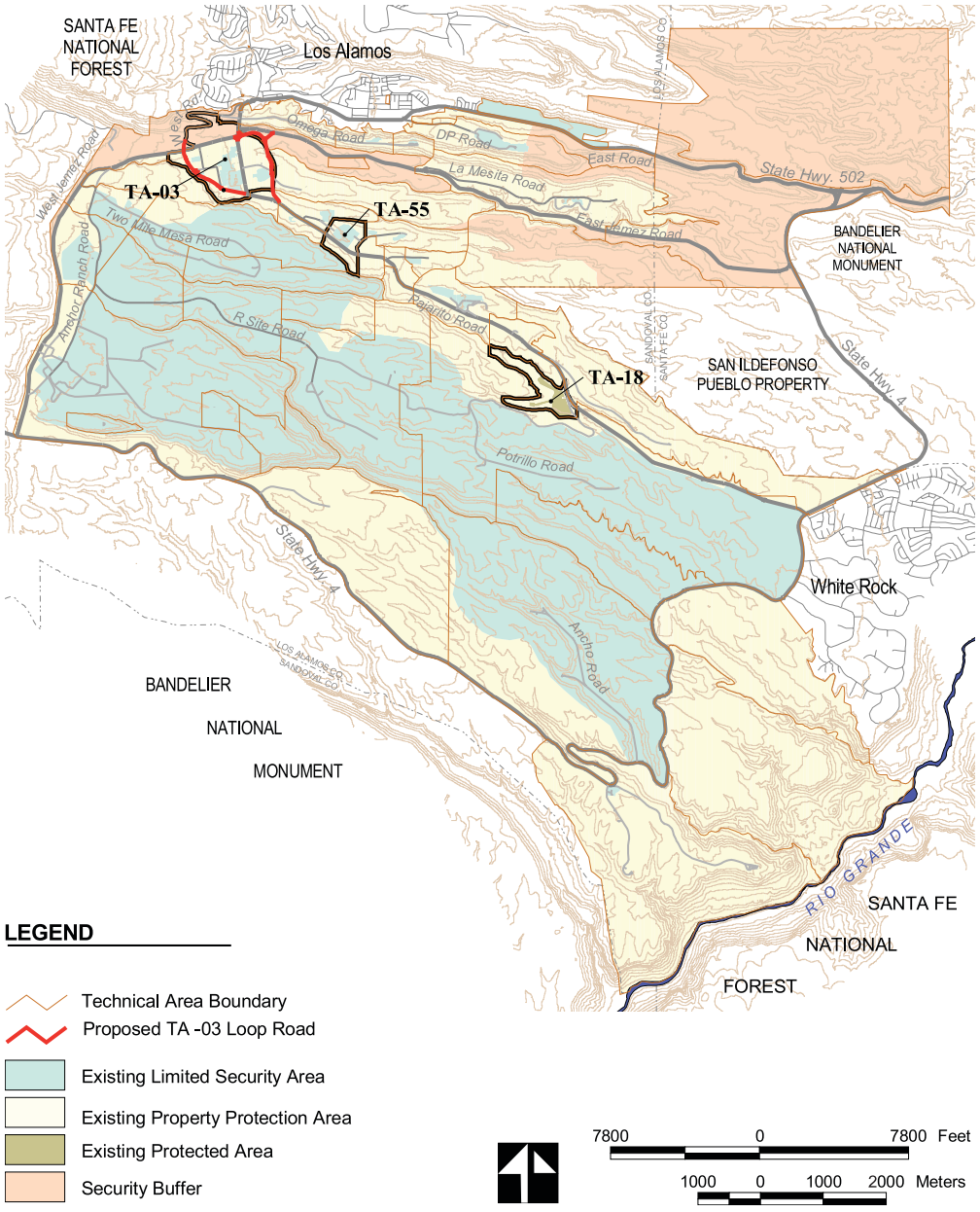
The level of security required for any project must be in compliance with the Safeguards and Security Division Security Plan. Overall site-wide security locations are shown on the Laboratory Security Plan *(Figure IV-12).*

f. Security Elements Siting Approval

Siting of control gates, fences and other physical barriers must be approved by the Security Strategic Planning Team of S-1. Siting factors include:

- topography
- erosion and drainage
- disturbance to site by construction
- existing site functions
- maintenance requirements
- visual impact

Figure IV-12: Site-wide Security Map



7. Safety Site Development Issues

Recent fires at the Laboratory have emphasized the need for proper land use and site design to reduce risks from natural and man-made safety threats.

a. Fire Management Zones

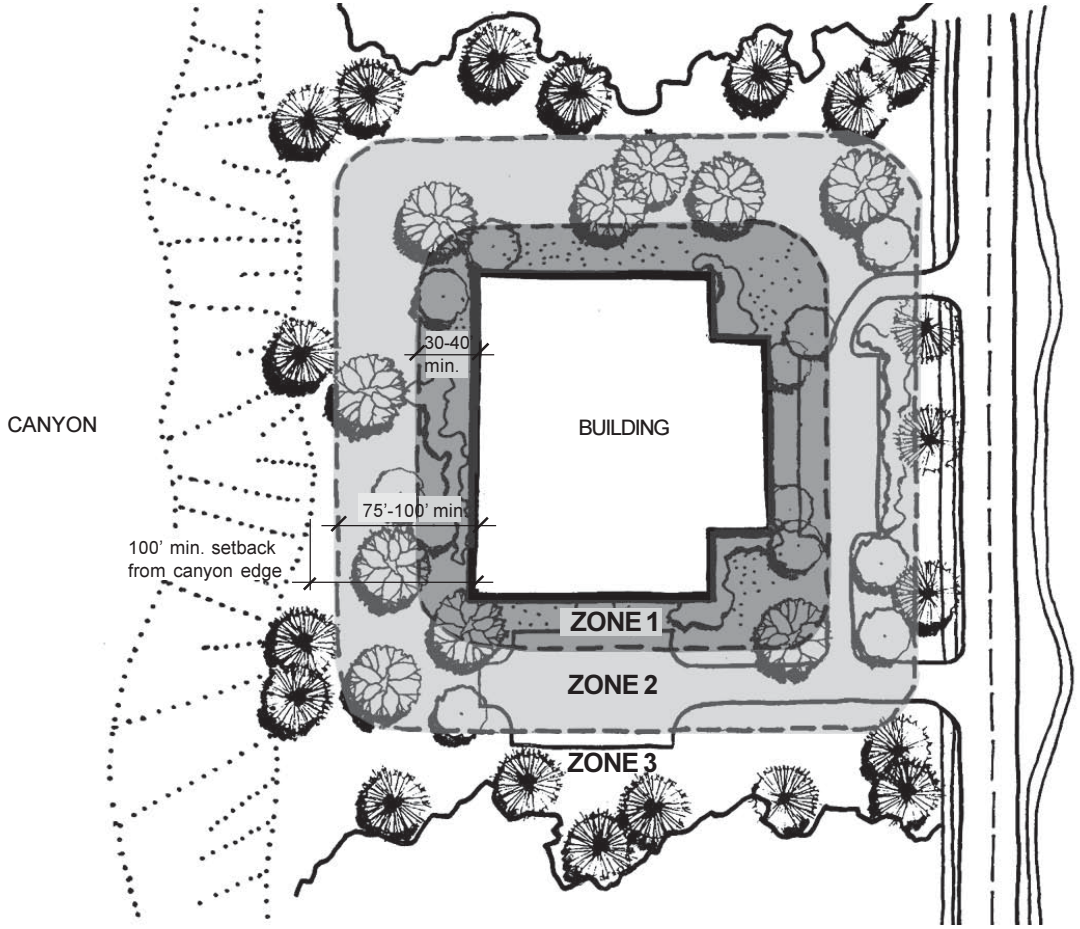
Three fire management zones should be maintained around buildings in roughly concentric areas to reduce fire risks (*Figure IV-13)*.

Zone 1 is the main defensible space area. It is the area requiring maximum development modification and management. Its size depends on the structure size and the slope of the ground. Steeper slopes require larger defensible zones.

Zone 2 is a transition zone between Zones 1 and 3. Management of this area is less intense than Zone 1 and focuses on reducing fuels and undergrowth beneath trees. The distance measurements for Zone 2 are similar to Zone 1, but combined they should extend at least 75-100 ft. from the structure.

Zone 3 is an area of traditional forest management activities. The area extends from the outer edge of Zone 2 to the property boundaries. No specific size of zone is required.

Figure IV-13: Fire Setback Guidelines Sketch



b. *General Fire Risk Reduction Guidelines*

- Set back all new structures 100 ft. from canyon edges to create a fire safety break (*Figures IV-13, IV-14, and IV-15*).
- Secure and hazardous facilities should have fire-retardant ground surfaces that extend 50 ft. from exterior walls of structures.
- Provide emergency and fire fighting access and improvements as required by the Laboratory.
- Provide space around buildings three stories and taller to position aerial fire apparatus (ladder, bucket, water tower, etc.). The space should be on at least one side and preferably two sides of each building. The space should be parallel to walls with windows.
- Separate fire lanes/roads and buildings with a distance of 10 ft. minimum and 50 ft. maximum.

Figure IV-14: Fire Setback Guidelines Sketch / Development on Mesas

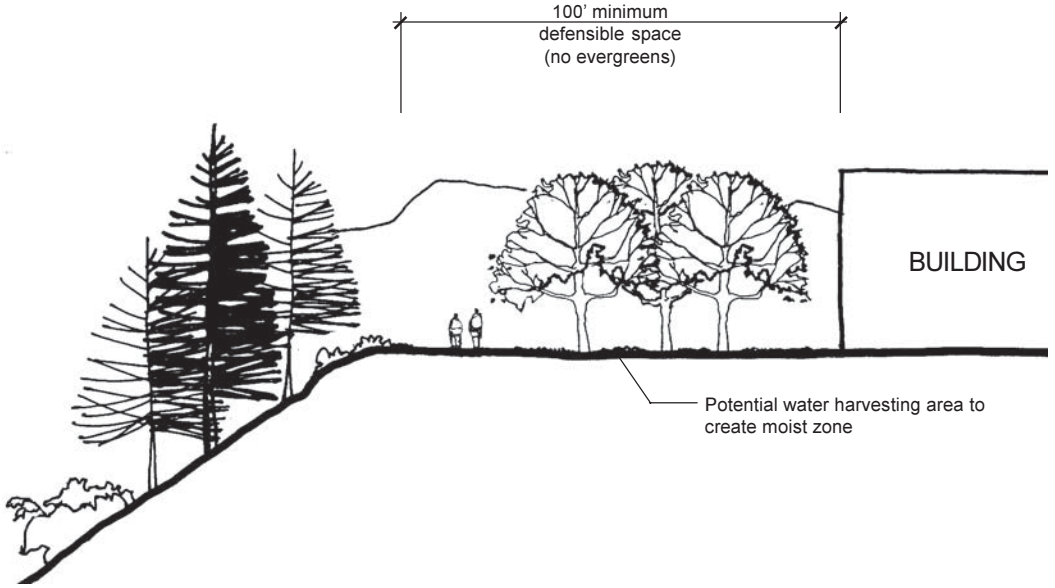
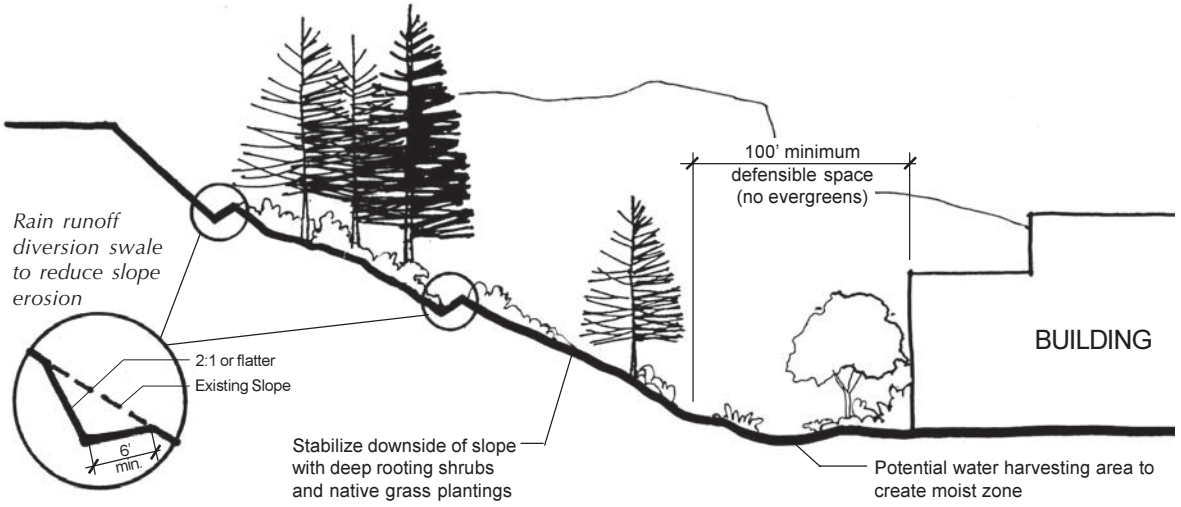


Figure IV-15: Fire Setback Guidelines Sketch / Development in Canyons



c. *Landscape Fire Risk Reduction Guidelines*

Planting near structures should be selected based on fire-wise practices and consistent with the native environment.

- Install and maintain landscape improvements to allow passage around structures by the largest fire apparatus used by the Laboratory.
- Shrubs: Use low-growing shrubs to reduce the fire spreading potential. Specify non-resinous varieties when close to structures.
- Deciduous Trees: Use deciduous and ornamental trees in areas immediately adjacent to and between structures. Place native Aspen and Narrowleaf Cottonwood where sufficient soil moisture for healthy growth can be maintained.
- Evergreen Trees: Plant evergreen trees at a safe distance from structures. Prevent tree crowns from touching one another or buildings. Maintain a 5 to 10 ft. clearance between tree crowns at their mature spread.
- Prune trees to a bottom canopy height of about 8 ft. within Zone 1, gradually decreasing to a pruned bottom canopy of 5 ft. at the transition from Zone 2 to Zone 3.
- Beyond 75 ft. from structures, plant shade-tolerant native grasses under the forest trees to reduce ground fire potential.
- Setbacks and considerations for landscape development around structures on mesas and at the bottom of canyons or hillsides are illustrated in *Figures IV-14 and IV-15.*

d. *Flood Reduction*

Identify areas subject to flooding and develop mitigation measures to reduce or eliminate flood potential. Typical flood mitigation measures include:

- Removal and prevention of development in 100-year flood zones.
- Set back construction from edges of flood zones at least 25 ft.
- Construct flood diversion structures and improvements with new development.

e. *Safety Hazard Zones*

Safety hazard zones are restricted areas around materials or activities that either need protection or that need to be protected from access/exposure by the public and non authorized Laboratory staff. The zones can be applied to hazards from natural causes (wildfires) as well as man-made causes (toxic sites resulting from current or former Laboratory activities).

Safety hazard zones are usually physical spaces separating the particular hazard to be avoided or item(s) to be protected. Techniques used to establish the zone can range from restrictions on development such as building setbacks from canyon edges to avoid wildfire encroachment or fences or walls to restrict access.

8. Environmental/Cultural Resource Site Development Issues

As steward of 43 square miles, the Laboratory is committed to protecting the natural environment and mitigating development impacts on the natural and cultural resources of the site.

Environmental and cultural resource issues that affect site development are:

- threatened and endangered species habitat protection
- wetlands and riparian protection
- cultural resources protection and preservation
- water quality protection
- erosion control
- terrain management

a. Threatened and Endangered Species Habitat Protection Issues

If a threatened and endangered species habitat (*Image IV-1*) is identified on a site proposed for development, the Environmental, Safety and Health (ESH) division will develop project specific mitigation, protection and/or management plans to be incorporated into the project program.

When designing and constructing new roads, identify the need for wildlife underpasses to minimize accidents between wildlife and vehicles. Consult with the Laboratory's ESH division on the type of underpass and placement.

b. Wetlands and Riparian Protection Issues

If wetlands or riparian areas are identified on a site proposed for development, ESH will develop specific mitigation, protection and/or management plans to be incorporated into the project program.

c. Cultural Resources Protection and Preservation Issues

If cultural resources (*Image IV-2*) are identified on a site proposed for development, ESH will develop specific mitigation, protection and/or management plans to be incorporated into the project program.

d. Water Quality Protection Issues

Water quality protection deals with both maintaining and improving the quality of water in the natural environment and as a source for potable water.

Specific water quality requirements will be developed for projects by ESH. General guidance to protect water quality include:

- Identify water pollution sources from development and operation of the site. Common site development sources of water pollution are:
  - runoff from parking lots and roads
  - concentrated rainwater runoff
  - pesticide, herbicide and fertilizer use
  - road and walkways de-icing activities
  - construction debris and materials
- Create prevention, mitigation and/or management plans for each water pollution source.
- Use best management practices to address water quality problems. A partial list of method for addressing water quality problems are:
  - constructed wetlands
  - water quality ponds and channels
  - erosion control measures (see pg. 24)
  - terrain management measures (see pg. 24)

Image IV-1: Endangered Species - Spotted Owl

Image IV-2: Cultural Resources - Omega Bridge

e. *Erosion Control Issues*

Advanced planning plays a significant role in effective erosion control. Erosion includes both water and wind erosion. General erosion control measures include:

- Develop an erosion control plan for all new development sites.
- Determine suitable locations for development and construction activities to avoid erosion.
- Identify erosion impacts caused by proposed actions on the erosion control plans. The erosion control plan may reveal potential impacts to adjacent sites and surrounding areas that affect the watershed areas beyond the installation boundaries. Wider impacts from erosion can be avoided, controlled, or mitigated.
- When erosion control vegetation is needed near high use, visually prominent areas, use ornamental plants able to withstand abuse from vehicles and pedestrians rather than native grasses and easily damaged vegetation.
- Incorporate some of the following strategies into the design of site improvements:
  1) Avoid increasing runoff.
  2) Slow runoff to allow percolation.
  3) Control the effects of water on steep slopes.
  4) Control drainage adjacent to buildings and structures.
  5) Design drainage channels to reduce and control runoff.
- Coordinate erosion control improvements with hydrologic and drainage requirements identified in the LEM.
- Identify soils that are highly susceptible to erosion in advance of any proposed actions.
- Identify best management practices and alternative methods for erosion control in each plan. A partial list of methods to consider are:
  1) *Surface controls*
     check dams (*Image IV-3*)
     straw bale barriers (*Figure IV-16*)
     riprap
     revegetation
     vegetative bioengineering (Figure *IV-17*)
     sediment fences and materials
     soil cement or stabilizers
     sediment ponds
     parallel grade swales (*Figure IV-73*)
  2) *Subsurface controls*
     mat and grid systems
     underground drainage systems.

f. *Terrain Management Issues*

Terrain management involves the prevention of soil and earth movement and loss from development activities. Management methods include retaining walls, terraced grading, cut and fill slope maximums. Erosion control measures are often used for terrain management.

Figure IV-16: Erosion Control - Straw Bale Barrier

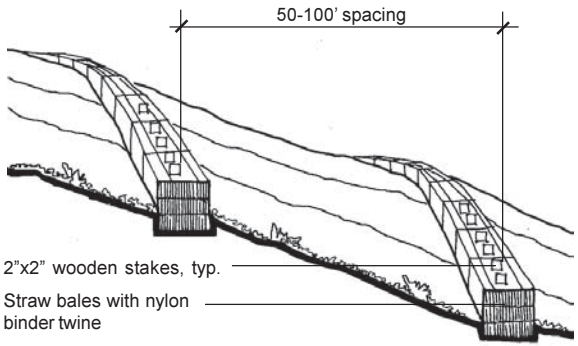


Figure IV-17: Erosion Control - Bank Stabilization

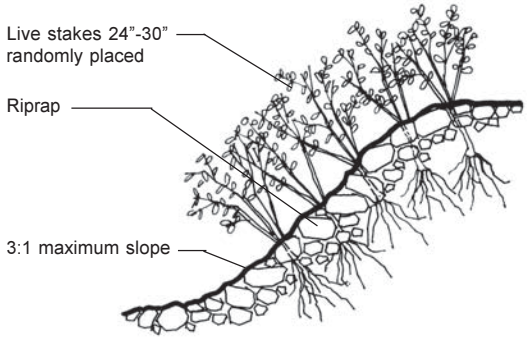


Image IV-3: Erosion Control - Check Dams

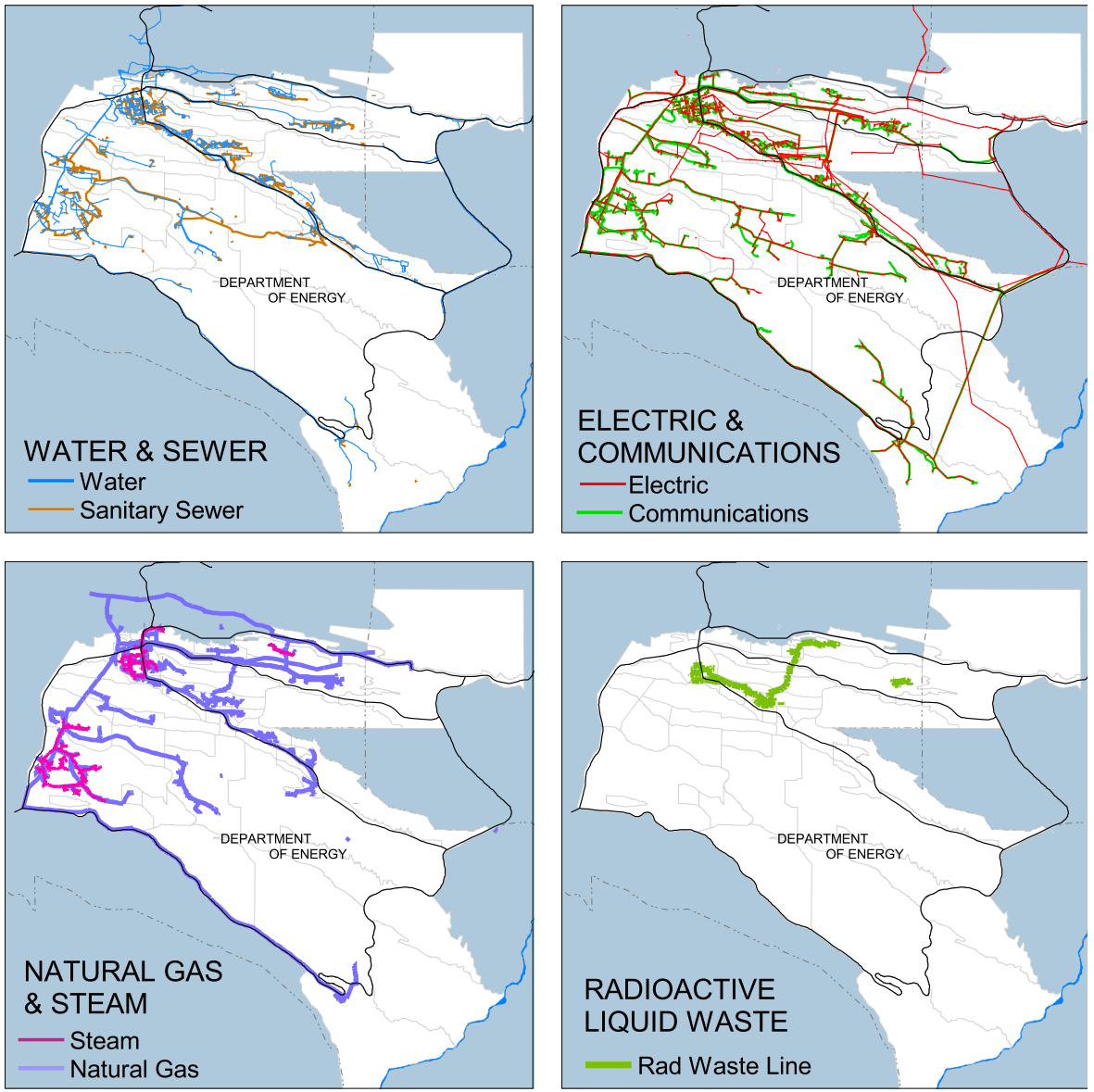
9. Utilities And Utility Corridors

Utilities supply critical services such as water, power, natural gas, steam, sewage treatment, telephone and communications services, and stormwater runoff. Their development impacts all sites. With proper coordination and placement, utilities improvements can be visually compatible and contribute to an attractive Laboratory environment.

Guidelines

- Use utilities corridors identified in the *CSP, ADPs* and *Specific Area Master Plans*. *Figure IV-18* shows site-wide corridors.
- Develop a long-range program to place selected above ground utilities underground. Priorities can be based on the benefits to be realized such as operational cost savings, safety, security and visual improvements. Placing utilities underground is a safeguard during potential fire events.
- Place utilities underground on new projects.
- Integrate utility development with the planning of future structures, roads and pedestrian walkways.
- Develop an organized system of utility locations for each project that anticipates and allows access for maintenance, periodic repair/upgrading, or replacement.
- When utilities are located above ground, reduce their visual impact by using non-reflective materials and screening with planting, walls or fencing.
- Locate above ground structures away from public view when possible.

Figure IV-18: Site Wide Utility Corridor Map



- Place fire hydrants in clearly visible locations and maintain access to hydrants.
- Closely coordinate the placement of utilities within the streetscape to avoid conflicts. Plant materials, paving, site furnishings, signs and light fixtures should not complicate access for utility maintenance.
- Conceptual locations of utilities as related to roads and pedestrian corridors are illustrated in *Figures IV-19, IV-20 and IV-21*.

Figure IV-19: Urban Arterial - Utility Corridor Section

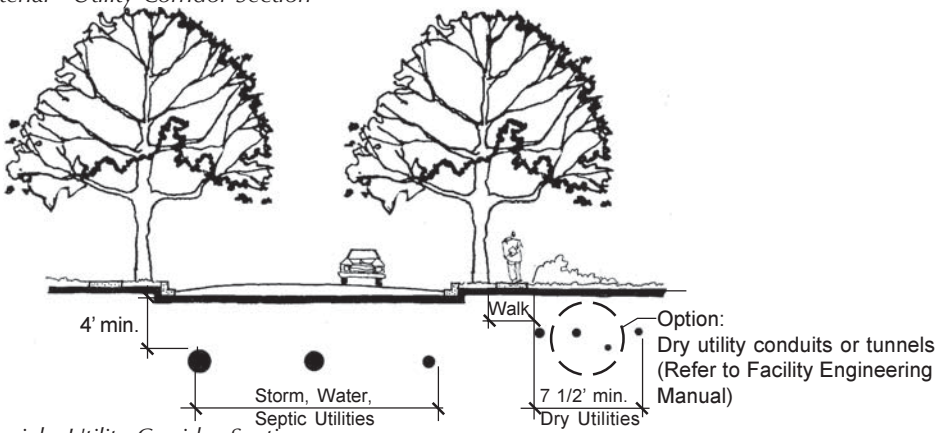


Figure IV-20: Rural Arterial - Utility Corridor Section

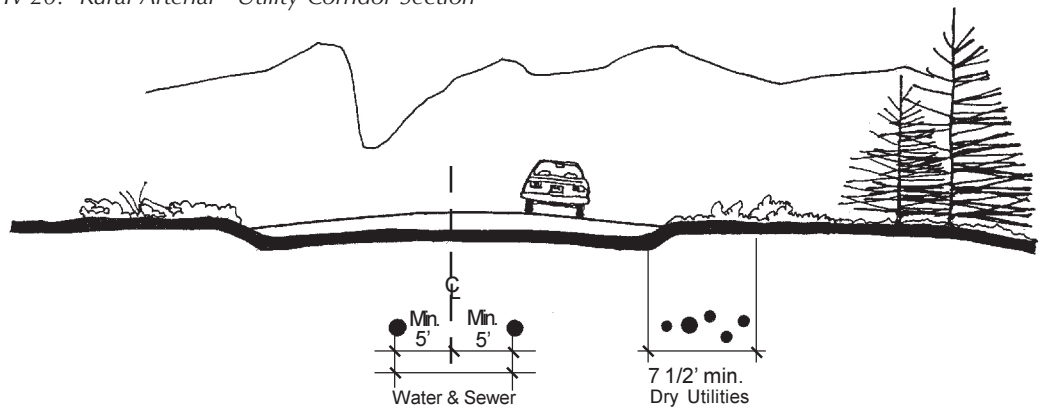
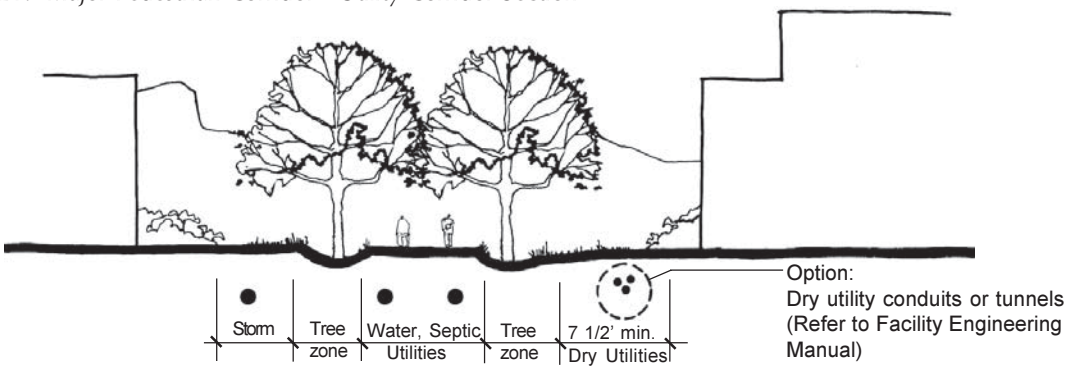


Figure IV-21: Major Pedestrian Corridor - Utility Corridor Section



IV. GUIDELINES FOR SITE DESIGN

B. CIRCULATION

B. CIRCULATION

Introduction

The circulation network structures the pattern and flow of pedestrians and vehicles at the Laboratory. It determines routes and travel modes in which people, goods and services access and traverse the site. The circulation network also plays a crucial role in the Laboratory's emergency response system.

The following systems comprise the Laboratory's circulation network:
- road
- parking
- transit
- bicycle
- pedestrian

Principles

Design principles for the circulation network are:

- The circulation network should be a balanced transportation network that accommodates automobiles, bicycles, transit and pedestrians.
- The circulation network should incorporate emergency response needs into the design of the network and its components.
- Landscaping, signage, lighting, security and safety needs should be integrated into the design standards for the circulation network.
- The circulation network should coordinate and link with off-site automobile, pedestrian, bicycle and transit systems of the State of New Mexico, Los Alamos County, and others entities that are contiguous with the Laboratory.

References

The following Laboratory and industry standards or guidelines should be referenced in the design of the circulation network.

CSP
Comprehensive Site Plan 2000 and supplement CSP 2001

ADP
Area Development Plans

LEM
LANL Engineering Manual

AASHTO
American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets 1990 and 1994.

UFAS
Uniform Federal Accessibility Standards

AASHTO/GDBF
Guide for the Development of Bicycle Facilities

NFPA
National Fire Protection Act

The following are related sections within the *Design Principles* that should be referenced:
Section IV-Landscape Elements – Signage
Section IV-Landscape Elements – Lighting
Section IV-Landscape Elements – Planting

1. Road System

The Laboratory road system consists of five road classifications:

– Major Arterial
  Rural
  Urban
– Transit Road
– Collector
– Local Street
– Service-Emergency Access

Principles

Develop the road system based on the following principles:

- The road system should have a clear hierarchy and form a complete network.
- The road system should address road design needs for emergency response and safety that are unique to the Laboratory.
- The road system should separate pedestrians and bicyclists from vehicular traffic.
- The road system should follow standards for streetscape development including setbacks, buffers, landscape, lighting and signage.

The matrix (*Table IV-1*) below identifies road classifications cross-referenced for design speeds, lane widths, road easements, road related pedestrian, bike and transit improvements, and landscape planting mix.

Table IV-1: Roadway Classifications

Roadway Classifications										
Roadway Classification	**Design Speeds** (miles per hour)	**Traffic Lanes**	**Traffic Lane Width**	**Median /Width**	**Corner Radius**	**Road Easement Width**	**Bike Lane Class** (see pg. 52)	**Sidewalk Width Location**	**Landscape** (see Appendix)	**Transit Facilities**
Major Arterial Rural	45	4 + up	12 ft.	Optional	15 ft. min.	100-120 ft.+	class 2	6ft. min. one side	Natural native plants	yes
Major Arterial Urban	35	4 + up	12 ft.	12 ft.	15 ft. min.	100-120 ft.+	class 2	6 ft min. both sides	Formal urban xeric	yes
Transit Road	25	2 - 4	12 ft.	Intersections only	15 ft. min.	60-80 ft.	class 2	8 ft. min. both sides	Formal urban xeric	yes
Collector Roadway	30	2	12 ft.	No	15 ft.	60-80 ft.	class 2	6 ft. min. one side	Informal xeric	yes
Local Street	25	2	11 ft.	No	15 ft.	50 ft.	no lane	5 ft. min. both sides	Base on context urban/rural	option
Service - Emergency Access	10	1-2	12 ft.	No	15 ft.	20 ft.	no lane	n/a	n/a	no

a. Major Arterial

There are two categories of major arterials designated for the Laboratory—urban and rural. Each category is determined by the location and proximity of the arterial to development density.

Rural major arterials include:

- Pajarito Road
- East Jemez Road
- West Jemez Road outside TA-03

Urban major arterials include:

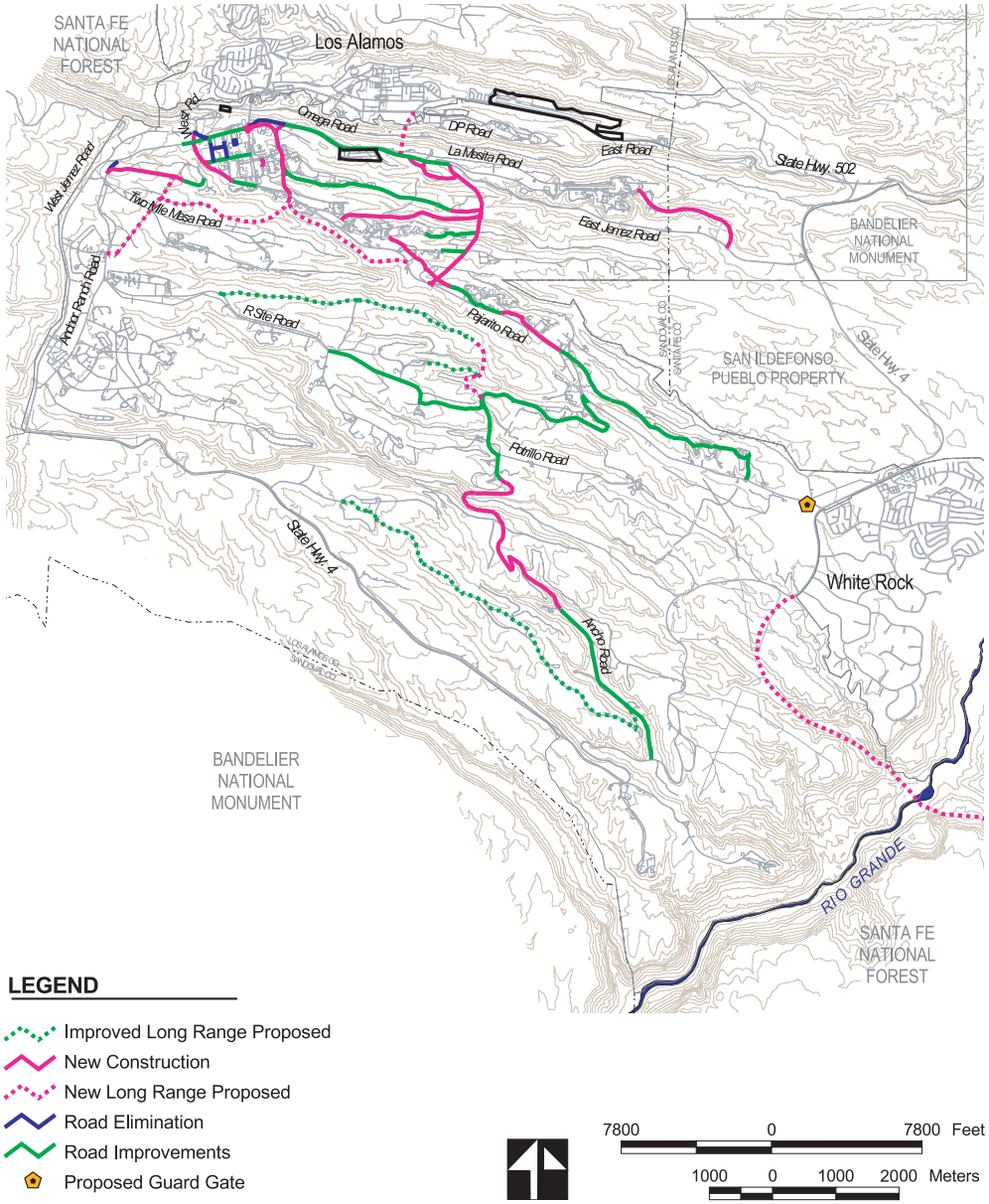
- Future east loop road at TA-03
- Future west loop road at TA-03
- West Jemez Road within TA-03

Arterials are the primary entrance roads to the Laboratory. The quality of the road design, the ease of wayfinding and the aesthetics of these roadways are important to the Laboratory's image and function.

Arterials play a major role in the Laboratory's emergency evacuation systems. To support this life-safety function, clear and consistent marking of emergency routes, and construction to accommodate high traffic volumes are important design considerations.

Figure IV-22 illustrates the long-range sitewide road system for the Laboratory.

Figure IV-22: Long-Range Sitewide Roadway System Plan



1) Major Arterial - Rural

Rural major arterials connect the edges of the Laboratory to the core area. They often extend through undeveloped areas and are the primary vehicular links between the dispersed tech areas across the site.

Rural major arterials are designed to accommodate significant traffic volumes and be primary emergency evacuation routes. The landscape standards for this road emphasize retaining the natural landscape and using native plant materials to enhance the natural setting.

Rural major arterials include:

- **Pajarito Road**
- **East Jemez Road**
- **West Jemez Road outside of TA-03**

Guidelines

a. Roadway

- 100 to 120 ft. wide road easement.
- Four or more traffic lanes.
- Standard curbing on medians, flat curb or shoulder at edges.
- Bike lanes on both road edges.
- Minimum 6 ft. wide pedestrian walk or trail on one side of road.

b. Intersections

- Acceleration, deceleration and left-turn lanes at intersections.
- Tech area locator signs and landscaping at intersection with arterial roads and collector roads.
- Striped pedestrian crossings at intersections.

c. Building and Parking Setbacks

- Buildings setback a minimum of 75 ft. from edge of road easement recommended.
- Parking lots setback a minimum of 50 ft. from road easement or buffered by landscaping to arterial road.

d. Streetscape

- Laboratory monument signage and image features at all site entry points.
- Transit stops near intersections with collector roads to tech areas.

e. Landscape

- Revegetate roadsides with native trees, shrubs and grasses.
- Extremely drought-tolerant plants or native plants for intersection landscaping.

See Road Classifications *Table IV-1* and *Figures IV-23* and *IV-24*.

Figure IV-23: Major Arterial - Rural / Plan View

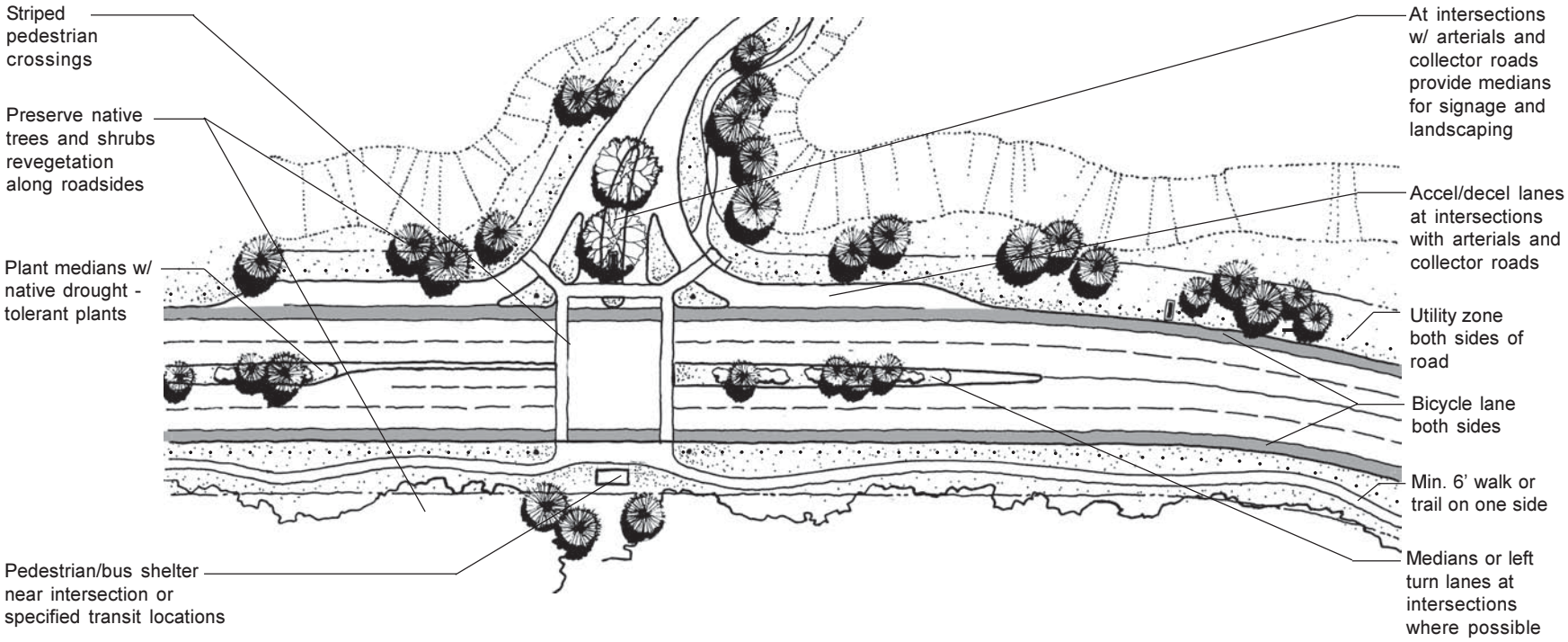
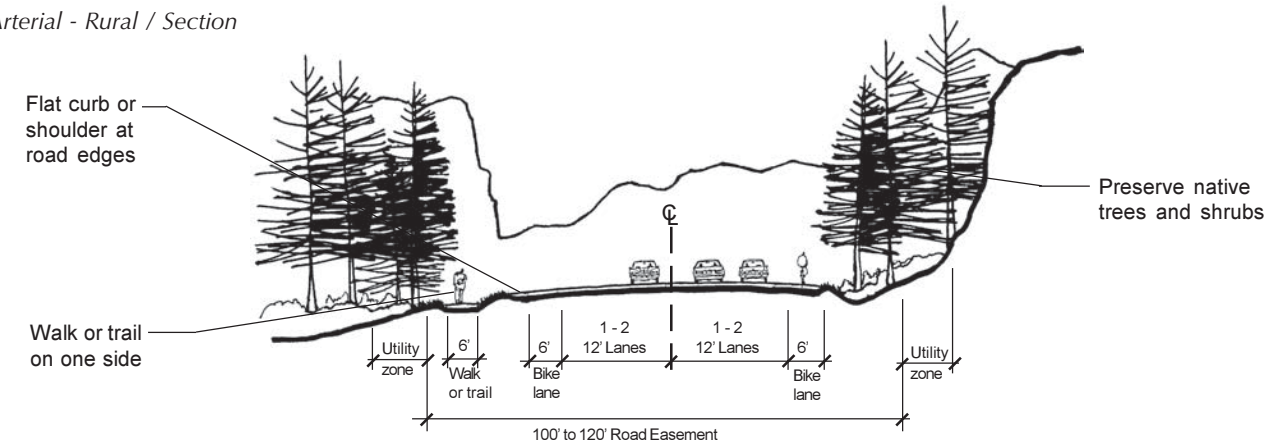


Figure IV-24: Major Arterial - Rural / Section



2) Major Arterial - Urban

Urban major arterials are the future perimeter circulation routes planned for the core planning area. They will be important visitor and public access routes. They will define the boundaries of the urban core of the Laboratory and are to be designed to have an urban quality streetscape.

Urban major arterials are integral to the safety and security plans of the Laboratory. They route high-volume traffic away from secure scientific locations within the core planning area. Controlled intersections, major directional signage and prominent pedestrian, bike and transportation improvements and landscaping are part of the design feature of this road type.

Urban major arterials are:

- **Future East Loop Road at TA-03**
- **Future West Loop Road at TA-03**
- **West Jemez Road within TA-03**

Guidelines

a. Roadway

- 100 to 120 ft. wide road easement.
- Four or more lanes of traffic.
- Center median, minimum of 12 ft. wide.
- Bike lanes on road edges.
- Standard curb and gutter at road edges and medians.
- Minimum 6 ft. wide pedestrian walks or trails on both sides of road.

b. Intersections

- Separate intersections a minimum of 300 ft. centerline to centerline.
- Acceleration and deceleration lanes at intersections.
- Medians on the secondary streets that intersect with urban arterials.
- Specialty paving to mark pedestrian crossings.

c. Building and Parking Setbacks

- Minimum 50 ft. building setback from the edge of road easements recommended.
- Minimum of 25 ft. parking lot setback from edge of road easement.

d. Streetscape

- Laboratory monument signage and image features incorporated at selected major intersections.
- Transit stops as sited by PM-1.

e. Landscape

- Formal arrangement of deciduous shade trees in center median.
- Informal clusters of native evergreens and flowering trees at street edges.
- Berms and informal groupings of tall evergreens with native and drought-tolerant shrub masses to screen parking.
- Intersections planted with clusters of flowering trees and flowering shrubs.

See Roads Classifications *Table IV-1* and *Figures IV-25 and IV-26*.

Figure IV-25: Major Arterial - Urban / Plan View

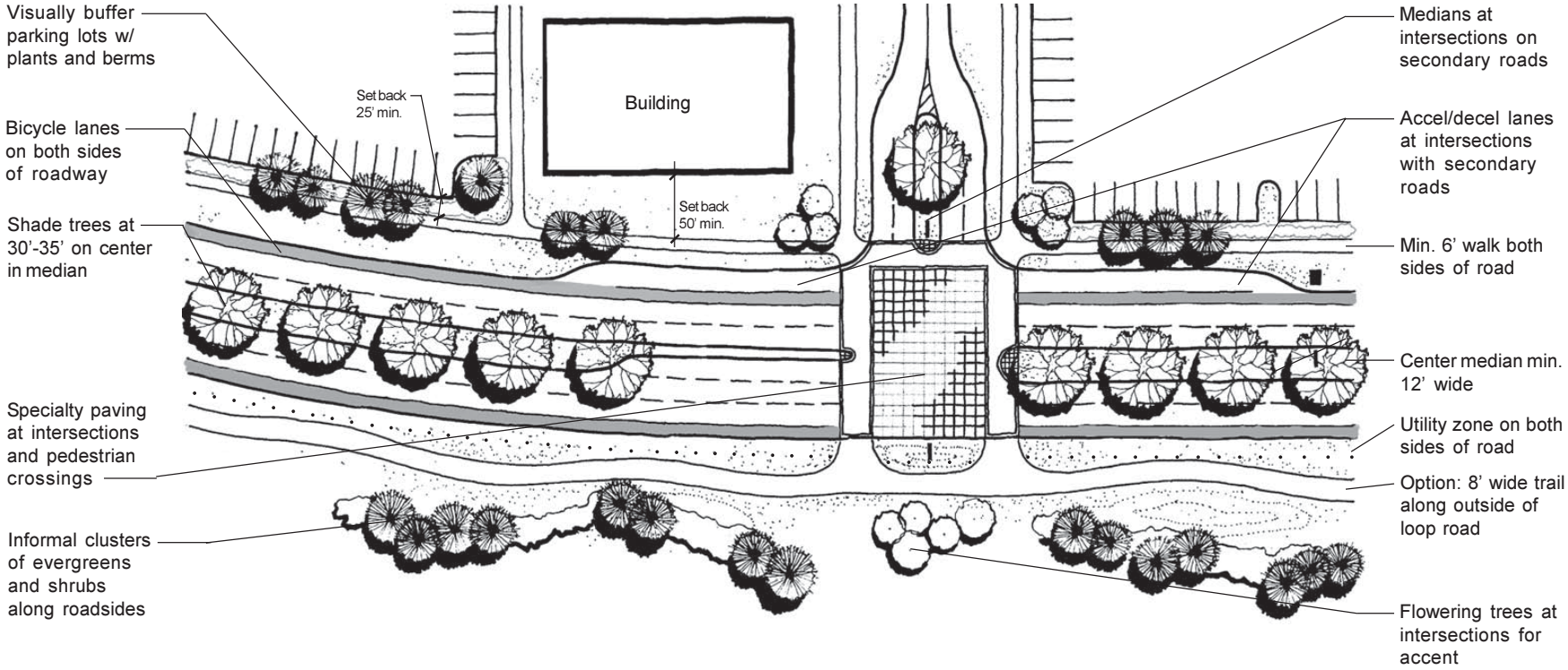
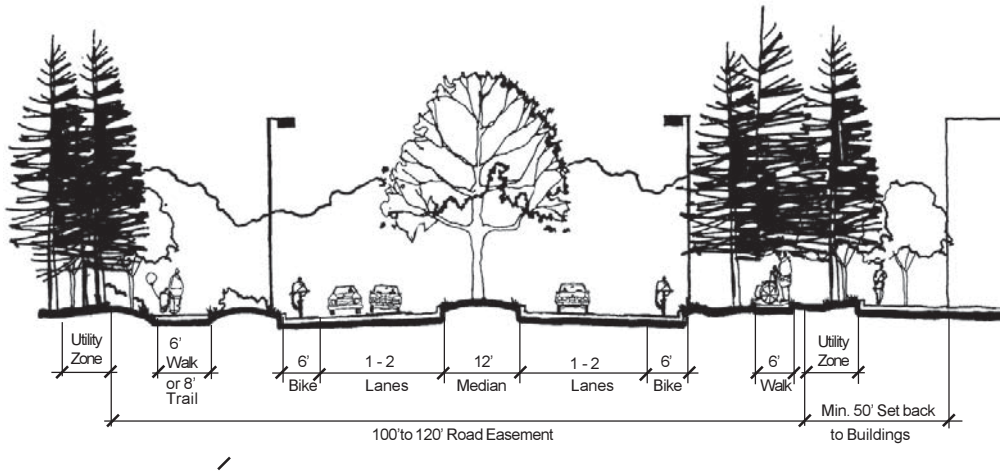


Figure IV-26: Major Arterial - Urban / Section



b. Transit Road

The transit road is a future transit-focused roadway within the TA-03 core area. The intent is to create a well-developed transit-oriented street to encourage the use of a future shuttle or transit system. Non transit traffic may be limited or controlled on this roadway.

The transit road is limited to Diamond Road and West Bikini.

Guidelines

a. Roadway

- Two lanes, 12 ft. lanes.
- 60 - 80 ft. wide road easement.
- Standard curb and gutter at road edges.
- Bike lane on both road edges.
- 8 ft. wide walks on both sides of road.

b. Intersections

- Specialty paving at pedestrian crossings.
- Medians and acceleration/deceleration lanes at intersections with major arterials.
- Gated and monitored entries at selected intersections may be required.

c. Building and Parking Setbacks

- Minimum 30 ft. building setback from road easement.
- Minimum 15 ft. parking setback from road easement.

d. Streetscape

- Emphasize transit signage and transit stops.

e. Landscape

- Shade trees and shrubs in formal pattern.

See Road Classifications *Table IV-1* and *Figures IV-27 and IV-28*.

Figure IV-27: Transit Road / Plan View

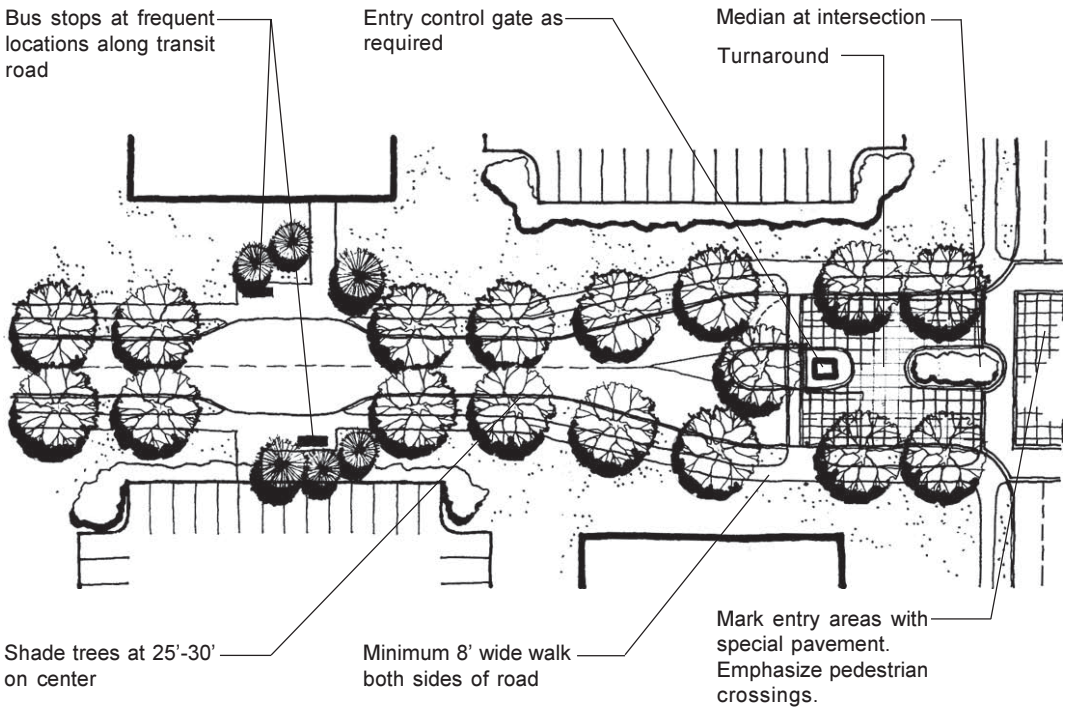
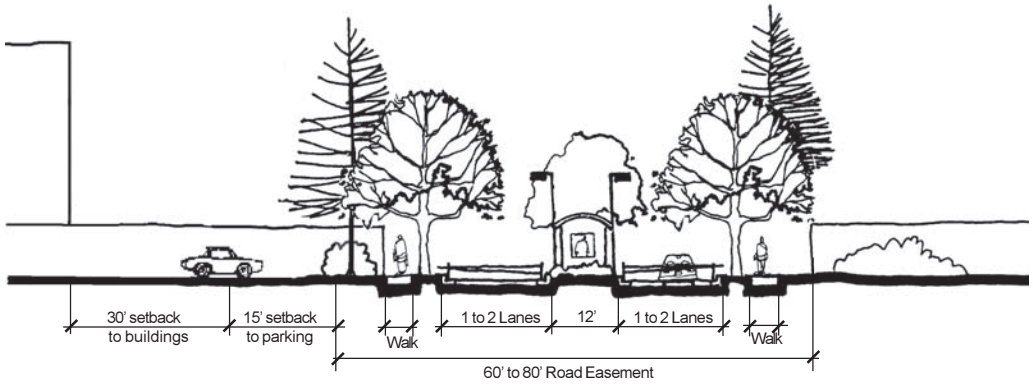


Figure IV-28: Transit Road / Section at Control Gate Area



c. Collector

Collector roads convey traffic between the Laboratory's major arterials and technical areas. The collector is the highest road classification in most areas outside the TA-03 Core.

Collector roads include ***La Mesita Road, Pecos Drive*** and ***Mesa del Buey Road*** among others.

Guidelines

a. Roadway

- 60 to 80 ft. wide road easement.
- Flat curb or shoulder at edges, curb and gutter on medians.
- Bike lanes on both road edges.
- 5 ft. wide pedestrian walk or trail on at least one side.

b. Intersections

- Acceleration and deceleration lanes at intersections with major arterials.
- Intersections and crossings striped for pedestrians.

c. Building and Parking Setbacks

- Minimum 30 ft. buildings set back from edge of road easement.
- Minimum 15 ft. parking lots set back from edge of road easement.

d. Streetscape

- Transit stops at high population clusters.

e. Landscape

- Informal arrangements of deciduous and evergreen trees, incorporating existing natural vegetation where possible.

See Road Classification *Table IV-1 and Figures IV-29 and IV-30*.

Figure IV-29: Collector Roadway / Plan View

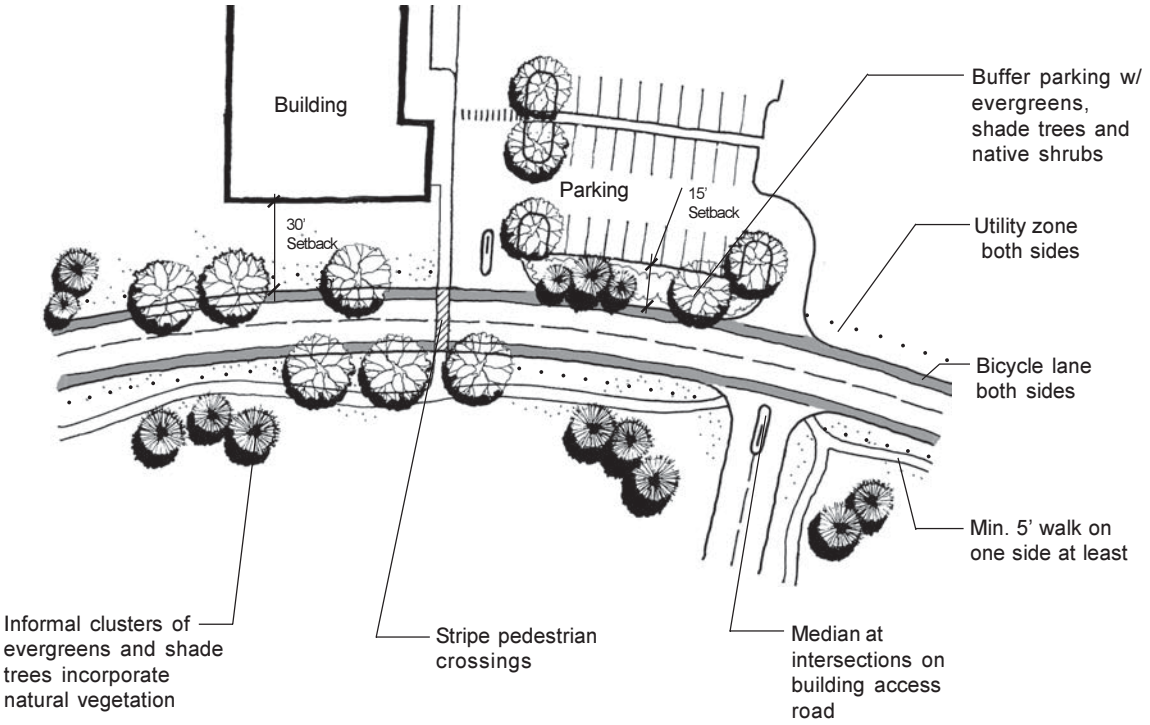
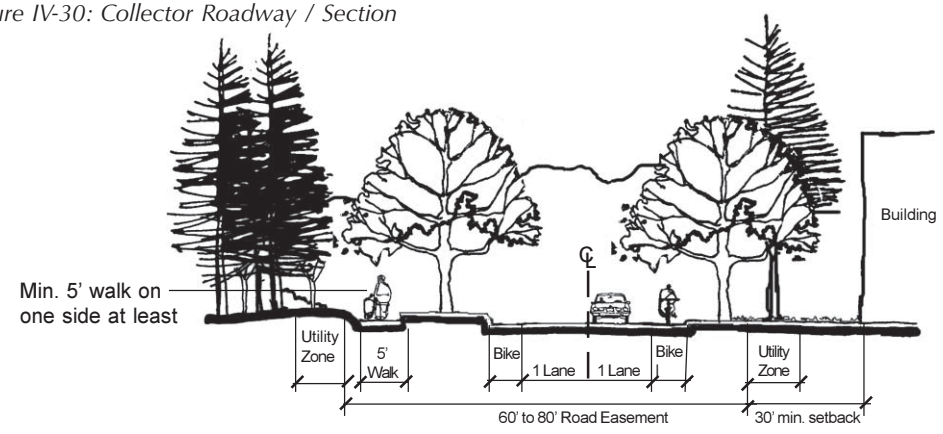


Figure IV-30: Collector Roadway / Section



d. Local Street

Local streets are primarily located in the TA-03 core planning area. Local streets are meant to compliment the pedestrian scale in TA-03 and in more developed settings at other TAs. Examples of local streets at the Laboratory include ***Bikini*** and ***Eniwetok*** in TA-03.

Guidelines

a. Roadways

- 50 ft. wide minimum road easements.
- Standard curb and gutter at road edges.
- No medians.
- Pedestrian walks on both sides of the road.

b. Intersections

- Intersections marked for pedestrian crossings.
- Intersections in urban areas of high visibility should use specialty paving at crossings.

c. Building and Parking Setbacks

- Minimum 25 ft. building setback from edge of road easement.
- Minimum 10 ft. parking setback from edge of road easement.

d. Streetscape

- Building cluster and building signage.
- Transit stops at building clusters.

e. Landscape

- Formal arrangement of deciduous trees along street edges.
- Mix of flowering, shade and evergreen trees and shrubs to buffer parking lots along streets.

See Road Classifications *Table IV-1* and *Figures IV-31 and IV-32*.

Figure IV-31: Local Street / Plan View

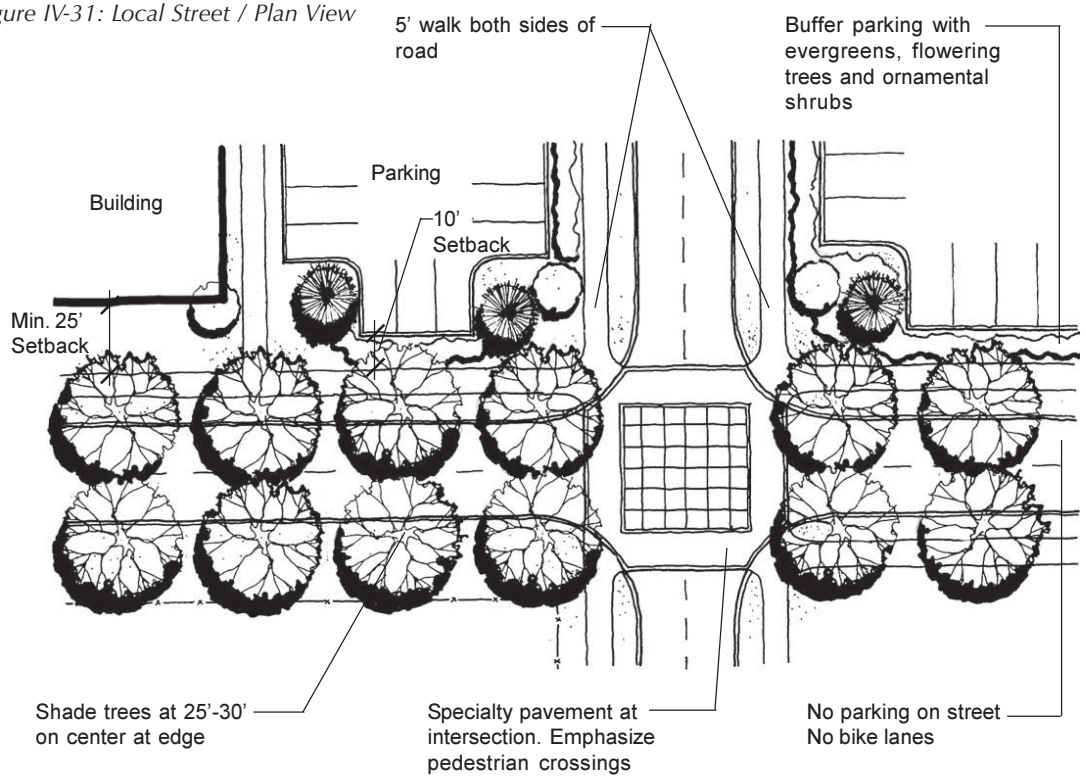
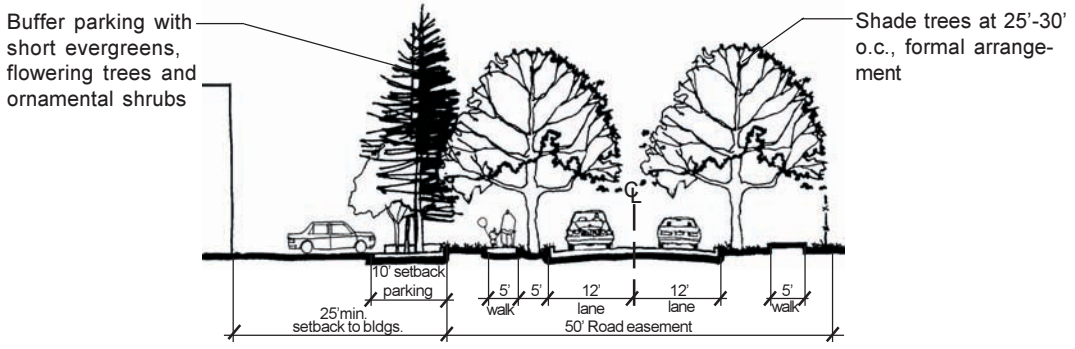


Figure IV-32: Local Street / Section



e. *Service-Emergency Access*

Service and emergency access roads provide maintenance, service and secondary emergency access. They are used primarily by maintenance and delivery personnel. These roads are usually paved but may be unpaved in low traffic areas.

Guidelines

a. Roadway

- 20 ft. wide minimum road easement.
- Minimum 12 ft. paved road bed.
- Minimum 16 ft. vertical clearance above road bed.
- Standard curb and gutter if in urban zone.
- Reverse crown allowed with approval from the Laboratory.
- No medians.
- Preferred grades of less than 5.0 % in travel direction and maximum 2.0% cross slopes.
- Turning radii per needs of service and emergency vehicles.

b. Intersections

- Safety mirrors or other safety aids at intersections with inadequate clear sight triangle (See *Figure IV-34)*.
- Stripe pedestrian crossings.

c. Building and Parking Setbacks

- Minimum 5 ft. building setback from edge of road easement.
- Minimum 5 ft. parking lot setback from edge of road easement.
- Parking along road not allowed.

d. Streetscape

- Service and/or emergency access signage.

e. Landscape

- None required.

See Road Classification *Table IV-1* and *Figures IV-33, IV-34, IV-35 and IV-36*.

Figure IV-33: Firetruck Turnaround

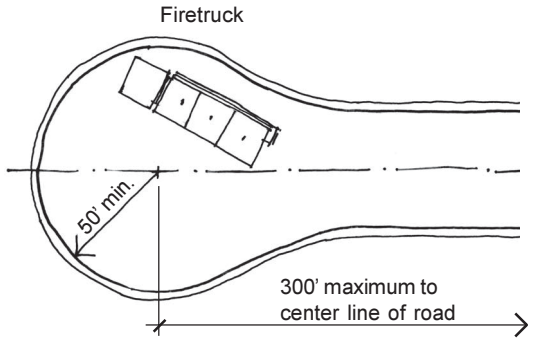


Figure IV-34: Clear Sight Triangle

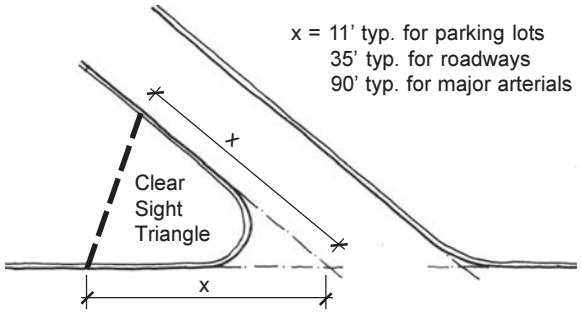


Figure IV-35: Service-Emergency Access Road / Plan

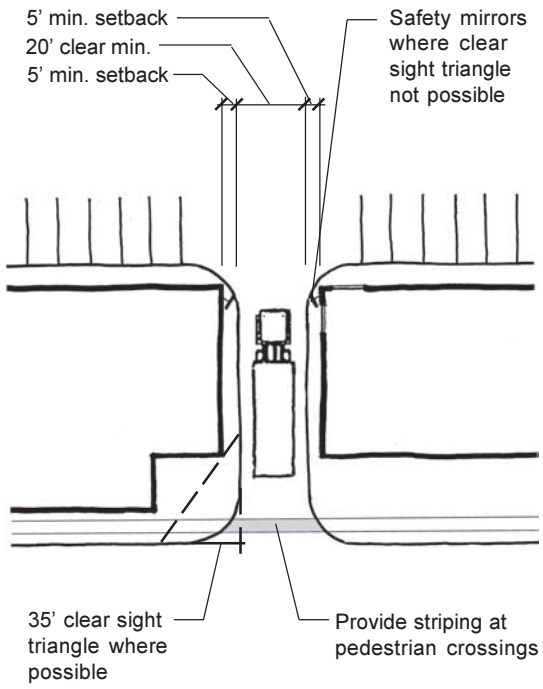
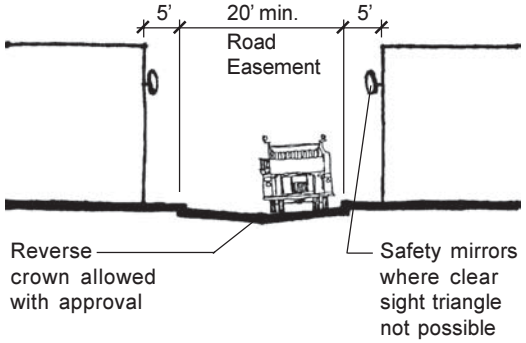


Figure IV-36: Service-Secondary Access Road / Section



2. Parking System

Parking is one of most consumptive land uses at the Laboratory. The *Comprehensive Site Plan* concept is to move parking to the perimeter of developed areas and to encourage transit use from the parking areas to the building complexes. This would create opportunities to develop a denser, more walkable, more secure Laboratory environment.

The *Design Principles* support this change with guidelines that link transit facilities with parking lots, create safe walking routes within lots, and encourage siting of lots to make transit routes more efficient and viable.

Principles

- The parking system should coordinate parking lots and structures with the land use goals in the *ADPs* and *Specific Area Master Plans.*
- Parking structures should be developed in densely populated areas of the Laboratory to reduce the land used for parking and to preserve areas for future development.
- The parking system should incorporate transit connections to encourage transit use.
- The parking system should encourage smaller connected parking lots instead of single large lots.
- The parking system should accommodate a variety of parking needs: automobiles, service vehicles, motorcycles, bicycles and handicap accessible stalls.
- The parking system should provide clearly marked accessible pedestrian routes within lots.
- The parking system should include landscaping to improve the appearance of parking lots and to mitigate the negative environmental effects of parking lots.
- The parking system should be designed for water harvesting, runoff management, easy maintenance and snow removal.

a. General Parking Design Guidelines

1) Stalls

- For recommended types, quantities, and layouts for parking stalls see *Tables IV-2 and IV-3* and *Figures IV-37*, IV-*38, IV-39 and IV-40*.
- The preferred stall arrangement is 90-degree parking stalls with two-way drive lanes.

2) Setbacks

- Set back parking lots a minimum of 40 ft. from existing buildings. Conversely, locate new buildings a minimum of 40 ft. from existing parking lots.
- Provide roadway setbacks according to the Road Classifications matrix (*Table IV-1*).

3) Layout

- Provide a minimum 10 ft. wide parking median for every six parking rows.
- Avoid dead end parking aisles.

4) Entry Drives

- Provide two-way, 24 ft. wide driveways to parking lots.
- Avoid one-way entries and exits as they require two curb cuts at the street.
- Provide visibility for safe entrance and exit of motorists in accordance with AASHTO standards for intersection visibility.
- Provide a clear sight zone at intersections within the parking lot. The clear site zone is between 3 and 8 ft. above the gutter line and within an 11 ft. clear sight triangle. See *Figure IV-34* clear sight triangle example.

5) Emergency/Fire Access

- Design designated emergency and fire access lanes within parking lots to be:
  - 24 ft. wide if no parking is on either side
  - 30 ft. wide if parking is on one side
  - 36 ft. wide if parking is on both sides

6) Paving

- Pave permanent parking areas with asphalt, concrete, or pavers.
- Use curbs and gutters at the perimeter of the lot and at medians within the lots.

7) Drainage

- Drain parking lots into storm sewers where necessary.
- Create opportunities to harvest water into medians and adjacent planting areas. Water harvesting areas must be designed and planted to withstand occasional flooding.

8) Pedestrian Access

- Design safe and clearly marked pedestrian routes throughout the parking lot.
- Locate transit stops in close proximity to or within parking lots.

Figure IV-37: 90° Parking Layout

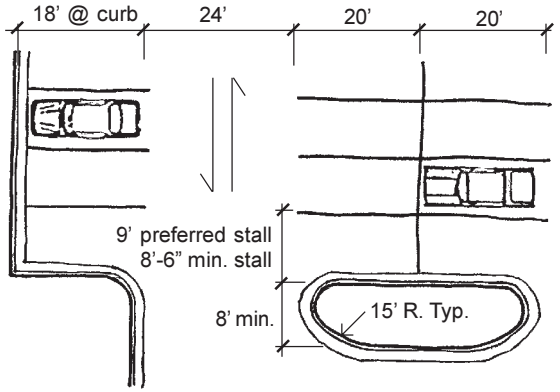


Figure IV-38: Angled Parking Layout

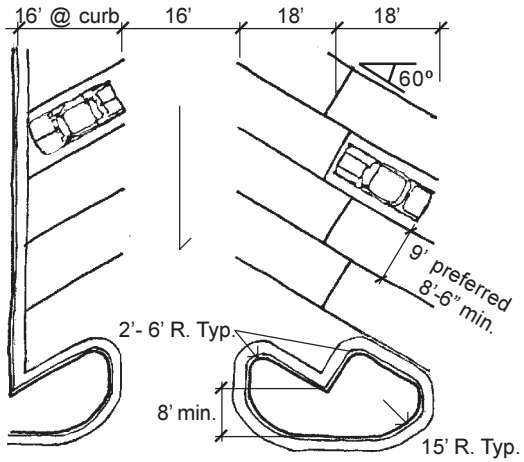


Table IV-2: Parking Stall Design Standards

Parking Stall Standards					
Car Type	**Angle** (degrees)	**Width** (ft.)	**Stall Length** (ft.)	**Number** (per 100 spaces)	**Location**
Standard Car	60	9	18	-	-
	90	9	20	-	-
	parallel	8	22	-	-
Handicapped Accessible	-	13	20	See *Table IV-3*	Max.150'ent.
EZ-GO Cart	-	9	6	-	-
Motorcycle	-	4	8	2	-
Medical	-	-	-	1	near entrances
Van	-	-	-	5	near entrances
Car Pool	-	-	-	5	near entrances
Visitors	-	-	-	-	near entrances
Govt. Officials	-	-	-	-	near entrances
Bicycles	-	2	6	10	near entrances

Figure IV-39: Accessible Stalls / Section

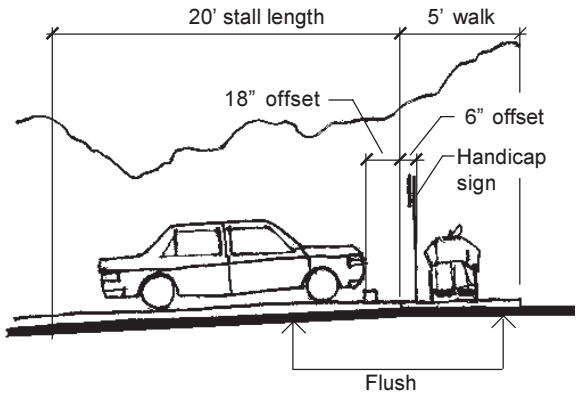
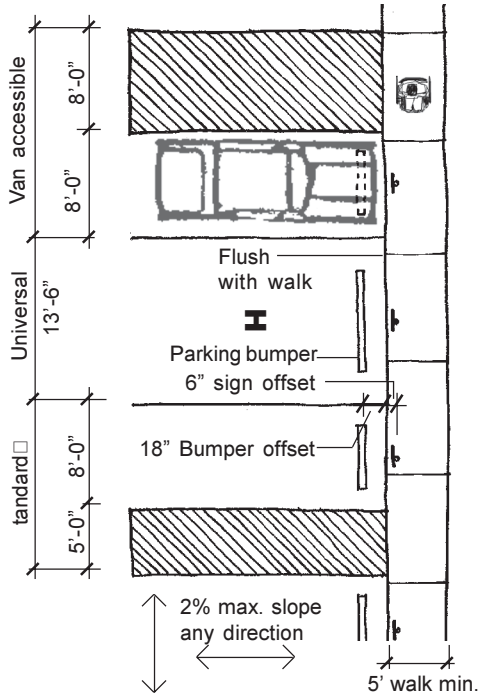


Figure IV-40: Accessible Stalls Layout



9) Parking Lot Landscaping

- Screen parking areas from roadways with berms, trees, shrubs and/or walls.
- Use planted medians to divide the parking lots into distinct sections and to accentuate entrances and the circulation pattern.
- Provide a minimum of one (1) planting area for every ten (10) parking stalls. The planting area should be within the paved perimeter of the parking lot and be a minimum of 8 ft. wide by the length of the adjacent parking stall. Each planting area should be planted with one (1) deciduous shade tree and shrubs.
- Preserve existing trees to screen and shade parking lots where possible, even at the expense of an additional parking space.
- Use evergreen trees for visual screening only in locations where they will not cause icing problems within the parking lot.

Table IV-3: Accessible Parking Space Requirements

Accessible Parking Space Requirements

Total Spaces	Required Accessible Spaces
1 - 25	1
26 - 35	2
36 - 50	3
51 - 100	4
100 - 300	8
301 - 500	12
501 - 800	16
801 -1,000	20

10) Parking Lot Lighting and Signage

- Conform with the *Design Principles* Lighting and Signage Sections. See Section IV-C.2 and .3.

b. Parking Lot Categories

Parking is accommodated currently in surface lots at the Laboratory. As readily developable land is diminishing sitewide, structured parking should be considered as an alternative in the more urban areas of the site.

Parking lot categories in use or planned at the Laboratory are:

- parking structures
- large parking lots - over 50 stalls
- small parking lots - 50 stalls or under
- service areas

c. Parking Structures

Parking structures are planned in the TA-03 revitalization and proposed in the Integrated Facilities Planning long-range development. Well designed parking structures can contribute positively to the architectural appearance of the Laboratory.

Guidelines

- Site parking structures in accordance with the relevant *Area Development Plan*.
- Design parking structures to compliment the architectural style of the surrounding buildings.
- Provide security access controls on all or portions of a parking structure as required.
- Parking sizes set forth in the Parking Stall Design *Table IV-2* are the preferred standards within a parking structure.

Images IV-4, IV-5 and IV-6 are examples of well designed parking structures using different exterior materials.

Image IV-4: Parking Structure Example - concrete panel

Image IV-5: Parking Structure Example - wire mesh panel

Image IV-6: Parking Structure Example - entryway

d. Large Parking Lots

Large parking lots accommodate more than 50 cars. Most large lots are located at the perimeter of densely developed areas of the Laboratory. Design large parking lots to include transit stops and shelters to support transit development. *Images IV-7* and *IV-8* illustrate improvements possible through application of the guidelines on a large scale parking lot.

Guidelines

- Incorporate all general parking lot design standards and landscape requirements.
- Subdivide large parking lots into smaller parking zones of 100 or less stalls. Use wide landscaped areas to separate the interior lots.
- Use end-of-row islands (a minimum of 10 ft. wide) to define circulation lanes. Maintain clear sight triangles in medians.
- Define access drives into large parking lots with 12 ft. wide landscaped medians on each side of the drive.
- Provide a minimum three car stacking length on driveways in parking lots with 100 or more parking spaces.
- Provide minimum 6 ft. wide sidewalks within or adjacent to large parking lots.
- Provide areas for stormwater detention and snow removal adjacent to the edges of the parking lot.

See *Figure IV-41* for an acceptable layout.

Figure IV-41: Large Parking Lot Layout - Plan

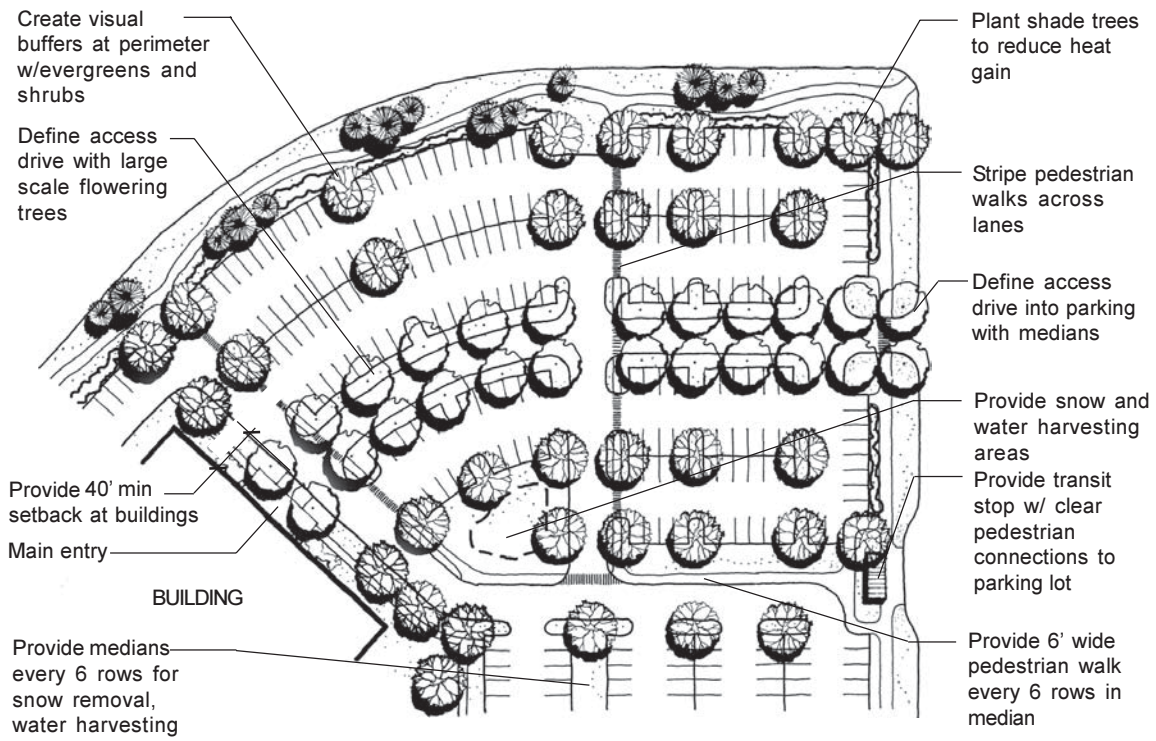


Image IV-7: Large Scale Parking - Existing

Image IV-8: Large Scale Parking - Applying Guidelines

e. *Small Parking Lots*

Small parking lots accommodate 50 cars or less. Small lots are widely distributed around the Laboratory and located in very close proximity to buildings on tight lots where space is at a premium. *Images IV-9* and *IV-10* illustrate improvements possible through application of the guidelines on a small parking lot.

Guidelines

- Incorporate all general parking lot design standards and landscape requirements.
- Select a location for shuttle or transit pickup that is near the building and parking lot to encourage transit use.
- Design minimum 8 ft. wide end-of-row islands to define vehicular circulation. Maintain clear sight lines in islands.
- Provide minimum 5 ft. wide sidewalks adjacent to the parking lot.
- Provide areas for stormwater detention and snow removal adjacent to the edges of the parking lot.
- On sites with minimal space for parking, building setbacks can be reduced to less than 20 ft. if approved in the siting notification process.

See *Figure IV-42* for an acceptable layout.

Figure IV-42: Small Parking Lot Layout - Plan

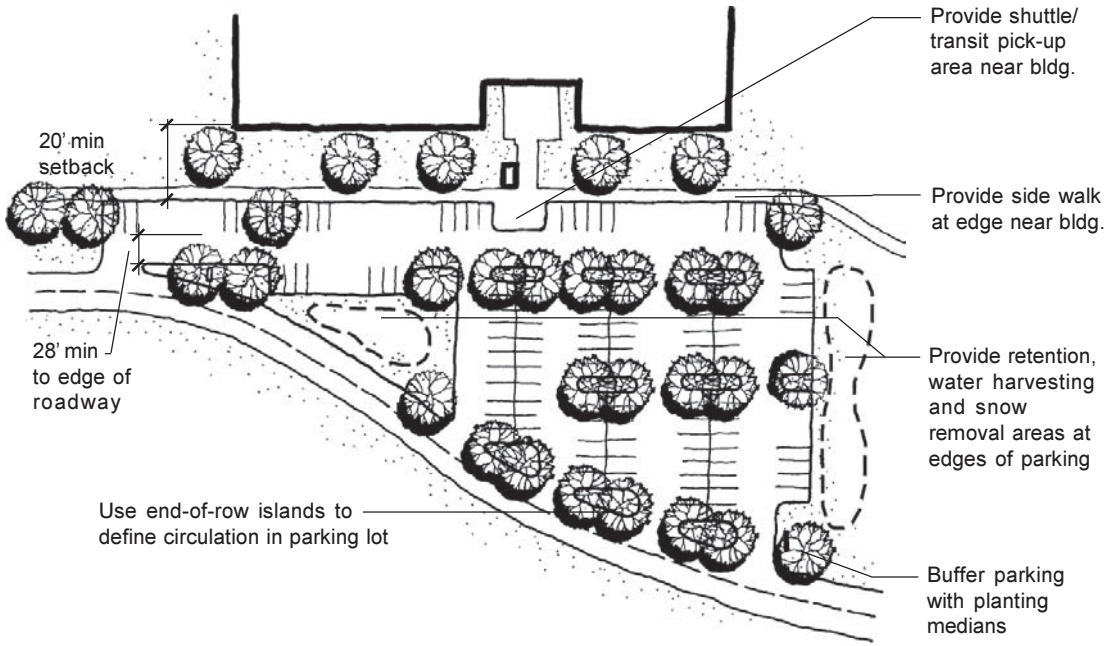


Image IV-9: Small Scale Parking - Existing

Image IV-10: Small Scale Parking Applying Guidelines

f. Service Areas

Service areas are not parking areas but often include limited parking for deliveries and maintenance operations. Screening and limiting access to these areas, when possible, improves the visual appearance and safety of the Laboratory (*Figures IV-43 and IV-44*).

Guidelines

- Do not locate service areas at main entries. Preferred locations are at the rear or sides of buildings.
- Share service and loading areas to building clusters whenever practical.
- Design service areas to accommodate the largest service vehicles anticipated for regular use of docks or turnaround space. Use 60 ft. outside wheel radius for truck turning layouts.
- Screen service areas where visible to roadways and pedestrian areas.
- Trash enclosure design criteria are:
  - 142 sq. ft. minimum
  - screen with solid masonry walls that are minimum of 5 ft. high and finished to be visually compatible with adjacent buildings
  - install safety barriers to protect walls and utility equipment.
- Design all service areas to accommodate fire apparatus access, positioning and turnaround per NFPA 1141
- Clearly mark pedestrian routes within service areas.

Figure IV-43: Service Areas

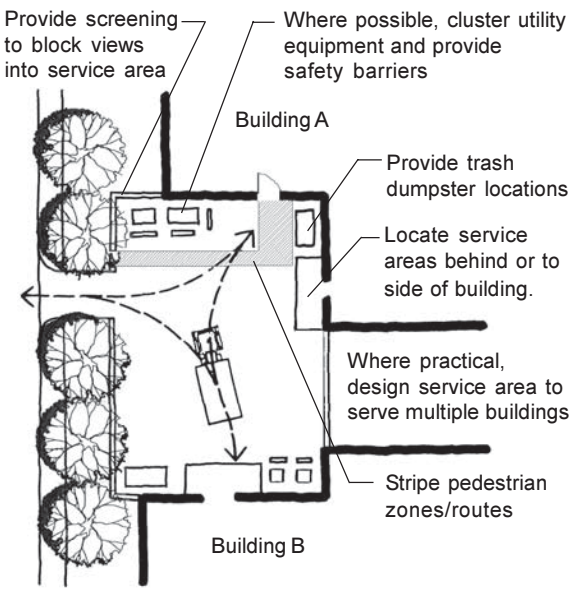
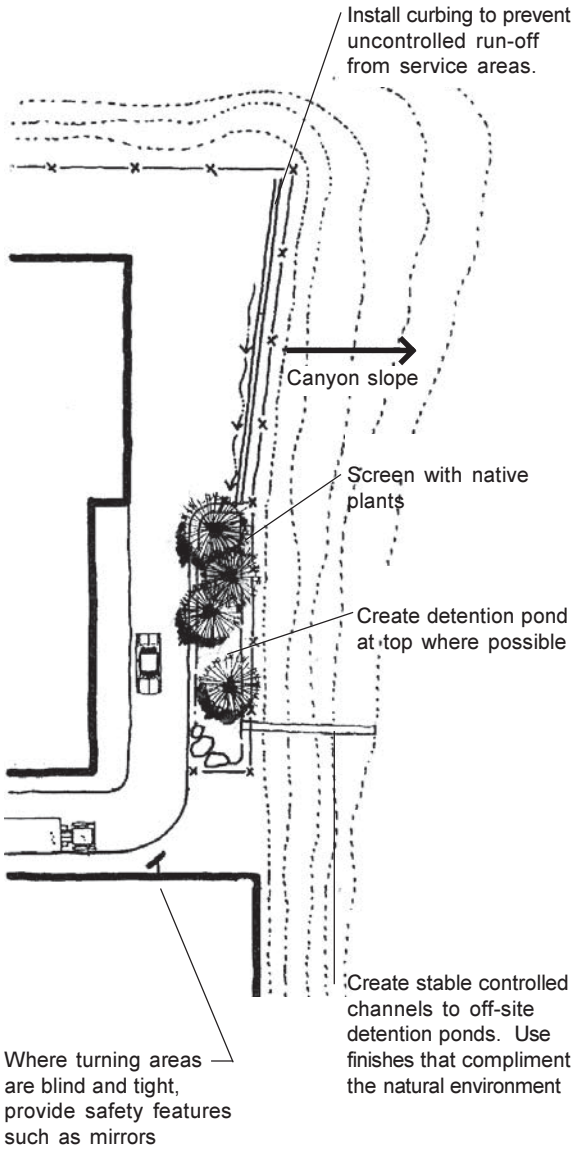


Figure IV-44: Service Areas At Canyon Edges



3. Transit System

Transit is an important element in the Laboratory's future circulation system. An efficient and easily accessible transit system reduces the need for parking and roads, improves air quality, and reduces energy consumption and traffic congestion.

Guidelines

- Plan transit improvements as part of the overall circulation system for the Laboratory.
- Implement transit facilities with new projects for sites, roads, parking and other site improvements.
- Site and design transit stops and shelters to be highly visible, accessible and attractive in order to encourage use.
- Insure that transit stops and vehicles accommodate individuals with disabilities.
- Provide amenities such as shelters, benches, bike racks, newspaper dispensers, telephones, night lighting and trash receptacles (*Figure IV-46*). Larger transit facility require more amenities (*Figure IV-45*).
- Site transit stops to avoid excess heat gain in the summer and to protect from winter winds (see *Figure IV-2* for wind information).

Figure IV-45: Major Transit Stop Layout / Plan View

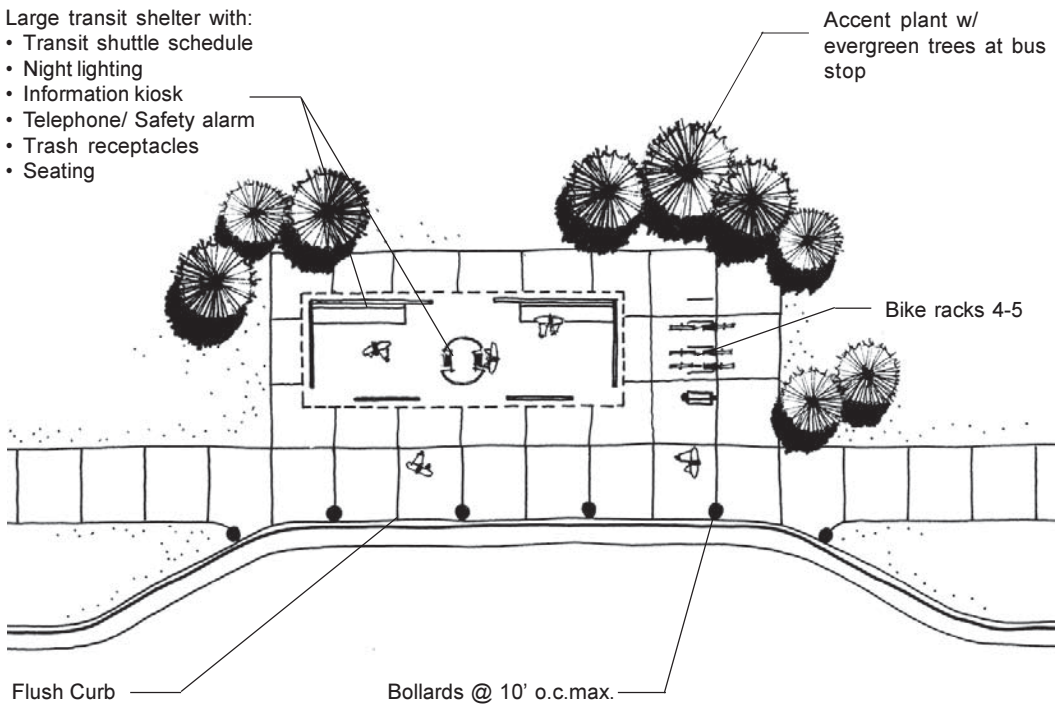
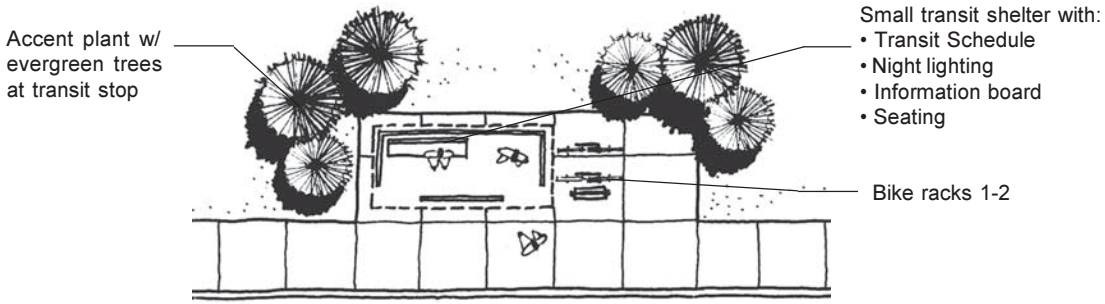


Figure IV-46: Minor Transit Stop Layout / Plan View



4. Bicycle System

Bicycles can be an effective alternate mode of transportation, especially when linked with transit services that have bicycle friendly amenities. Bicycle racks on transit vehicles are one such amenity. Transit vehicles with mounted bike racks allow a bicyclist to change to transit when weather is inclement or when distances are too great. Building in flexible travel modes is important to consider when planning the circulation network at the Laboratory.

a. AASHTO Classes of Bicycle Lanes

Class 1 - trail or path physically separated from roadways as well as pedestrian walkways with minimal crossflow by motorists (*Figure IV-47*).

Class 2 - designated bike lanes separated from adjacent motor vehicle traffic by separate lanes or striping (*Figure IV-49*).

Class 3 - designated bike route where motorists and bicycles share traffic lanes.

Guidelines

- Incorporate bicycle trails with utility maintenance access roads, secondary emergency routes and fire break lines. A minimum 12 ft. wide trail will serve both the access and bicycle needs.
- Integrate bicycle lanes with new roadways and roadway renovation projects, see Roads Classifications *Table IV-1* for coordination.
- Separate bike traffic from motorized vehicular traffic where possible.
- Separate bicycle and pedestrian traffic where possible. Design for the safety of both bicyclist and pedestrians when access is shared, see *Figure IV-48*.
- Provide parking for bicycles near building entries, parking lots and transit stops.

Figure IV-47: Class 1 Bicycle Trail

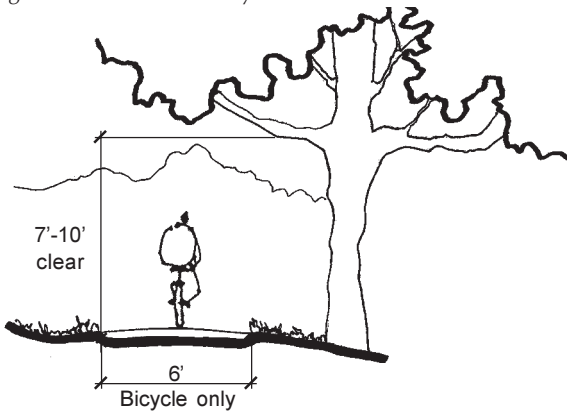


Figure IV-48: Class 1 Mixed Pedestrian / Bicycle Trail

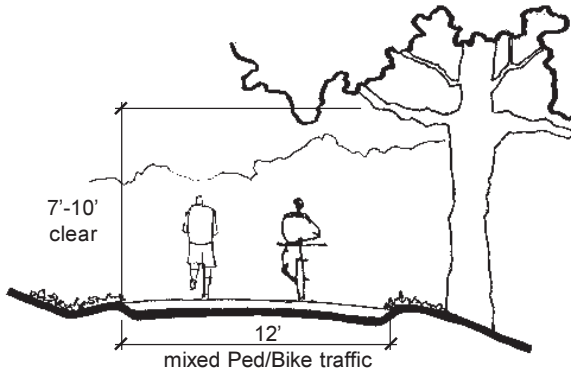
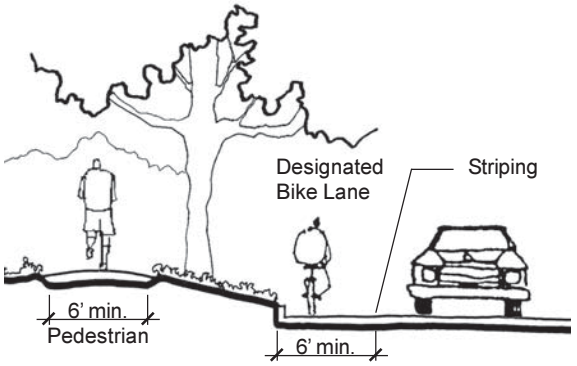


Figure IV-49: Class 2 Bicycle Trail



5. Pedestrian System

The Pedestrian system requires the development of attractive, comfortable and safe pedestrian spaces and corridors to encourage walking. Walking allows for informal personal interactions that stimulate the exchange of information and ideas between staff.

The Pedestrian system is composed of:

- Corridors and sidewalks
- Trails
- Plazas and courtyards

Principles

- To encourage use, the pedestrian system should emphasize the human scale and amenities including landscaping, seating, shelters, signage, lighting, and pedestrian security improvements.
- Pedestrian spaces and corridors should be developed within each technical area as integral elements of the *Area Development Plans* and *Specific Area Master Plans*.
- The pedestrian system should be a complete looped and connected system that accommodates a variety of pedestrian activities, including jogging and hiking.
- The pedestrian system should be separated from automobile and bicycle systems. Intersections with other circulation systems should be designed for safe pedestrian crossings.
- The pedestrian system should connect major activity areas, link to other distant work sites and the adjacent community, and access the surrounding natural canyons and forests.
- Pedestrian plazas and courtyards should be located in relationship to major pedestrian corridors, building entries, and areas of concentrated pedestrian activities.

a. Designing the Pedestrian System

Area Development Plans (ADPs) and *Specific Area Master Plans* propose the locations of activity and population centers at the Laboratory, and the conceptual layout of the pedestrian system to serve them.

The following example demonstrates how to apply the information from those plans to design the pedestrian system.

Figure IV-50 is an example from the *ADP* for the Core Planning Area. The area bounded by the orange line is an area in TA-03 where large building revitalization and development is now in process. This area is used in the following example.

Figure IV-51 extracts the conceptual walkway system based on the *ADP* guidance. The concept diagram establishes the hierarchy of walks anticipated for the area.

Figure IV-50: Core Area Development Plan with Enlargement Area of TA-03

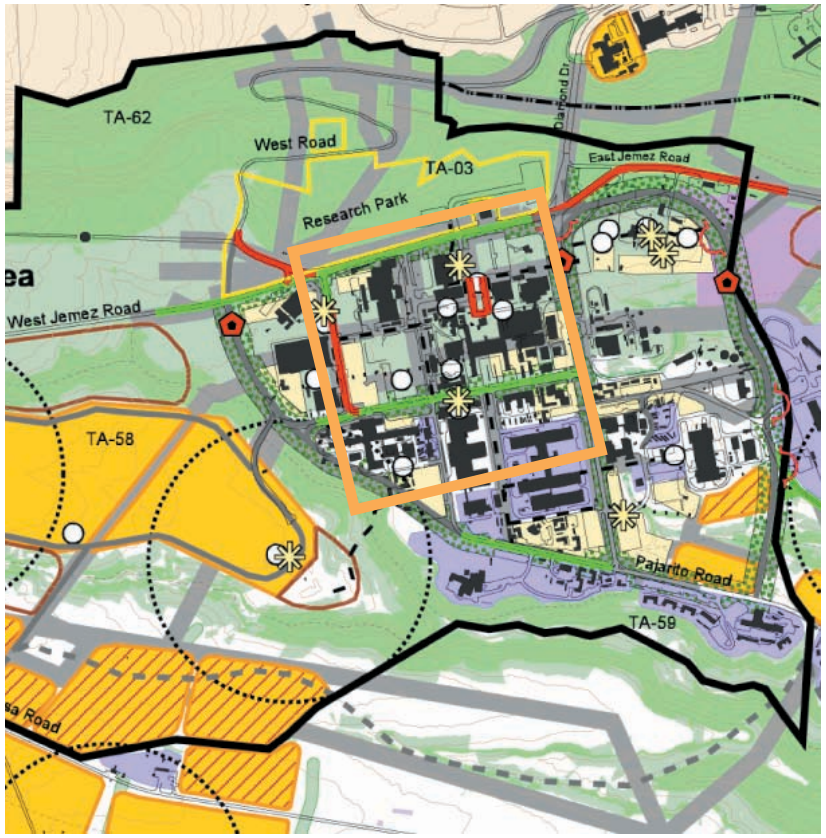


Figure IV-51: Pedestrian System - Concept Diagram / TA-03 Core Area

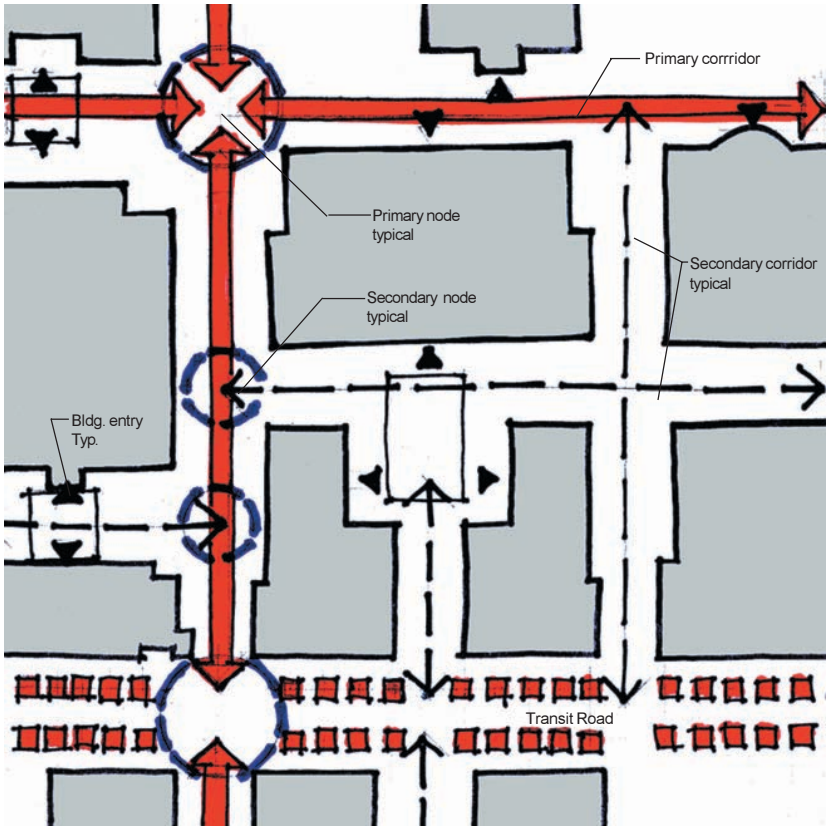


Figure IV-52 applies the standards in the *Design Principles* to each pedestrian corridor and sidewalk type.

- Primary pedestrian corridors are formal in design and axial in alignment.
- Secondary pedestrian corridors are informal and meandering in nature.
- Sidewalks are determined by the requirements of the road they are related to.

Figure IV-53 shows the design finished with planting to strengthen the design concepts of the pedestrian system.

Specific design guidelines for the components of the pedestrian system are described in the following section.

Figure IV-52: Pedestrian System - Walkway Design Concept / TA-03 Core Area

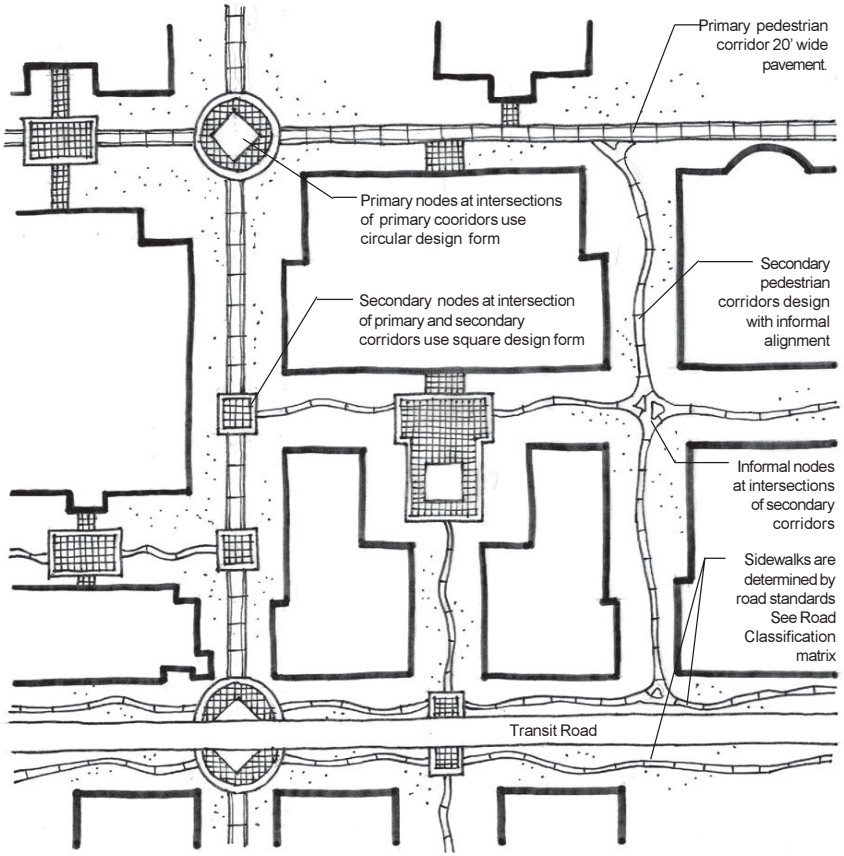
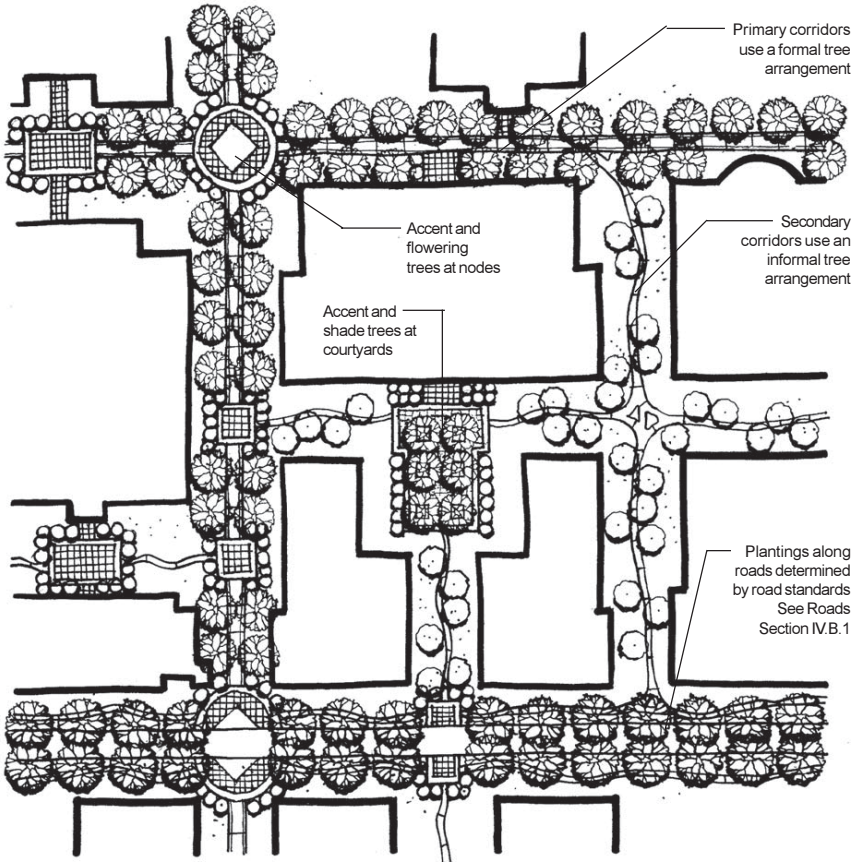


Figure IV-53: Pedestrian System - Landscape Concept / TA-03 Core Area



b. Corridors and Sidewalks

Pedestrian corridors and sidewalks are the connectors of the pedestrian system. Corridors and sidewalks, similar to the road system, need to have a hierarchy in order to be a clear, safe, discernible system for pedestrians.

The corridors and walkways hierarchy is:

- primary corridors
- secondary corridors
- sidewalks
- corridor and walkway elements.

1) Primary Pedestrian Corridors

Primary pedestrian corridors are located in densely developed areas where population is more concentrated. Primary corridors serve areas that are free of vehicular traffic. Not every Tech Area will have a primary corridor.

- Place primary corridors within a minimum 50 ft. wide pedestrian corridor easement.
- Provide a paved width of 12 to 20 ft., with 20 ft. being the preferred width.
- Design primary corridors as primary emergency access and utility corridors. (See Section IV-Utilities and Utility Corridors.)
- Where a corridor is designed as an emergency or fire access route, provide a minimum 20 ft. clear horizontal zone and maintain a 16 ft. vertical clearance above the corridor paving.
- Use specialty paving on primary corridor intersection nodes.
- Light corridors for safe nighttime use.
- Design corridors with amenities to include seating, signage, trash receptacles, safety alarms, landscaping, bicycle furnishings, etc.
- Design corridors to meet Laboratory Facilities Engineering Manual requirements for accessibility.

2) Secondary Pedestrian Corridors

Secondary pedestrian corridors in urban areas are important connecting walks between sets of buildings and the primary pedestrian corridors. In the more remote Tech Areas, secondary corridors may serve to connect a series of building complexes or developments. Secondary pedestrian corridors may be the highest category of walk in many Tech Areas

- Place secondary corridors within a minimum 30 ft. wide pedestrian corridor easement.
- Provide a minimum paved width of 8 ft. for secondary corridors.
- Light corridors for safe night time use.
- Design corridors with amenities to include seating, signage, trash receptacles, exterior safety alarms, landscaping, bicycle furnishings, etc.
- Design corridors to meet Laboratory Facility Engineering Manual requirements for accessibility.

3) Sidewalks

Sidewalks are part of road improvements. The width and location of sidewalks is defined in the Road System section of this document.

4) Corridor and Sidewalk Elements
Crosswalks, stairs and ramps require careful design to create a safe pedestrian system.

a. Crosswalks
When pedestrian traffic crosses other circulation systems, clearly designated and marked crosswalks are required.

- Mark crosswalks with specialty paving or clearly visible painted stripes.
- Match crosswalk width with that of the connecting walkway or with a minimum width of 6 ft.
- Avoid mid-block crosswalks between intersections, and signalize if possible.
- Install pedestrian crossing signals when crosswalks are at mid-block to alert vehicle drivers to the safety concern.
- Provide curb-cut ramps at crosswalks.
- Install street lighting at each crosswalk for nighttime visibility for both pedestrians and drivers.
- Maintain a minimum 35 ft. clear sight triangle to provide pedestrians and drivers an unobstructed view at crosswalks.
- Provide pavement markings and signage where walkways and bikeways intersect.

b. Exterior Stairs
Stairs are required at steep grade changes on corridors and sidewalks (*Image IV-11*).

- Exterior steps should have riser heights between 5-7 inches with tread widths of 12-16 inches. A general formula is:
  2 risers + 1 tread = 26 inches.
- Match stair width with the width of the corridor or sidewalk leading to them, or a minimum of 4 ft. wide.
- Avoid stairs with less than two risers as they can present a safety hazard.
- Maintain the same tread width and riser height for all steps in a set of stairs.
- Provide steps with solid risers and rounded or chamfered nosing.
- Light stairs and steps to ensure safe nighttime use.
- Provide a landing for every 5 ft. of elevation change in the stairs or every nine risers.
- Design stairs to standards in the Laboratory Engineering Manuals.

c. Exterior Ramps
Ramps provide wheelchair access where elevation changes occur. Ramps generally should be adjacent to or near stairways to provide a variety of access options.

- Design ramps to standards in the Laboratory Engineering Manuals.
- Keep ramps at less than 1:20 slope when possible.
- The minimum width for ramps is 4 feet.
- Light ramps for safe nighttime use.

Image IV-11: Exterior Stairs

c. Trails

Trails are mostly located within the open and undeveloped areas of the Laboratory. They are often unpaved jogging and hiking routes. They provide recreational, health and wellness opportunities for Laboratory staff.

- Trail alignments can serve as firebreaks, utility maintenance access and secondary emergency access. Trails related to these accesses should be 12 ft. wide.
- Trail alignments should be coordinated in the ADP's and specific area master plans.
- New projects should include trail improvements in the immediate area of the project.
- The type of trail surface should be selected based on the ability to maintain the trail surface and its frequency of use.

Figures IV-54, IV-55 and *IV-56* are trail types in use at the Laboratory.

Figure IV-54: Asphalt Trail - Section

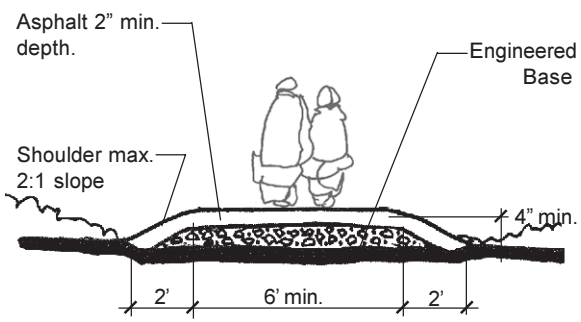


Figure IV-55: Gravel Trail - Section

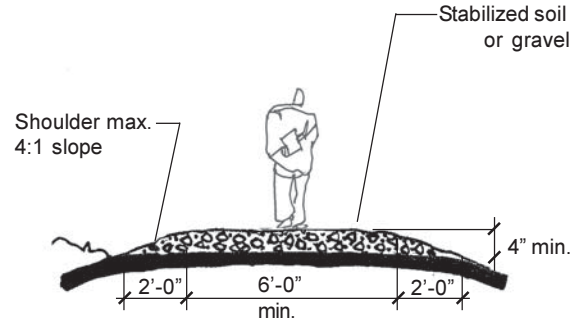
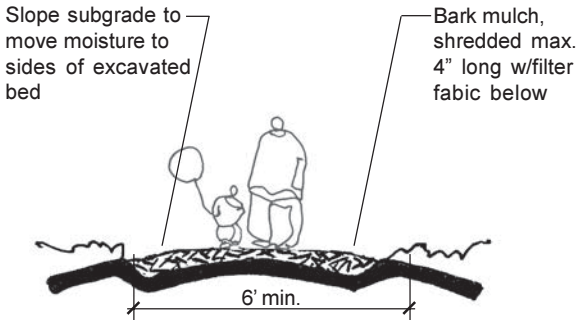


Figure IV-56: Bark Mulch Trail - Section



d. Plazas and Courtyards

Plazas and courtyards are the social spaces in the pedestrian system. People walk, talk, rest, and enjoy the outdoors in plazas and courtyards. Human use and comfort should be the focus of plaza and courtyard designs.

The aesthetic quality of plazas and courtyards is important. Visitors and staff use these spaces on a regular basis. Well designed visually pleasing plazas and courtyards encourage greater use and improve the Laboratory's work environment.

1) Plazas

Pedestrian plazas are large public outdoor spaces within or adjacent to a complex of buildings (*Figures IV-57 and IV-58*). Their purpose is to accommodate a variety of formal and informal events and functions. Microclimate considerations are an important factor in human comfort in exterior plazas.

Guidelines

- Locate plazas as indicated on the ADPs and specific area master plans.
- Incorporate outdoor furnishings such as seating, art, kiosks, picnic tables, plantings, and shelters. Large plazas may have special features such as an amphitheater.
- Use specialty paving materials to define and organize spaces within the plaza.
- Accommodate emergency, security, utility, and maintenance needs as appropriate and necessary.
- Maintain a 20 ft. clear horizontal width on all emergency access routes within plazas.
- Maintain a 16 ft. minimum vertical clearance over emergency lanes within plazas.
- Include areas to accommodate snow removal storage in Plaza designs.
- Control access to plazas with breakaway or removable bollards.

Figure IV-57: Plaza Design - Example Site Analysis

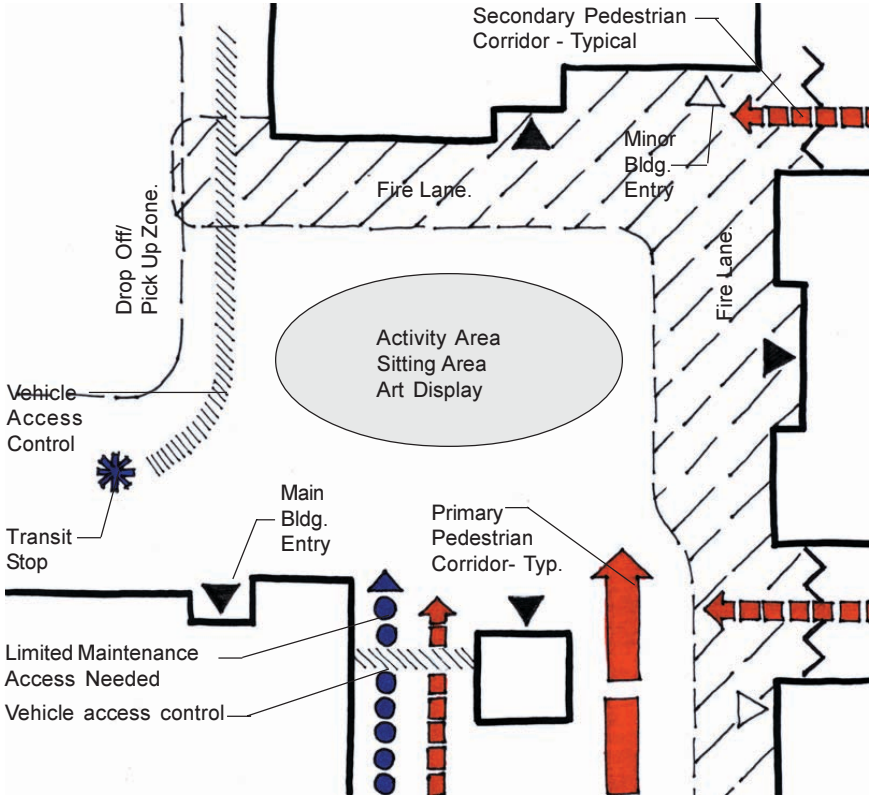
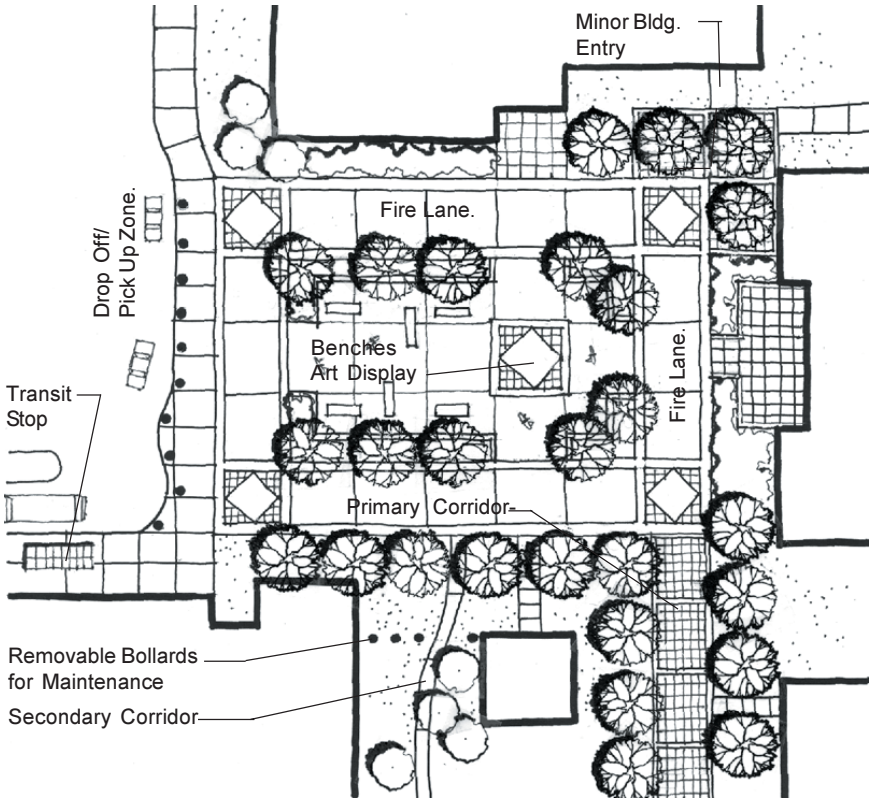


Figure IV-58: Plaza Design - Schematic Plan



2) Courtyards

Pedestrian courtyards are small public spaces serving a single building or a small number of buildings (*Figures IV-59 and IV-60*). Courtyards provide staff areas for work breaks, smoking, and conversation. These areas are used on a daily basis for the small-scale personal interactions that make a workplace productive.

- Building entry courtyards should provide a clear pedestrian access route from the parking area to the main door of the building.
- Courtyards should also link with nearby pedestrian corridors, sidewalks and parking.
- Provide pedestrian amenities such as trash cans, ash trays, seating and landscaping.
- Locate bicycle racks, trees and other pedestrian amenities at least 15 ft. from building entrances and walls.
- Include building identification signage as part of courtyard design.
- Create a drop-off and pick-up location near entry courtyards for shuttle vans and transit vehicles.

Figure IV-59: Courtyard Design - Example Site Analysis

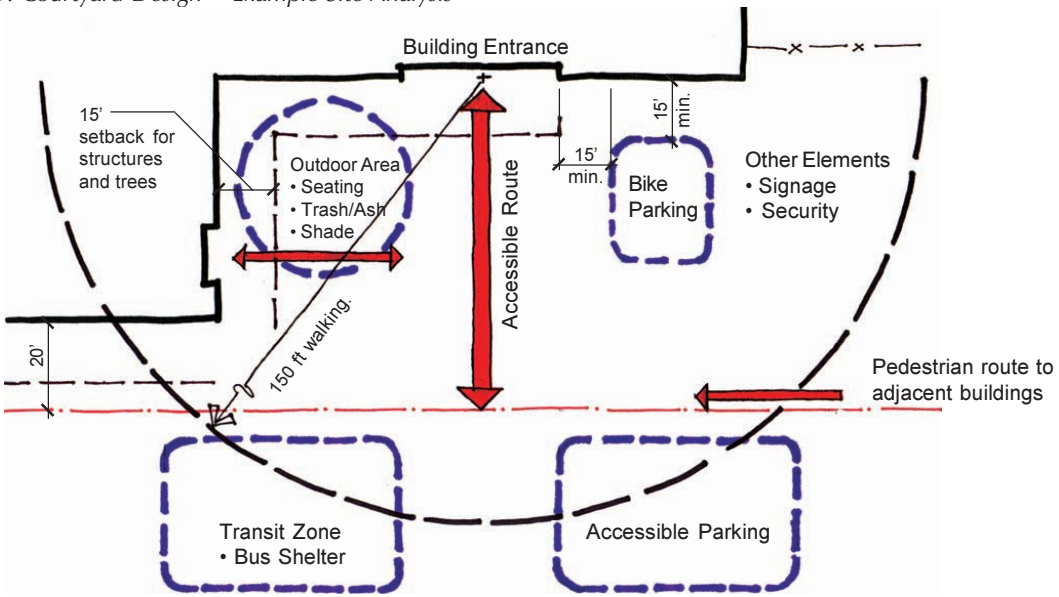
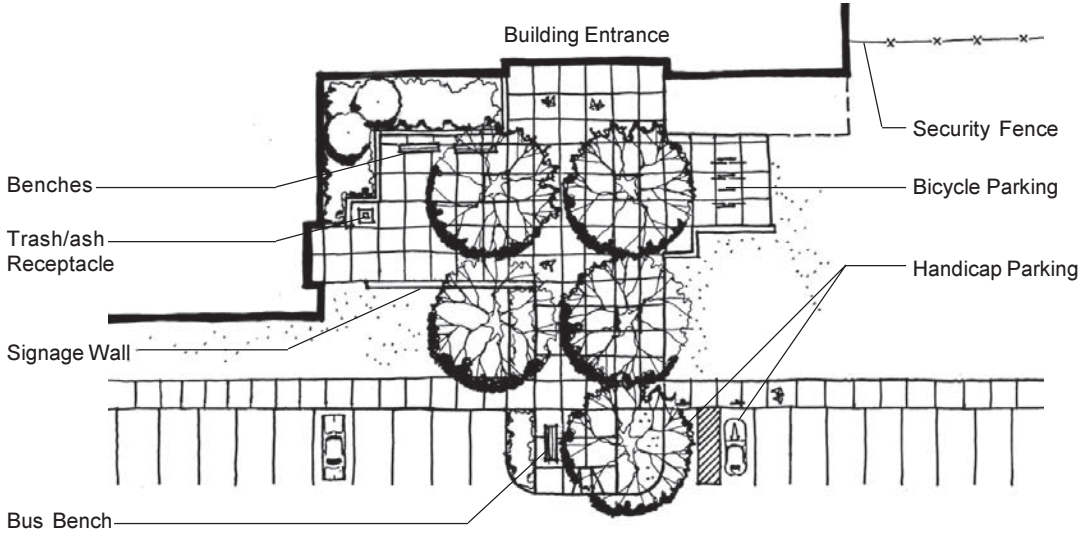


Figure IV-60: Courtyard Design Recommendations - Plan



IV. GUIDELINES FOR SITE DESIGN

C. LANDSCAPE ELEMENTS

C. LANDSCAPE ELEMENTS

Introduction

Landscape elements are the site amenities and furnishings that create livable exterior spaces. Landscape elements bring visual continuity to the diverse sites and projects throughout the Laboratory. Well designed landscape elements improve the image and function of the Laboratory work environment.

Landscape Elements include:

- Security features
- Signage
- Lighting
- Paving
- Site furnishings
- Planting

Principles

The principles for landscape elements are:

- Landscape elements should create an attractive, human-scale environment for visitors and staff.
- Landscape elements should be selected based on the rural or urban development character of the project site.
- Standards for landscape elements such as site furnishings, paving, lighting, plant materials and signage should be established and included in new developments.
- Landscape elements should be selected for durability, maintainability and appearance They should incorporate recycled and “green” material standards.
- Landscape design should enhance the natural landscape and promote the use of native, drought-tolerant and low-maintenance plant materials.
- Landscape plantings should encourage water harvesting and include water conserving practices and techniques.
- Landscape elements should support security needs with new innovative landscape designs and techniques.

References

Other Laboratory and industry documents to be used as references are:

SSSP
Site Safeguards and Security Plan

MUTCD
Manual of Uniform Traffic Control Devices

LEM
LANL Engineering Manual, LIR 220-03-01 (Chapter 7-Electrical, Chapter 4 Section 211-Landscaping)

IESNA
Illumination Engineering Society of North America, Lighting Handbook: Ninth Edition, 2000

NEC
National Electric Code, 1999

NMNSPA
New Mexico Night Sky Protection Act, {74-12-1 to 74-12-10 NMSA 1978}, 1999

ADA
Americans with Disabilities Act - ADA Guidelines

UFAS
Uniform Federal Accessibility Standards

Landscape Development Zones

Landscape element standards are based on being in one of two development zones: urban or rural. Each development zone is defined by its location, public visibility, and security requirements (see *Figure IV-61)*.

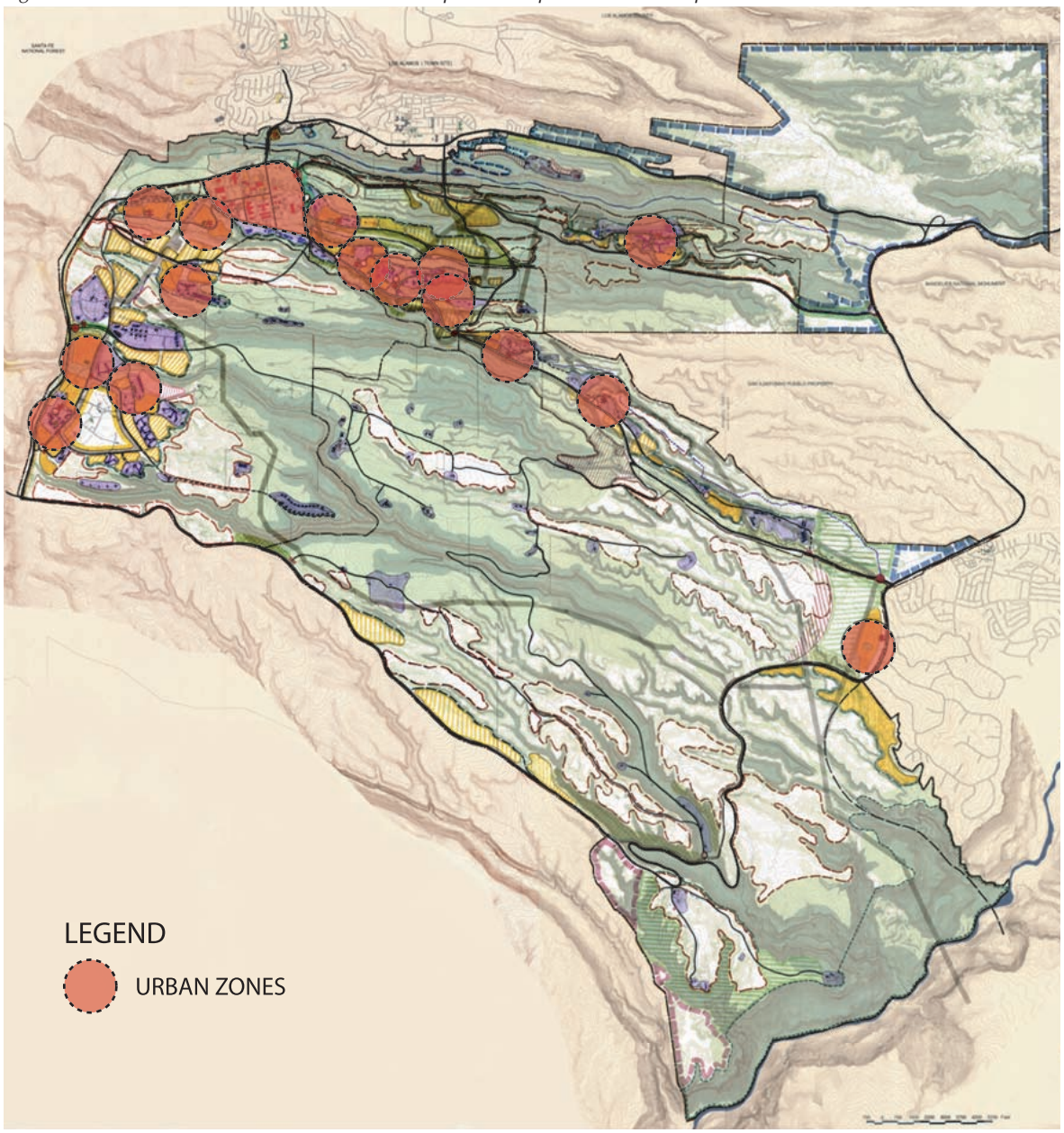
Urban Zone

Urban zones are characterized by dense concentrations of buildings, heavy traffic volumes and diversity of activities. Urban zones are noted on *Area Development Plans (ADPs)* as "centers." Examples of urban zones are TA-03, LANSCE, TA-55, and parts of TA-35.

Rural Zone

Rural zones are the remaining, less developed areas of the Laboratory. These zones are usually less populated, more isolated locations and closely surrounded by the natural environment. Examples of rural zones are TA-16 at Sigma Mesa and TA-54.

Figure IV-61: Sitewide Urban and Rural Landscape Development Zones Map



1. Security Elements

Security is an important function at the Laboratory. Properly designed security features can be effective and attractive and contribute to the visual appearance of the institution. *Images IV-12* and *IV-13* illustrate improvements possible through application of the guidelines.

The *Design Principles* encourage design opportunities for meeting security needs while improving the image of the site.

Security elements include:
- barriers
- gates
- fences
- walls
- bollards and jersey barriers
- buffer zones and landforms

a. Barriers

Barriers prevent passage or approach. They include limiting or restricting visual as well as physical access.

There are four types of barrier uses at the Laboratory:

- Limited access - Barriers that limit access to secure or classified areas or sites.
- Assets protection - Barriers that protect assets or sites from unauthorized access.
- Visual Screen - Barriers that visually screen unattractive areas from general view.
- Safety/Hazardous - Barriers that protect personnel from safety hazards.

Barriers must meet the required security level and should incorporate the design guidelines of the particular landscape development zone. See *Table IV-4* for recommended barrier materials.

Image IV-12: Before image of security fencing

Image IV-13: After security fencing upgrade concept

Guidelines

- Integrate barrier design with architectural style, colors and materials.
- Incorporate drainage and erosion control measures into the design of security fences and structures.
- Design and locate barriers for ease of maintenance.
- Barriers used to limit access and protect assets shall have a 20 ft. clear zone inside the barrier to facilitate visual supervision.
- Intrusion detection systems (IDS) should be integrated into the design of the barrier and access control systems. The selection of the particular IDS is determined by S-Division. Special design considerations for exterior IDS systems may include: topography, vegetation, wildlife, weather, soil conditions and background noise.
- Unacceptable barrier materials in any zone are:
  - wood or recycled wood
  - metal, plastic, or wooden slats woven in chain link fencing
  - plastic materials

Table IV-4: Barrier Materials

Barrier Materials								
■ preferred □ acceptable	**Limited Access**		**Asset Protection**		**Visual Screening**		**Safety Hazard**	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Gate, opaque					■	■		
Gate, visually open	■	■	■	■			■	■
Fabricated Structural Steel Fencing	■	■	■	■		■	■	■
Chain link fence, vinyl coated		■		■				■
Chain link fence, galvanized		■		■				■
Chain link fence, vinyl coated with vines					□	■		
Chain link fence, galvanized with vines						■		
Masonry wall, finish to match building	■	■	■	■	■	■	■	■
Concrete wall, finish to match building	■	■	■	■	■	■	■	■
Concrete interlocking wall units, colored	■	■	■	■			■	■
Bollard, fabricated finished steel	■	■	■	■			■	■
Bollard, pre-cast concrete	■	■	■	■			■	■
Bollard, steel pipe/filled concrete		■		■				■
Jersey Barrier, finish to match buildings	□	■		■			□	■
Jersey Barrier, standard concrete		■		■				■
Specilaized barriers (IDS)	As approved or required by S Division							

b. Gates

Gates are also barriers. Careful attention to the gate's appearance and its relationship to the surrounding buildings can result in a distinguished and attractive entrance. *Images IV-14, IV-15 and IV-16* are examples of well designed gates. Gate designs must comply with security requirements set by Security Division. Contact S-1 for guidance.

Guidelines

- Chain link gates are discouraged except where part of a chain link fence.
- Entrances and exits from secure areas and buildings shall be the minimum number required to meet operational requirements and safety concerns.
- Gates should permit visibility beyond the secure boundary.
- All gates are to be of steel manufacture.
- Gates used for visual screening such as trash and storage enclosures are to be constructed to be a minimum 33% opaque.
- Guardhouses should be designed to avoid fencing in front of or behind the guardhouse. Fencing should direct pedestrians to the guardhouse area or secured entry point.
- Gates may be designated to allow fire and emergency services access. The minimum gate width for fire and emergency access is 12 ft.

Image IV-14: Gatehouse Design Quality

Image IV-15: Pedestrian Turnstile

Image IV-16: Vehicular Gate

c. Fences

Fences, like gates, are barriers and can make a positive visual impact while meeting the security needs of a project. Fence designs must comply with requirements set by Security Division. Contact S-1 for guidance.

Guidelines

- Fence design should compliment the physical appearance of adjacent buildings and gate houses.
- The fencing layout should be planned as an integral part of the site and building plans.
- New project construction should begin with removal of existing fencing that is no longer required. Renovation of substandard obsolete fencing should be included with each construction project.
- Open fencing can provide visual screening when covered with dense vines or with tightly spaced bars or rails. Fences used for visual screening should be 33% opaque.

Image IV-17: Security Features Integrated w/ Site

Image IV-18: Raised Planter as Security Features

d. Walls

Walls can be designed to blend so well with the other site improvements that their function as security barriers is camouflaged. Walls used for security must comply with requirements set by Security Division. Contact S-1 for guidance.

Guidelines

- Wall materials appropriate for security barriers include:
  – masonry walls
  – concrete walls
  – jersey barrier walls
  – concrete interlocking unit systems
- Use wall materials that compliment the adjacent building colors and finishes.
- Walls used for visual screening should be a minimum of 6 ft. tall.
- Security walls can incorporate planters and seating in their design (*Figures IV-17 and IV-18*). The height and size of the planters and seating will depend on security requirements for the wall.
- Retaining walls are effective blast barriers as the soil retained by the wall provides additional mass.

e. Bollards and Jersey Barriers

Bollards and jersey barriers primarily restrict vehicular access (*Figures IV-62, IV-63 and IV-64*). Bollards and jersey barriers used for security must comply with requirements set by Security Division. Contact S-1 for guidance.

- Bollards should be a minimum of 30 inches tall.
- The maximum spacing for bollards is 6 ft. on center.
- Bollards should be heavy gauge structural steel or cast concrete. Wood bollards are not acceptable for any site.
- Provide removable bollards at secure locations needing emergency or service vehicle access.
- Bollards should be used in service areas, to protect transformers and other utility boxes and meters.
- Bollards and jersey barriers should be finished to enhance the site and compliment the surrounding architecture.
- Plantings integrated with bollards and jersey barriers can add additional protection and enhance the visual appearance of the barrier.

Figure IV-62: Barrier - Concrete Bollards

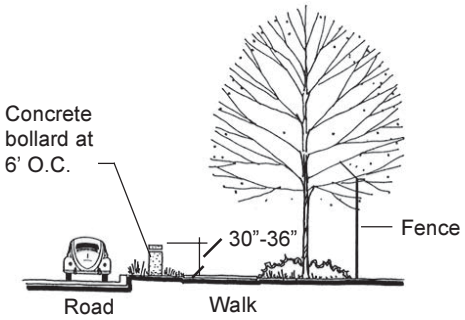


Figure IV-63: Jersey Barrier

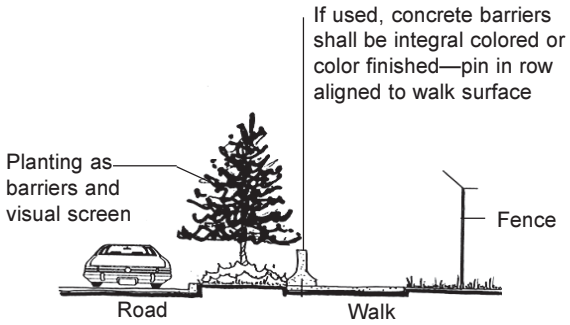


Figure IV-64: Barrier - Raised Planter

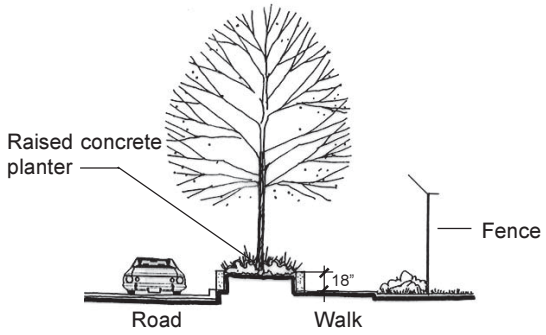


Figure IV-65: Barrier - Vertical Grade Change + Fence

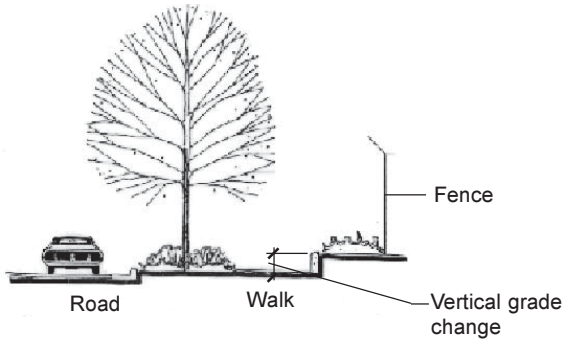


Figure IV-66: Barrier - Landscaped Berm

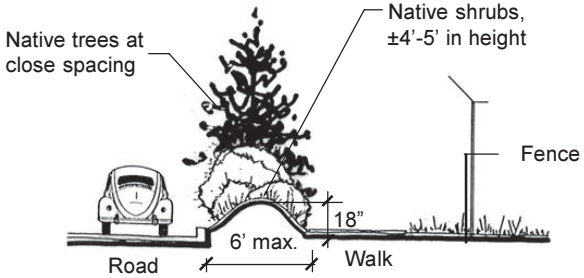
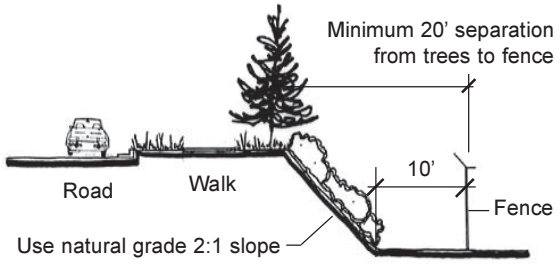


Figure IV-67: Barrier - Grade Change



f. Buffers and Landforms

Buffers and landforms use distance and natural slopes or grading to create barriers (*Figures IV-65, IV-66 and IV-67*). These barrier methods can enhance the landscape of the site while providing protection. Security buffers and landforms must comply with requirements set by Security Division. Contact S-1 for guidance.

1. Buffers

Buffer zones rely on distance to protect or screen an area. Required buffer distances are set by Security Division.

2. Landforms

Berms and swales are landforms that together with landscaping can provide asset protection, visual screening and an attractive landscape (*Figure IV-66*).

2. Signage

Signage is a communication system. It gives directions, provides information, regulates our conduct and identifies features in our environment. A signage system that communicates well improves the operations, safety and perception of the Laboratory.

Signage Categories

There are four categories of exterior signage
– identification
– directional
– regulatory
– interpretive

Principles

The underlying principles that guide signage at the Laboratory are:

- Create a unique identity by incorporating a Laboratory logo and standardized graphics into all orientation, identification, and directional signage
- Express a world-class research environment.
- Organize signage to reduce visual clutter and improve legibility.
- Promote safety and security through clear and legible information delivery.
- Replace old signs with new signs in accordance with current standards.
- Follow DOE, county, state, and Laboratory standards.

a. *Identification Signage*

There are five distinct categories of identification signs. These consist of various sizes depending on the size of the area identified.

1) Entry Identification - Laboratory

The Laboratory needs distinct entry monument identification signage at major entrances to the site. The entry monument identification signage conveys a sense of place and importance. The two entry monument identification sign types are:

- Primary entry identification (*Image IV-19*)
- Secondary entry identification *(Image IV-20*)

See *Figure IV-68* for entry monument locations.

Image IV-19: Primary Entry Signage

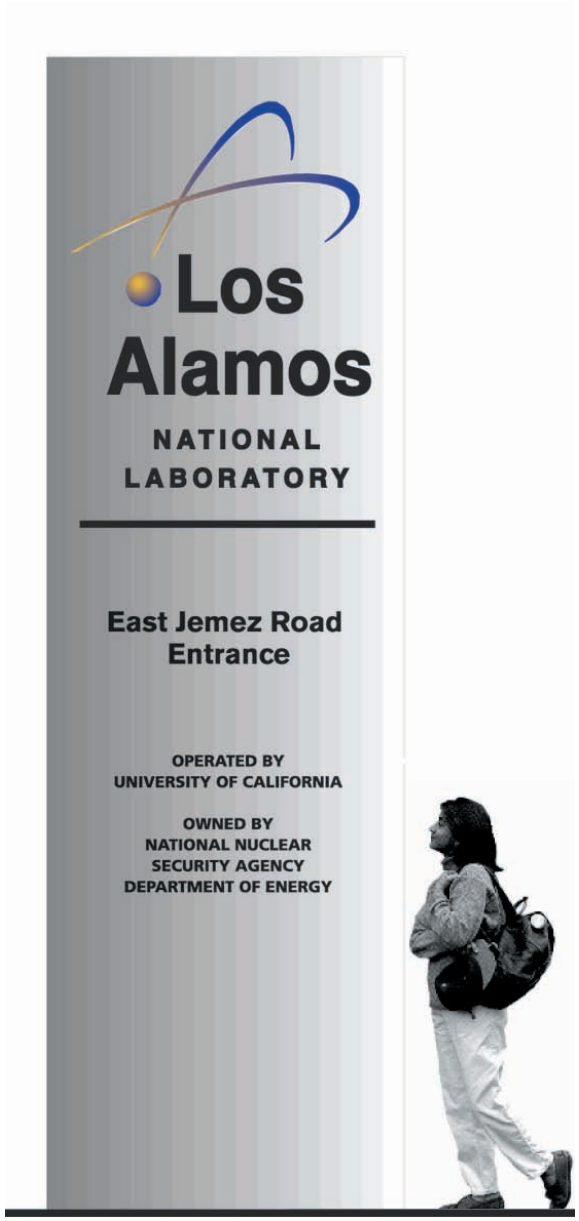


Figure IV-68: Entry Monument Locations Map

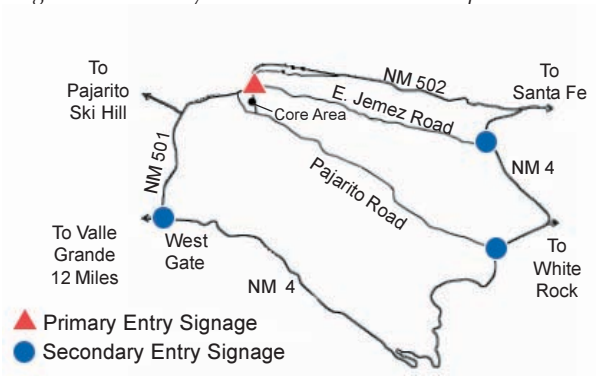
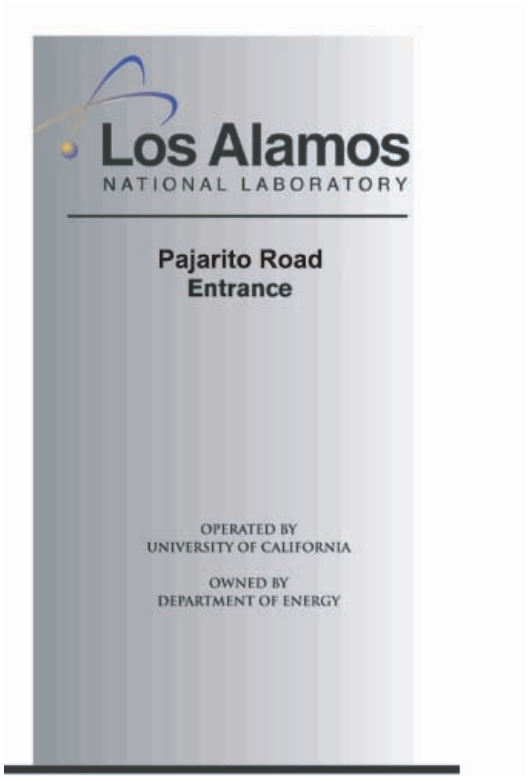


Image IV-20: Secondary Entry Signage



2) Planning Area Identification

The second signage category identifies planning areas at the Laboratory.

- Core Area
- Pajarito Corridor East
- Pajarito Corridor West
- Anchor Ranch
- LANSCE Mesa
- Omega West
- Sigma Mesa
- Dynamic Testing

Each area sign should communicate the same type and amount of information in a standard format as shown in *Image IV-21*.

3) Facility and Tech Area Identification

Identification signage for a major facility or tech area within a planning area is the next level of signage. Major facility signs are illustrated in *Image IV-24*. Tech Area signs follow the format of *Image IV-22*.

4) Building, Operation and Division Identification

Building, operation and division identification signs can be freestanding (*Image IV-25*) or building mounted (*Images IV-23 and IV-26*).

Image IV-21: Planning Area Identification (typical)

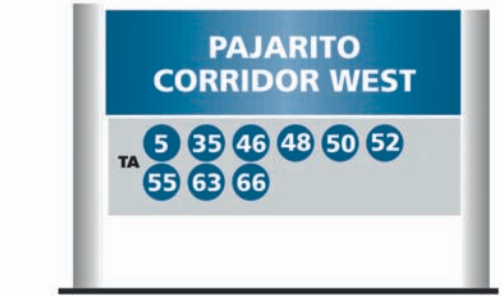


Image IV-22: Technical Area and Division Identification

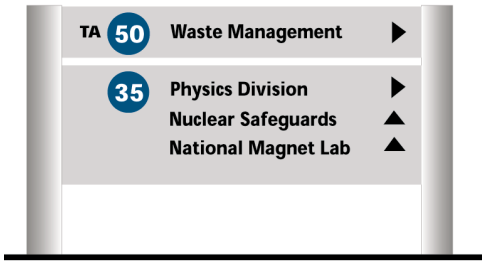


Image IV-23: Building Mounted Identification

Image IV-24: Facility Identification (typical)

Image IV-25: Freestanding Building Identification

Image IV-26: Building MountedIdentification

b. Directional Signage

Directional signage has two categories that correspond to their use on specific roadways.

1) Major Roadway Directional

Directional signs for use on major arterials (*Image IV-27*) include directions to:

- planning areas
- tech areas

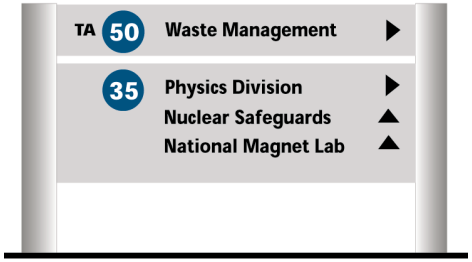
2) Interior Roadway Directional

Directional signs on interior roadways (*Image IV-28*) give directions to:

- tech areas
- divisions
- operations
- buildings

Image IV-27: Major Roadway Directional

Image IV-28: Interior Roadway Directional



c. Regulatory Signage

The two categories of regulatory signs are:

1) Traffic Control

Regulatory signage (*Image IV-29*) communicating traffic control information includes:

- roadway (stop signs, speed limit postings)
- parking
- street identification

2) Safety and Security

Safety and security signage (*Image IV-30*) can be used at any of the following levels:

- site-wide
- specific areas
- building entries

Image IV-29: Traffic Control

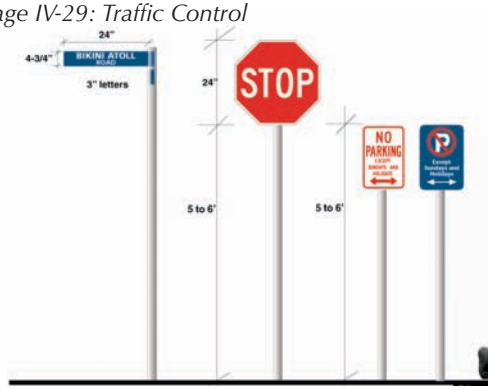
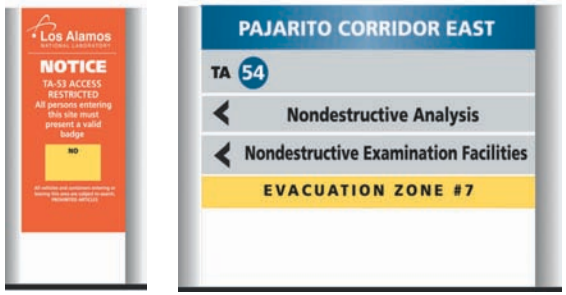


Image IV-30: Vehicular Safety and Security



d. Interpretive / Wayfinding Signage

This category of signage gives directional and interpretive information for pedestrians, visitors and public transportation patrons.

1) Pedestrian / Trail / Bicycle

Interpretive signage for pedestrians and bicyclist include:

– trail markers
– directionals

2) Visitor

Visitors signage includes:

– welcome information
– directionals (parking, destination routes)
– interpretive pull-offs (for historical or explanatory information at a site or building) (*Image IV-31*)

3) Public Transit

Interpretive signage for public transit includes:

– bus marker routes (*Image IV-32*)
– bus schedules and information

Image IV-31: Interpretive Signage

Image IV-32: Transit and Pedestrian Signage

3. Exterior Lighting

Lighting at the Laboratory provides protective lighting for securing the site. Security to operate well needs lighting standards that are consistent, reliable, and uniform.

Lighting standards for design and fixtures are needed for the following zones:

- roadways
- parking areas
- building areas
- pedestrian areas
- security areas

Principles

The following exterior lighting principles guide the location, fixture selection, and installation of lighting.

- Exterior lighting should create a hierarchy of fixtures to organize the lighting of the site.
- Exterior lighting should increase site safety and security through establishing illumination standards for different functions and areas of the Laboratory.
- Exterior lighting fixtures should reinforce a Laboratory image of "Science and Technology" *(Images IV-33* and *IV-34).*
- Exterior lighting fixtures should be selected for functional compatibility, cost-efficiency, energy efficiency, visual consistency and ease of maintenance.
- The exterior lighting system should accommodate the unique uses, functions and constraints of the Laboratory.
- The exterior lighting system should strive to reduce the negative environmental effects of outdoor lighting by incorporating light controls, monitoring operating times, minimizing light trespass and reducing light intensities where possible.

Image IV-33: Lighting - Structural (Kim Lighting)

Image IV-34: Lighting - Mitre (Architectural Area Lighting)

a. General Exterior Lighting

1) General Area Lighting

- For general illumination levels, see *Table IV-5*.
- Maintain exterior lighting standards and recommended levels set by the Laboratory Engineering Manuals *(LEM)*, IESNA Lighting Handbook, and the New Mexico Night Sky Protection Act.
- Limit light trespass to 0.5 footcandles, 10 ft. beyond the design area boundary.

2) Wall Mounted Fixtures

- Where possible use pole-mounted instead of building-mounted area lighting.
- Select wall mounted fixtures on buildings and at entrances to compliment the building architectural style and to comply with security requirements.

3) Pole Mounted Fixtures

- Use pole-mounted fixtures heights for areas as noted on *Figures IV-69 and IV-70*.
- Poles should be tapered, round aluminum with a brushed or anodized finish or tapered round galvanized steel poles. Poles should be designed to withstand extreme wind loads of 80 m.p.h. with a 1.3 gust factor.
- Do not use wood light poles.
- Structurally engineer light pole bases in parking areas and extend 30" above grade.

4) Controls

- Provide a central timer, photocell and/or motion sensor control for all exterior lighting unless specific security requirements apply.
- Provide lightning protection as required by the *LEM*.

Figure IV-69: Recommended Pole Heights

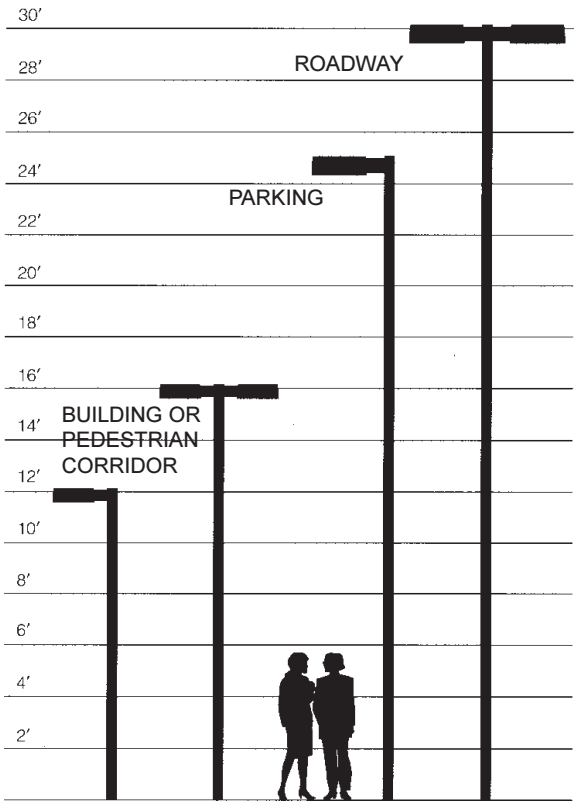
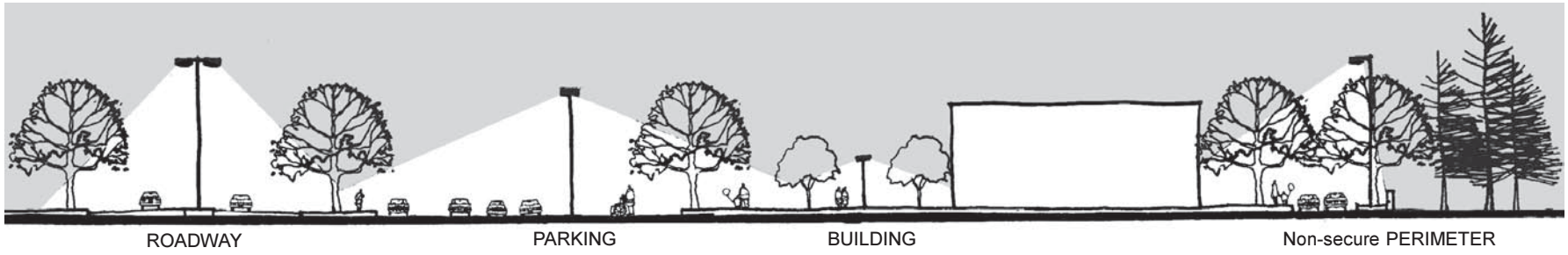


Figure IV-70: Lighting Areas



5) Luminaires

- All exterior luminaries shall be "full cutoff" type as defined in the IESNA Lighting Handbook. Only luminaires with zero candela intensity at 90 degrees above nadir and less than 100 candela at 80 degrees above nadir are considered "full cutoff."

6) Lamps

- For general site lighting, use color-corrected, high-pressure sodium lamps.
- For landscape, accent, and signage lighting use a maximum of 150 watts incandescent
- For internally illuminated signage use fluorescent lamps with low temperature ballasts and conform to Laboratory signage standards.
- The use of incandescent lamps is discouraged.

7) Placement

- Maintain a 1 ft. setback from paving for light fixtures in planting areas.
- Minimize planting near light poles for maintenance access.

b. Security Lighting

Protective illumination should be provided to permit detection and assessment of adversaries and to reveal unauthorized persons. Provide lighting as specified by DOE and S-1 requirements and as listed below:

- Protective lighting in protected areas, material access areas, and vital areas should be designed to provide 24-hour visual assessment.
- Lights should provide a minimum two (2) footcandle (fc) illumination at ground level for at least a 30 ft. diameter around protective personnel posts, and two (2) footcandle illumination for 150 ft. in all directions.
- Where protective lighting at remote locations is not feasible, patrols and fixed post locations may be equipped with night vision devices.
- Minimize glare where it impedes effective operations of protective personnel, is adjacent to highway or is objectionable to occupants of adjacent properties.
- Light sources on protected perimeters should be located so that illumination is directed outward wherever possible.
- If sodium vapor or other High Intensity Discharge (HID) lamps are used in isolation zones, then alternate lighting should be available in the event that power is lost and to cover the time before the HID lamps can be relighted (about three minutes). Both the HID lamps and the alternate lighting shall be connected to primary and standby power.

Table IV-5: Selected Required Luminance - IESNA Standards

Area	*Luminance Average (fc)*
Roadways	
Major arterial urban	0.6
Collector and transitway	0.6
Local urban	0.4
Parking Areas	0.5
Building Areas	
Entrances	5.0
Service areas	2.0
Pedestrian Areas	
Plazas	1.0
Sidewalks	
Roadside	0.2
Pedestrian Ways	0.5

4. Paving

Paving is the man-made surface upon which we walk, run, drive and bike. The stability and design of different paving surfaces determines the ease with which we can use those surfaces. Changes in material color and surface finishes can create visual interest.

Paving falls into two general classifications: hard and soft. Appropriate hard and soft paving materials for the Laboratory and their recommended uses are listed on *Table IV-6*.

Guidelines

- Design paved areas to accommodate emergency vehicle and fire department apparatus access, per NFPA 1141.
- Use specialty paving treatments to accent special areas such crosswalks, primary pedestrian corridors, plazas, courtyards, and other key pedestrian zones.
- Use paving to clearly differentiate between pedestrian and vehicular traffic.
- Match all repairs and patches to pavements, curbs and gutters to the original paving form, color, and material.
- Use asphalt or crusher fines for remote low-volume pedestrian paths.
- Where utility lines lie beneath the paving, use unit pavers such as brick or interlocking concrete pavers. They permit easy access, quick repair, and can be reused.

Table IV-6: Paving Materials

PAVING MATERIALS		FIELD PAVING		EDGING		TRAIL PAVING	
		URBAN	RURAL	URBAN	RURAL	ACCESSIBLE	NON-ACCESSIBLE
HARD PAVING							
Concrete	**Cast-in-place**	■	■	■	■		
	Stained	■	■	■	■		
	Integral Color	■	■	■	■		
	Patterned	■	■				
Brick		■	■	■			
Precast Concrete Pavers		■	■	■			
Unipavers		■	■				
Stone Pavers	**Granite**	■		■			
	Porphyry	■		■			
Asphalt						■	
SOFT PAVING							
Decomposed Granite						■	
Crushed Stone with Fines						■	
Gravel							■
Bark Mulch							■
Compacted Soil with Binder						■	

a. Hard Paving Surfaces

- Use hard paving materials that provide a firm, regular, even surface in high-traffic areas.
- Provide paving with a nonskid finish to prevent slipping; expansion joints should be narrow and filled to the surface (*Image IV-35*).
- Avoid irregular hard paving material such as cobble, bomanite, flagstone, or highly textured concrete on accessible routes.
- Avoid exposed aggregate concrete. It is unstable under freeze/thaw conditions.
- Use poured-in-place concrete for its durability, ease of installation, versatile appearance and relatively low expense.
- Use integrally colored concrete, bomanite, and stained concrete products in urban areas with heavy traffic. Select colors that are compatible with the adjacent architecture or the natural landscape.
- Limit brick or stone paving materials to accent areas, such as the entries to buildings, sitting areas and on major pedestrian corridors (*Image IV-36*).
- Use interlocking concrete pavers as accent paving in major pedestrian corridors and building entries (*Image IV-37)*. Interlocking concrete pavers are the best choice when paving over utility lines.
- Control weed growth in unit paving materials like brick or interlocking pavers by placing a geotextile weed barrier beneath the sand bedding layer.
- Asphalt is an inexpensive and flexible surface. Limit asphalt paving for walks to rural paths or trails. Install over an engineered basecourse to extend the life of asphalt surfaces and to reduce maintenance.

b. Soft Paving Surfaces

Soft paving surfaces include decomposed granite, bark, soil, crusher fines and other granular materials.

- Reserve soft paving materials for pedestrian circulation routes with low-volume uses such as trails and rural bike paths.
- Materials that cannot be firmly compacted, such as sand, gravel or bark are not recommended for running or biking surfaces. Sand, gravel and bark are not considered accessible surfaces and should be restricted to rural low volume areas.
- In urban areas, stabilize soft paving materials with an edging such as a concrete or metal edging to contain the material, minimize erosion and reduce maintenance.

Image IV-35: Textured Concrete Paving Finish Patterns

Image IV-36: Paver/Drain/Curb Example

Image IV-35: Stone Pavers Uni-decor

5. Site Furnishings

Site furnishings, used consistently, reinforce the importance of pedestrian spaces. They provide the amenities that make developed outdoor spaces usable and comfortable for people.

Site furnishings include:
- benches
- picnic tables
- trash and ash receptacles
- bicycle racks
- transit shelters

Image IV-38: Coordinated Site Elements

Guidelines

- Select furnishings made of durable, low maintenance and sustainable materials such as metal and recycled wood or plastic able to withstand extreme ultraviolet exposure .
- Coordinate site furnishings to compliment each other and the surrounding architecture (*Image IV-38*).
- Install furnishings on paved surfaces for ease of access and maintenance.
- Select site furnishing models that are handicapped accessible.
- Place site furnishings in convenient and useful locations. Densely populated areas, major plazas and pedestrian corridors should receive the highest level of treatment in terms of the number and variety of site furnishings.
- Site furnishings along pedestrian corridors and sidewalks should be out of the flow of traffic. Furnishings should be clustered to consolidate space.
- Place furnishings in locations that maintain access to buildings, fire hydrants and other safety and security elements.
- Flagpoles, fountains and public art should be used in prominent, highly visible areas.
- Locate seating areas in shaded locations when possible.

a. Benches

- Locate benches on walk edge farthest from the street in shaded locations when possible.
- Set benches at bus stops a minimum of 4 ft. from the face of the curb.
- Benches should be 6 ft. long minimum.
- Do not use wood benches.
- On walkways 6 ft. or less in width, provide an adjacent pad for bench placement.
- See *Images IV-39a and IV-39b* for the recommended benchs.

Image IV-39a: Recommended Bench-Urban Area

Image IV-39b: Recommended Bench - Rural Area

b. *Picnic Tables*

- Provide rectangular tables 6 ft. minimum.
- Use two seat tables only in areas where the demand for such tables exists.
- Provide handicapped access to at least one side of tables.
- Install tables on paved level pads with paved access to pad.
- See *Images IV-40a and IV-40b* for the recommended picnic table.

c. *Trash and Ash Receptacles*

- Provide 30-32 gal. receptacles with plastic liners.
- Locate receptacles near key activity nodes where people gather or traverse.
- Place receptacles on paved surfaces with easy access for trash collection.
- Place trash receptacles a minimum of 6 ft. from benches or seating areas.
- Secure trash receptacles to the ground.
- See *Images IV-41a* and *IV-41b* for the recommended trash receptacle.

d. *Bicycle Racks*

- Provide a minimum clearance of 15 ft. between bicycle racks and security features or buildings.
- Place racks on paved surfaces and in well-lighted areas.
- Allow a 2 ft. wide by 5 ft. long space for each bicycle rack.
- See *Image IV-42* for the recommended bicycle racks.

Image IV-40a: Recommended Picnic Bench-Urban Area

Image IV-41a: Recommended Trash Receptacle-Urban Area

Image IV-40b: Recommended Picnic Bench-Rural Area

Image IV-41b: Recommended Trash Receptacle-Rural Area

Image IV-42: Recommended Bicycle Rack

e. *Transit Shelters*

- Use the Laboratory standard design transit shelter.
- Provide modular transit shelters that can be easily adapted to several different sizes and are structured to resist local wind and snow loads.
- Specify colors that have a semi flat finish to reduce glare and are cool to the touch when in direct sunlight.
- Place shelters on paved surfaces.
- Allow a minimum clearance of 6 ft. between transit shelters and the face of the curb for pedestrian traffic.
- See *Images IV-43 and IV-44* for the recommended small and large transit shelters.

Image IV-43: Transit Shelter (small)

Image IV-44: Transit Shelter (large)

6. Planting Design

Plant materials can enhance the relation of the Laboratory to its surrounding natural environment. Plants used in the landscape of the Laboratory must be very low-maintenance, minimize irrigation water use, maximize harvested rainwater and provide an attractive setting for visitors and staff.

Plant design includes:
- xeriscape techniques
- water management zones
- environmental amelioration
- wildlife planting

Principles

The following planting design principles should be employed:

- Plant design should preserve and enhance existing natural landforms and vegetation.
- Plant design should emphasize the use of native and drought-tolerant, low-maintenance plant materials.
- Plant design solutions should minimize adverse impacts on the natural habitat.
- Plant design and maintenance should reduce fertilizer and pesticide pollution by using integrated pest management techniques, recycle green waste, and minimize runoff by using water harvesting methods.
- Plant design should include the installation of reliable, low-flow, water-efficient irrigation systems to establish plants in the initial years.
- Plant design should incorporate energy conservation and resource management concerns.

Image IV-45: Grass Mowing

Image IV-46: Native Blue Grama Grass As Lawn

Image IV-47: Coyote Willow - Native Riparian Plant

Image IV-48: Native Sheep Fescue Grass

Image IV-49: Xeric Planting

Image IV-50: Wildlife Habitat Planting

a. Xeriscape Landscape Principles

The Laboratory has a strong commitment to using xeriscape principles for landscape development to reduce the demand for irrigation water and to integrate with the natural environment of Los Alamos (*Image IV-49*). The following are the six xeriscape principles.

1) Minimize turf areas

Use native grasses (*Image IV-48*) instead of bluegrass and fescue lawns. Buffalo grass or Blue Grama Grass (*Image IV-46*) are suitable warm-season native grasses for use as lawn areas.

2) Improve the soil

Improving the soil provides the following benefits:

- Plants will grow better and use water more effectively and efficiently.
- Rainfall will more readily be absorbed by the soil, hereby reducing runoff and erosion, and acting as a supplemental water supply.

Soils can vary greatly over an installation or even on a job site. Use a soil analysis to determine the exact soil improvements needed. Although native plants in the region may not require soil improvements to thrive, the addition of organic soil allows better absorption of water and provides beneficial nutrients for plants.

3) Irrigate efficiently

Irrigating xeriscape plants slowly, deeply, and infrequently is the most desired irrigation pattern. Designing irrigation systems using drip emitters, low volume spray heads, matched precipitation heads, flow meters, controllers with rainfall sensors, and automated systems are a few of the many ways that irrigation can reduce water demand.

4) Select water-efficient plants

Cluster plants with similar water requirements to simplify irrigation system design and maintenance needs. Create watering zones (hydrozones) based on site conditions, plant material, water needs, and microclimates. The landscape design can be organized into three hydrozones, see *Figure IV-71*:

Outer Hydrozone

The outer hydrozone should be the largest planting zone. It is the natural area of the site and the edges of the developed cores. Plants chosen for this zone should be natives or very hardy plants with extremely low water requirements. Once established, these plants should require little to no irrigation and require only seasonal maintenance such as weed control and occasional pruning.

Intermediate Hydrozone

The intermediate zone is the transitional area between the inner and outer zones. Plants in this zone may require limited supplemental irrigation to augment natural precipitation. Opportunities to use runoff from paved areas or roof drains should be utilized (*Figure IV-72*). Plant densities are

reduced as compared to the inner zone. Overall maintenance and water use should be controlled and limited in this zone.

Inner Hydrozone

The inner zone should be limited to high-visibility areas in terms of appearance, image, and usage. Some rural areas of the Laboratory may not have inner hydrozone landscape areas. This zone may have a higher water use than the other hydorozones. Water-loving plants can be used in this zone if placed where irrigation or other runoff can be collected or redirected to support the plants. Long-term maintenance of this zone is critical.

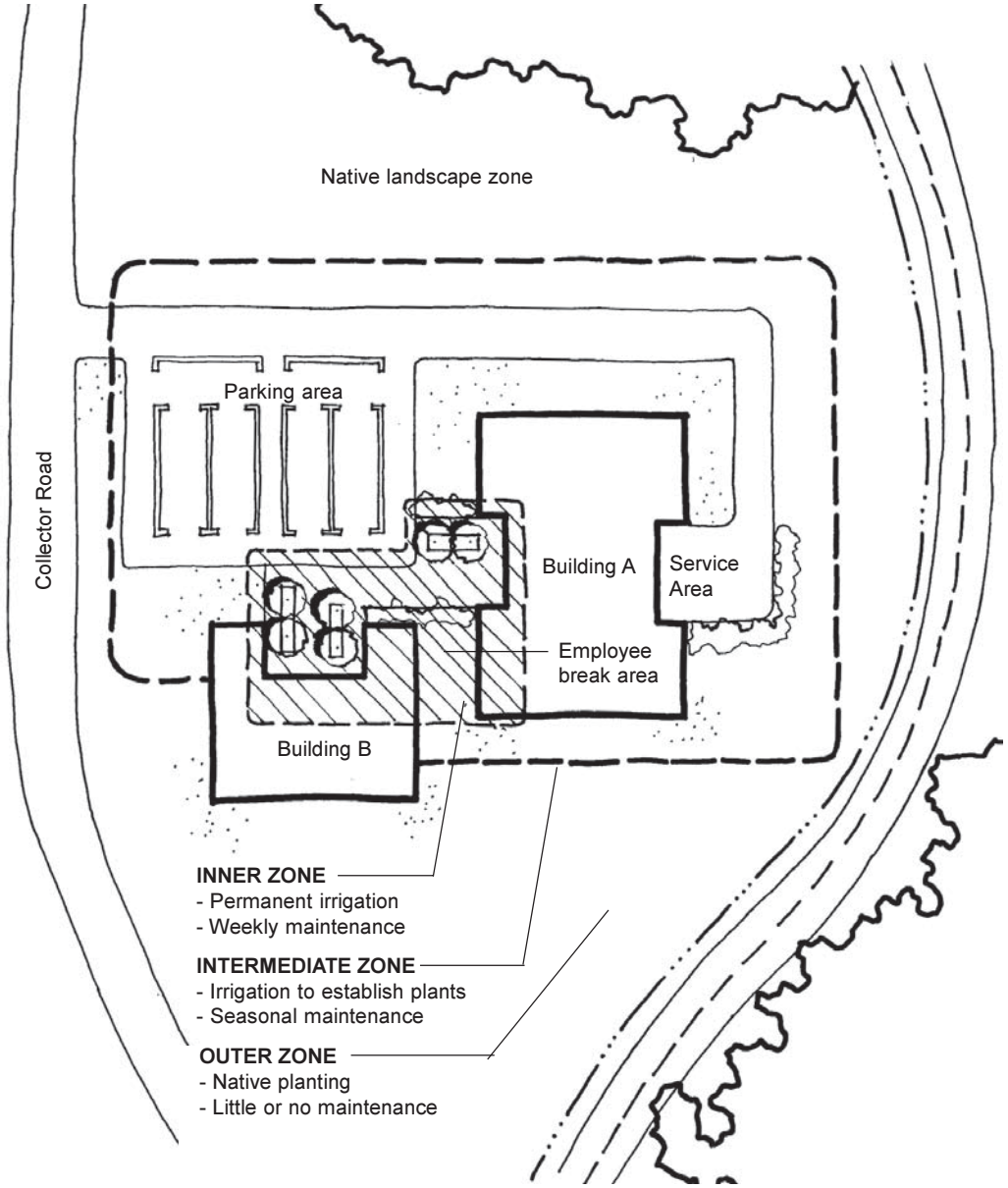
5) Use Mulches

Organic or inert mulches applied to proper depths will reduce water needs and weed growth while providing visual interest and surface erosion control. Organic mulches such as pine needles, crushed pecan shells and finely chipped bark provide the added benefit of improving the soil through slow decomposition. All non-native planting in developed areas of the Laboratory should be mulched.

6) Practice Proper Maintenance

Matching management levels to plant types creates healthier and easier to maintain landscapes. A well designed and established xeric landscape generally requires minimal maintenance and less fertilizer and insecticide. As xeric landscapes mature, they should be managed toward a less frequent but deep watering regiment.

Figure IV-71: Landscape Hydrozones



b. Water Conservation

Irrigation water is being drawn from the same finite resource that supplies the larger community; thus, the Laboratory has a strong commitment towards water conservation.

Guidelines

- Design landscape plans in conjunction with site layout and grading plans. Avoid oddly shaped or steeply graded planting areas, which are difficult to irrigate and maintain efficiently.
- Design landscaping plans in conjunction with irrigation systems to recognize differing water requirements of various plants.
- Select low to moderate water use plants for growth and survival.
- Minimize turf areas.
- Investigate water-absorbing soil additives and conduct experiments in the field to determine success and cost-effectiveness before modifying standard installation landscape construction specifications and details.
- Design irrigation systems using low-flow, low-volume automated systems wherever possible.

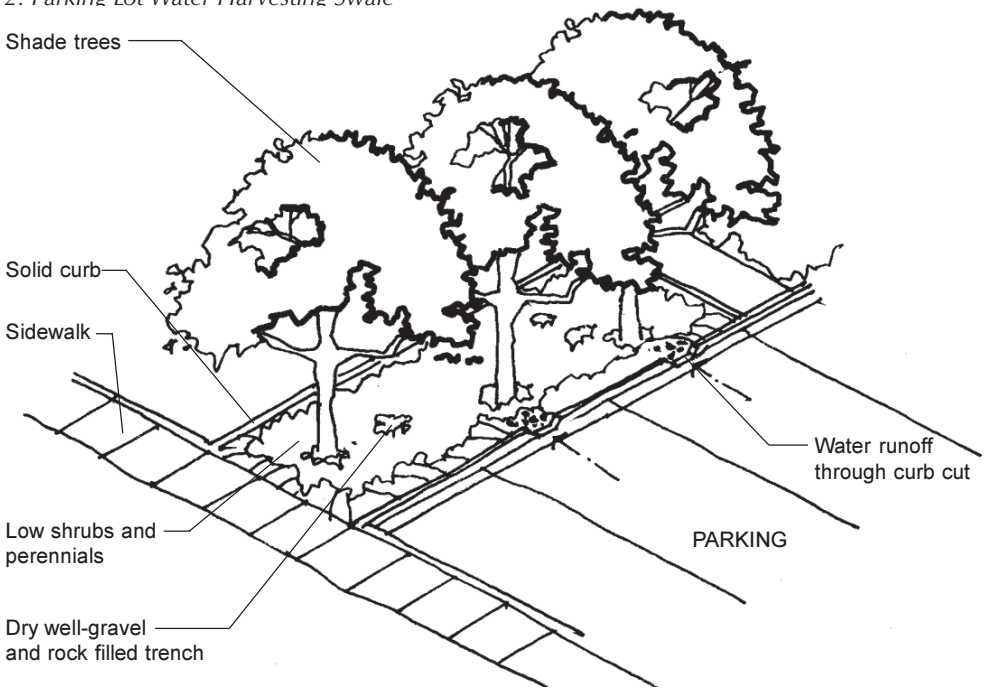
c. Rainwater Harvesting

Potable drinking water is the largest source of irrigation water used at the Laboratory. To better manage that precious resource, water harvesting of rainfall is as an alternate water source that should be utilized. Rainwater harvesting collects, concentrates, and stores natural rainfall for use by plants.

There are many ways to collect or redirect rainfall runoff from roofs, paved areas (*Figure IV-72*), or through the manipulation of the ground plane. Water harvesting methods for rainwater include

- Parallel swales (*Figure IV-73*)
- Terraced grading
- Cisterns
- Rain gardens
- Gravel grid gardens
- Hay bale swales
- Dry sumps
- French drains

Figure IV-72: Parking Lot Water Harvesting Swale



d. Functional Uses of Plants

1) Wind control

Plants can modify wind speed on the ground for distances up to thirty times their height (*Figures IV-74 and IV-75*). Dense masses of large evergreen trees planted to intercept prevailing winter and summer winds can influence the energy efficiency of facilities and increase the livability of outside spaces.

2) Temperature modification

Throughout many regions of the United States, direct radiation from the sun creates uncomfortably high temperatures during the summer season. Locating densely foliated trees and shrubs to the southwest and west of facilities can reduce heat gain. In most regions, warmth from the sun is desirable during the winter. Deciduous trees planted to the south and west of facilities will provide summer shade, while not blocking winter sun.

3) Noise abatement

Trees, shrubs, ground covers, and turf buffer noise by disguising the source of the sound and minimally reducing the sound intensity when sufficiently massed. To be truly effective in controlling noise, plants need to be used in concert with masonry walls or similar noise buffering structures.

4) Glare control

Trees, shrubs, and other vegetation can effectively reduce glare and reflection when placed between the light source and the observer.

5) Surface erosion control

Wind and water can erode valuable top soil. Plants, especially grasses, can prevent or control erosion by stabilizing the soil through their root structures. Exposed soil on cut banks and steep slopes should be immediately planted with grasses and/or native low-growing shrubs and spreading ground covers.

e. Plant Diversity

The planting philosophy of the Laboratory is to support the ecological diversity and existing natural environmental system of the site. Many species in an area automatically make that area both visually pleasing and biologically stable. In a stable community, the plant population is characterized by long-lived species and species with low reproductive powers. The diversity of successional communities enables them to survive catastrophic events such as fire. The existence of a variety of species assures greater resistance to disease and to the intrusion of alien plants. In natural areas of the Laboratory, plant selections should incorporate a variety of plants that support the natural diversity of Los Alamos flora.

Figure IV-73: Water Harvesting Parallel Swales

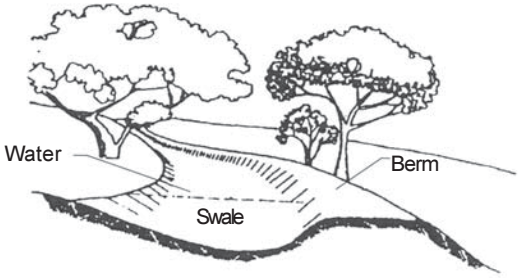


Figure IV-74: Wind Mitigation Plan

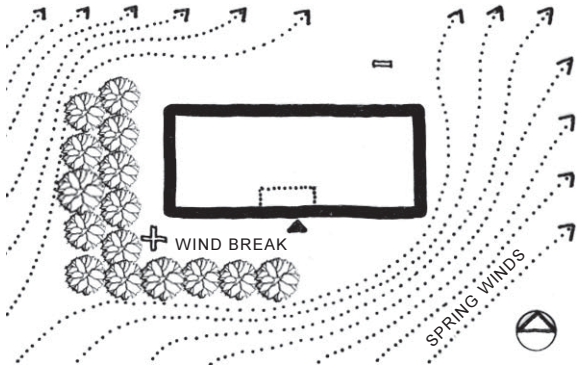
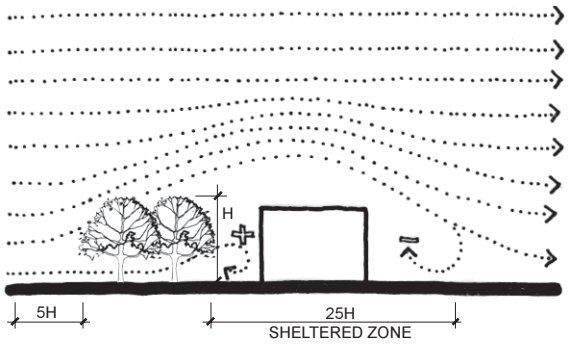


Figure IV-75: Wind Mitigation Section



g. Wildlife Food and Cover

Plants as wildlife food and cover serve an important function in the natural environment (*Image IV-50*). The Laboratory encourages planting that incorporates wildlife values.

Guidelines

- The greater number the habitat junctions the greater the species diversity. Therefore, plant two or more plant communities adjacent to each other wherever possible.
- Mix fast and slow-growing plants in groups of five or more to provide larger food supplies, be more conspicuous to wildlife and insure survival of a plant species.
- Use native plants for all restoration areas and for stabilizing drainageway slopes. Native plants are more resistant to diseases and insects and more acclimated to the site.
- Not all native plant species provide food for wildlife. Select palatable berries with an abundance of small fruits (pea size or smaller). For animals other than birds, the most attractive foods are nuts.
- Plant shrubs, vines and other vegetation important in wildlife diets along the edges of fields, lawns, roads, lakes and other openings.
- Place edge plantings at least 20 ft. across wherever possible.
- Avoid planting fruit trees such as apricots, apples, peaches, etc. in the immediate vicinity of buildings as these tend to attract bears.

1) Ground plane

- Provide a variety of ground covers by planting borders and patches of low growing native perennials, low growing shrubs, etc., to compete with invading grasses.
- Native grasslands can be locally restored by planting the proper mix of grasses either as buffer strips edging shelter belts or as large plantings. Mix tall, medium and short grass habitats to provide a more varied wildlife cover. Provide wet or dry mixtures as needed to tolerate occasional flooding or dry sites.

2) Shrubs and trees

- Mix several shrub and tree species to vary the shape and density for a greater selection of nest sites. Plant clusters of shrubs that include some thickly branching ones at least 3 1/2 ft. high.
- Select shrubs and trees that fruit at different times to provide food throughout the year.

3) Changes in slope

- Create slopes by gently sloping soil mounds with a steep rock face, or stone walls and abrupt changes in slope will be introduced to attract ground feeding birds. Natural habitats will be preserved or created: stream banks, rock outcrops and tree roots preserved to provide crevices in which birds and other small animal life can dig for insects and worms.

4) Rock or brush piles

- Provide rock or brush piles for birds and small mammals. The location of the piles is important. Locate them on the edge or within a couple hundred feet of feeding or watering areas, or along travel lanes. Place piles at intervals between water and feeding areas to create travelways and areas more habitable for wildlife.

5) Water sources

- Shallow ponds (average depth 2.3 ft.) with gently sloped sides are more widely used by waterfowl than deep ponds (average depth 6 ft. or more) with steep side slopes or lakes. Shallow ponds provide better feeding sites and cover than deep ponds, and the former more closely resemble the shallow-water marsh habitat of natural wetlands.

V. GUIDELINES FOR ARCHITECTURAL DESIGN

V. GUIDELINES FOR ARCHITECTURAL DESIGN

Introduction

Architectural design guidelines can promote a greater sense of architectural cohesiveness, permanence and visual quality at Los Alamos National Laboratory.

A visually coordinated complex of structures also contributes to improved wayfinding and safety and security functions.

The topics covered in this section include:

- Unifying elements
- Building massing
- Building articulation
- Colors and materials
- Specific planning area color palettes

Principles

The following principles are the foundation for the architectural design guidelines:

- Building design should reflect the science and technology environment of the Laboratory while relating to the climate and aesthetics of the Southwest and New Mexico.
- Buildings should incorporate energy and resources conservation materials and systems.
- Architectural design controls should be used to promote visual clarity and cohesiveness within each planning area.
- Building design should incorporate low-maintenance, fire-resistant materials.
- Buildings should be designed to have flexible space in order to accommodate future uses or functions.

References

Other Laboratory and industry documents to be referenced are as follows:

LEM
LANL Engineering Manual

LEED
Leadership in Energy and Environmental Design

UFAS
Uniform Federal Accessibility Standards

ICC/ANSI A117.I
International Code Council/American National Standards Institute
("Accessible and Usable Buildings and Facilities)

ASHRAE - Standard 90.1
American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.

A. UNIFYING ARCHITECTURAL DESIGNS

Unifying design establishes architectural cohesiveness within each planning area as well as within the overall facility. A specific palette of colors, materials, and forms will visually link the areas and an identified unifying element will act as a visual connector to link other design components within the Laboratory.

1. Architectural Color Palettes

Specific color and material palettes have been established for the following planning areas:

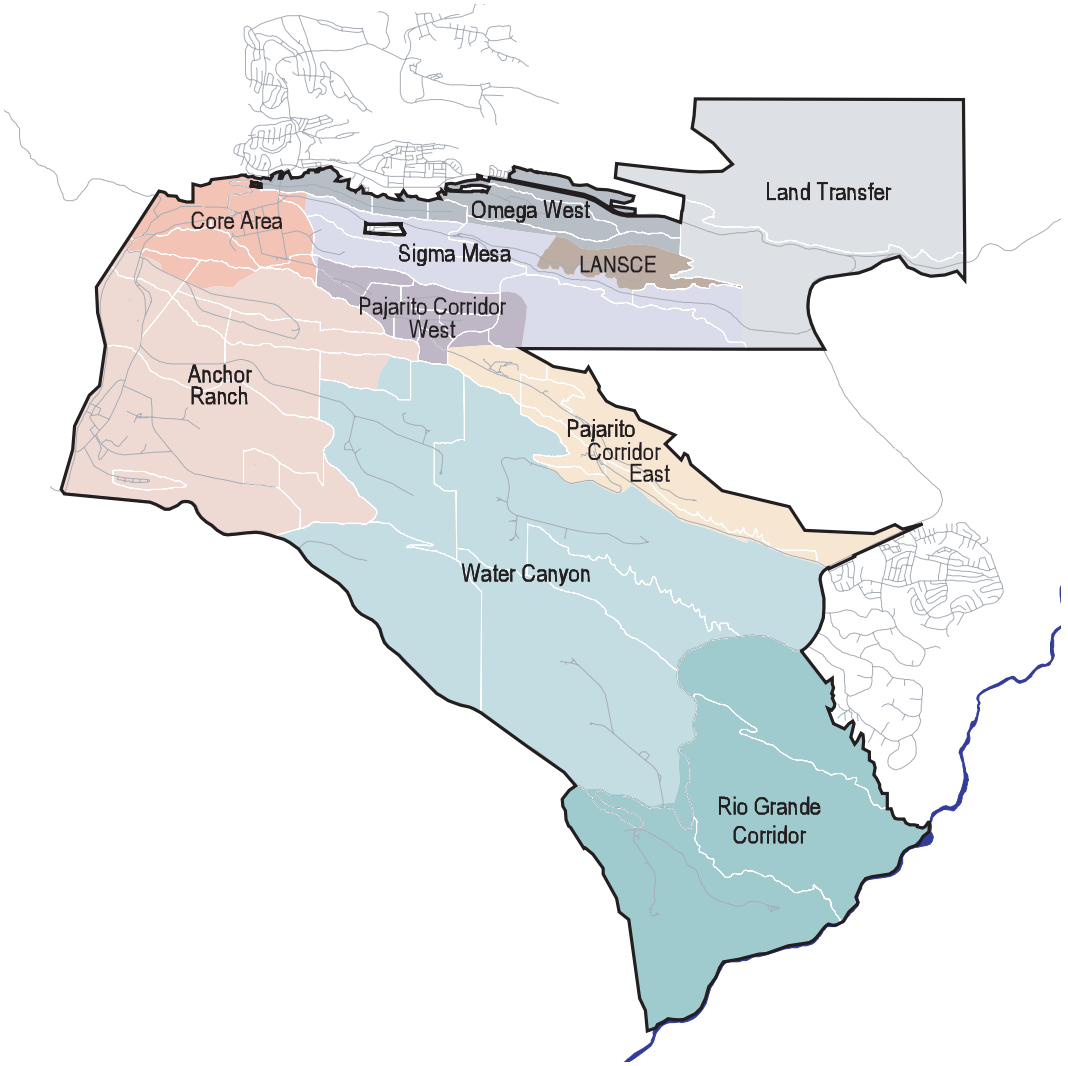
- Core area
- LANSCE
- Pajarito Corridor West
- Pajarito Corridor East
- Anchor Ranch

Each planning area's palette is unique but also relates to an overall palette for the Laboratory. The color and design specifics for each of the above planning areas follows the architectural guidelines in Section V-D-1 and 2.

2. Unifying Elements

A metallic material used as an accent should be incorporated into all new or renovated buildings and facilities. The metallic accent should complement the Laboratory's proposed way-finding system as well as the exterior lighting fixtures, functional architectural elements, or primary entry design. Feature elements should be visible from the primary entry.

Figure V-1: Comprehensive Site Plan Area Map



B. BUILDING MASSING

The Laboratory can promote a cohesive environment through a distinct vocabulary of architectural forms based on a visual inventory of existing buildings. The intent is to highlight the Laboratory's science and technology mission while acknowledging indigenous regional architecture.

The Laboratory's architecture is defined by:

- Building design
- Building form
- Roofs
- Building entries

1. Building Design

a. Architecture

An architectural style direction has been identified for use at the Los Alamos National Laboratory. The Laboratory's architectural guidelines for newer renovated structures includes:

- Use strong forms that characterize the Southwest imagery such as circles, arcs and stepped massing (*Image V-1*).
- Provide a predominance of wall mass over window openings on appropriate solar exposures (*Image V-2 and V-3*).
- On large wall areas, use warm colors in various materials such as stucco, stone, stone tiles, concrete and concrete block (*Image V-1*).
- Use stronger accent colors from a southwest palette on architectural elements such as window frames, entry structures, sunshades, accent wall segments and accent roof elements.
- Combine durable natural materials such as stone with industrialized materials such as steel, glass and aluminum.

b. Fire-Resistant Design

All new structures should follow Laboratory and reference guidelines for fire-resistant building design. Existing buildings should incorporate these design measures when upgraded and renovated.

Image V-1: Building Design Example

Image V-2: Building Design Example

Image V-3: Building Design Example

2. Building Form

Building form is determined by various factors including building size, building footprint, number of stories, intended use, structural system and limits established by adjacent spaces and structures. The following sections identify design guidelines based on building size, composition, height and location. Mechanical stacks or cooling towers are not considered a building mass for purposes of assessing massing requirements.

a. Building Massing

Building mass requirements should be based on building square footage. See *Table V-1* for guidelines.

Additional building mass requirements include:

- Provide a break in plane for each change in mass. Massing changes should have a five-foot minimum offset horizontally and three-foot minimum offset vertically (*Figure V-2*).
- Provide a change in mass and plane at all primary entrance facades. Small structures may achieve this with an entry element projection or recess.
- Maintain an approximate 1/3 to 2/3 proportion mass between the primary facade relative to the overall building length (*Figure V-3*).
- Articulate secondary facades by means of plane changes, material and color changes, and window patterning.
- Step back buildings three stories and greater a minimum of five ft. along 50% of the building perimeter.

b. Building Composition

Buildings should express a balanced composition of massing, fenestration and detailing. The horizontal direction should have a greater percentage of mass or area than the vertical direction to connect the building to the site. This effect can be achieved through:

- A composition of building masses on a multiple structure complex,
- A composition of openings (window and door) on a single mass structure, or
- Any combination thereof.

Unique elements such as triangular shed roofs or vaulted roofs, as utilized on the Materials Science Laboratory, add further interest and impact to the overall building composition. See *Table V-4* for specific building form guidelines for each planning area.

Figure V-2: Building Massing

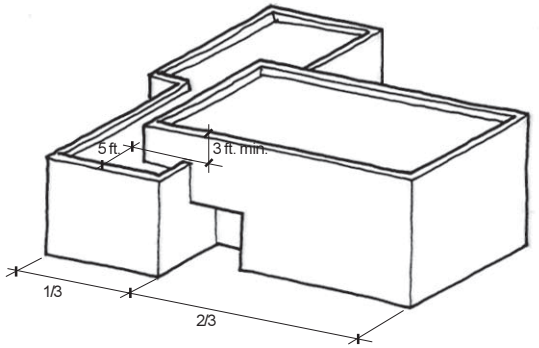


Figure V-3: Primary Building Facade Massing

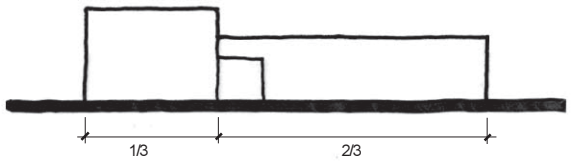


Table V-1: Building Massing

Building Massing	
Building Size	**Mass Requirements**
< 25,000 sf	1 mass min. with a break in plane on two facades min.
25,000-50,000 sf	2 masses min.
+ 50,000 sf	3 masses min.

Image V-4: Building Massing and Roof Forms

c. *Building Height and Use*

Requirements for building height are a function of building use and location (see *Table V-2*). All office, administrative, and light lab buildings two stories or more in the core area maximize the buildings use and adaptability while minimizing site impact (*Image V-5*).

d. *Relationship Between Old and New Structures*

Design new structures within a building complex to relate to adjacent structures as much as is practical through integration of similar forms, massing, materials, details and colors. Colors and materials should comply with those approved for the specific planning area.

e. *Adaptive Reuse*

Design all new office and laboratory buildings for changes of use or user. Design interior spaces for greater space planning flexibility and adaptability by limiting or strategically organizing interior structural elements.

Image V-5: Building Height Requirements

Image V-6: Building Height Requirements

Table V-2: Building Height Requirements

Building Height		
Planning Area	**Office, Administrative and Light Laboratory**	**Storage**
Core Area	60 ft. min. / 2-5 Stories	x
TA 35, TA 16 Admin.	60 ft. max. / 3 Stories	x
Other Planning Areas	30 ft. max. / 2 Stories	x

3. Roof Forms

a. *Roof Design and Climate*

The following are guidelines for roof design in response to the local climate:

- Design roofs to accommodate winter snow loads and summer rains common to the north central New Mexico climate.
- Detail roof edges to protect the structure from moisture damage.
- Locate drainpipe outlets to manage rain and snow melt runoff and avoid ice buildup particularly on northern exposures.
- Incorporate a system of internal or external downspouts and gutters, site drains and/or swales to deliver water away from the building.

b. *Roof Forms, Colors and Materials*

Acceptable roof forms include flat, pitched (shed, gable) and vaulted (bow). For added interest on administrative, office and light lab buildings, pitched or vaulted roof forms may be combined with parapeted roof forms on a single building (e.g., shed and parapeted or vaulted and parapeted). Roof monitors and clerestories are encouraged as a means to admit daylight and solar heat gain.

Primary Roofs - Primary roof forms are those that dominate the building massing.

Secondary Roofs - Secondary roof forms (i.e. projecting entry structures) are those that complement the primary roof form and cover minor building masses.

Acceptable roof materials have a Class "A" fire rating, are low-maintenance and have long-term durability. The following table (*Table V-3*) identifies acceptable roof forms, materials, pitch, light reflectance value (LRV) and color ranges. For a listing of metal roof colors and roof forms identified for use within each planning area, see *Table V-4*.

c. Mechanical Equipment

Basic Rooftop - Screen rooftop mechanical units from view with parapets and/or metal enclosures. Match the color of the metal enclosures with the primary wall color.

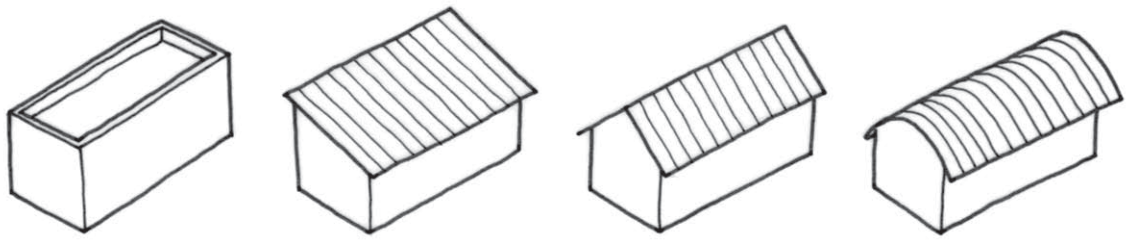
Larger Equipment - Coordinate cooling towers and mechanical stacks with the design of the main structure in regard to style, color and finishes. Screen mechanical equipment from view of main access roads behind solid materials that are consistent and harmonious with the main structure, see *Image V-7*.

Table V-3: Roof Standards

Roof Standards				
Roof Form (see Figure V-4)	**Material**	**Color**	**Pitch**	**LRV**
FLAT **Parapetted**	Single-Ply membrane	Cap sheet or gravel color to be harmonious with primary field color	Sloped to drain 1/2" per foot min.	Medium value or darker
PITCHED **Shed** **Gable** (may be combined with flat)	High-quality, heavy gauge metal Standing seam (main facilities) Panelized (storage + support facilities)	Large areas are to be in muted shades. Accent roofs may use more intense shades.	Shed 3/12 to 8/12 Gable 5/12 to 8/12	35% or less
VAULTED **Bow** (may be combined with flat)	High-quality, heavy gauge metal Standing seam (main facilities) Panelized (storage + support facilities)	Large areas are to be in muted shades. Accent roofs may use more intense shades.	Flatten arch, no full barrels	35% or less

Image V-7: Mechanical Integration and Screening

Figure V-4: Roof Forms



4. Building Entries

Guidelines for primary and secondary building entries are:

- Clearly define building entrances as viewed from primary access points (streets, walkways, parking areas). The entrance can become more visually prominent by constructing it as a separate, distinctive mass attached to the building or as a large, recessed opening within the building's overall mass. The use of entrance courts, awnings, canopies, trellises and special accent materials or colors can also highlight building entrances.
- Incorporate materials such as stone or highly finished metals into primary entrance designs to add interest and importance.
- Design all entrances at a human scale through the use of easily recognizable elements such as standard heights of doors, railings, stairs, seating and window mullions.
- Provide weather protection for all seasons at primary entries with a covered area projecting or recessed a minimum of eight ft.
- Identify secondary entries similar to primary entries but with fewer and smaller accents.

Image V-8: Primary Entry

Image V-9: Entry Canopy

Image V-10: Entry Canopy

Image V-11: Covered Entry

Image V-12: Entry Feature

Image V-13: Facade Articulation

Table V-4: Architectural Materials by Planning Area

Architectural Materials by Planning Area			
Planning Area	**Roof Form**	**Metal Roof Color**	**Wall Materials**
Core Area	FLAT - Primary SHED - Secondary or accent GABLE - Primary (storage bldgs only) VAULTED - Primary, secondary, or accent	Large areas: Complement field color(s); Light reflectance in medium value range Accent areas: Shades selected from accent colors palette	Stucco - Primary or secondary Concrete Panels - Primary or secondary Concrete Block - Secondary or accent Metal Panels - Secondary or accent Metal Siding - Primary (storage buildings only) Stone - Secondary or accent
LANSCE	FLAT - Primary SHED - Secondary or accent GABLE - Primary (storage bldgs. only)	Large areas: Complement field color(s); Light reflectance in medium value range Accent areas: Shades selected from accent colors palette	Stucco - Primary or secondary Concrete Panels - Primary or secondary Concrete Block - Accent only Metal Panels - Secondary or accent Metal Siding - Primary (storage buildings only) Stone - Accent
Pajarito Corridor West	FLAT - Primary SHED - Secondary or accent GABLE - Primary (storage bldgs. only)	Large areas: Muted colors selected to be consistent with or complement field color(s); Light reflectance in medium value range Accent areas: Shades selected from the accent color palette	Stucco - Primary or secondary Concrete Panels - Primary or secondary Concrete Block - Primary or secondary Metal Panels - Secondary or accent Metal Siding - Primary (storage buildings only)
Pajarito Corridor East	FLAT - Primary SHED - Accent only GABLE - Primary (storage bldgs. only)	Large areas: Muted colors selected to be consistent with or complement field color(s); Light reflectance in medium value range Accent areas: Shades selected from the accent color palette	Stucco - Primary or secondary Concrete Panels - Primary or secondary Concrete Block - Secondary or accent Metal Panels - Accent only Metal Siding - Primary or secondary (storage buildings only)
Anchor Ranch	FLAT - Primary GABLE - Primary, secondary, or accent	Large and accent areas: Muted colors that complement the field color(s) or the shades found in the accent colors palette	Stucco - Primary or secondary Concrete Panels - Primary or secondary Concrete Block - Secondary or accent Metal Panels - Accent only Metal Siding - Primary or secondary (storage buildings only)

C. BUILDING ARTICULATION

Façade articulation (visual changes along a building) adds interest to a structure's appearance. Façade articulation can reduce the scale and mass of a large structure. Fenestration can add depth, rhythm, shade and shadow to the building façade.

Methods of articulating buildings covered in the *Design Principles* include:

- Facade articulation
- Fenestration
- Building skin materials
- Colors and materials

1. Facade Articulation

Façade articulation can reduce the scale and mass of a large structure. Various fenestrations can be used to add depth, rhythm, shade and shadow to the building façade (Image V-13).

The following are façade articulation techniques:

- Window fenestration and multiple wall surface materials
- Score lines on stucco or concrete walls
- Banding of different colors or materials
- Attached or free-standing shading devices on south or west exposures

2. Fenestration

a. Size, Shape, Pattern, Type & Scale

- *Horizontal/Vertical Balance* - Most Laboratory office, administrative, or light lab structures have predominately horizontal forms. For vertical balance to these structures, individual window sizes should be square or preferably more vertical than horizontal (*Image V-17*).
- *Window Groupings* - Multiple window groupings are expected and acceptable but are most effective when the groups are more vertical than horizontal (*Image V15-18*).
- *Reveals Around Windows* - Windows that are set in from the building façade are preferred over multiple window groupings or openings to emphasize a building's mass. Reveals should be recessed a minimum of six inches to add depth and shadow (*Image V-16*).
- *Tall Buildings* - Buildings three stories or more should have windows with reveals.
- *Scale* - Use mullions and smaller-paned glazing to add human scale to the fenestration.

Image V-14: Horizontal/Vertical Balance

Image V-15: Window Groupings

Image V-16: Reveals Around Windows

Figure V-5: Daylighting - Light Monitor

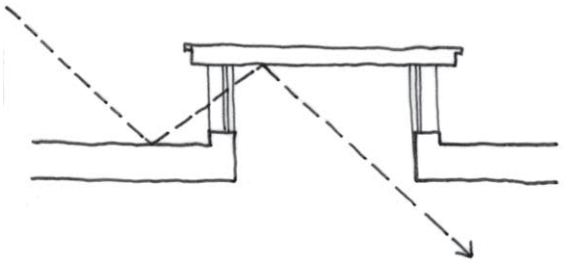


Figure V-6: Daylighting - Shed Skylight

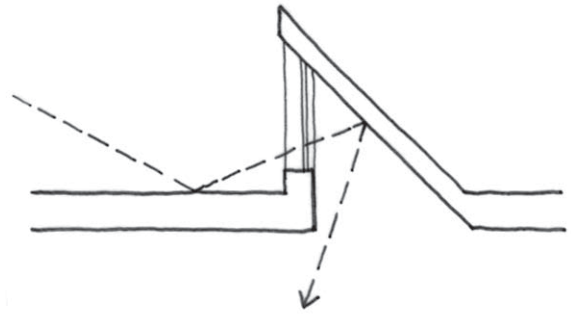
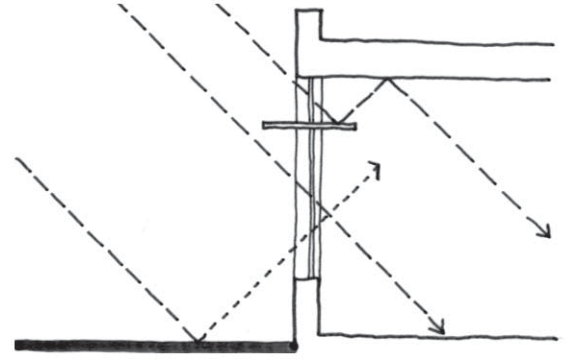


Figure V-7: Daylighting - Light Shelf



b. Daylighting

Orient and size windows to take advantage of solar orientation and help provide internal lighting to reduce the heating load and efficiently light interior spaces. Use awnings to shade south and west sun exposures during summer months. For efficient interior daylighting, use north-facing shed skylights *(Figure V-6)*, roof monitors *(Figure V-5)* and light shelves *(Figure V-7)*.

c. Curtain Walls

Glass curtain walls may be used only as a minor wall surface element and comprise no more than 20% of the building perimeter. Curtain walls may be used only for solar gain or daylighting purposes.

d. Glass Block

Glass block is an appropriate and functional material that is consistent with the high-tech environment at the Laboratory. Glass block is acceptable for use within any planning area.

e. Frame & Glass

Window frames should be of factory colored metal or clear anodized aluminum. Distinctive frame colors are encouraged to add interest to the building exterior and help emphasize the architectural style of the Laboratory. The Material Science Laboratory exhibits a successful use of colored window frames. Approved glass colors are gray, green or clear. Use of bronze or highly reflective glass is not allowed.

Image V-17: Roof Form/Window Example

Image V-18: Roof Form/Window Example

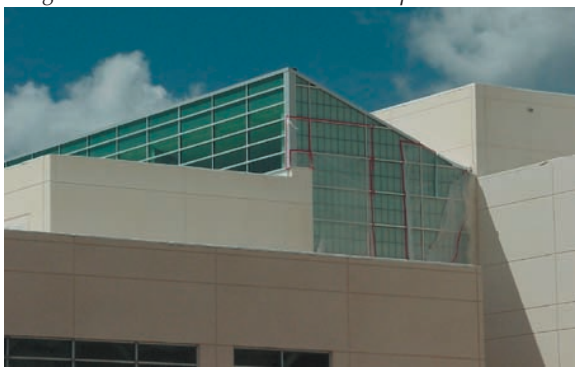


Image V-19: Window Daylighting/Awnings

3. Building Skin Materials

a. Acceptable Materials

Select building skin materials with high thermal performance, fire resistance, long-term durability and low maintenance. Industrial materials such as steel, selected for its high tech expression, should provide an appearance of refinement and quality. Natural materials such as stone, either in block or tiles, should be selected and incorporated in the design to appear permanent and indigenous to the Southwest *(Images V-20* through *V-25*).

Acceptable building skin materials include:

- Synthetic stucco
- Concrete block
- Concrete panels
- Metal panels
- Structural steel framing
- Stone

Alternate or additional materials may be submitted to PM-1 for review. See *Table V-4* for material guidelines within specific planning areas.

Building skin application guidelines for structures are intended to**:**

- Provide more than one, but not more than three, solid wall materials per structure.
- Utilize the same materials wherever appropriate within a complex, but vary the application.
- Combine smooth surface materials such as glass, metal and stucco with textured materials such as stone, concrete block, or textured concrete.

Image V-20: Precast Concrete

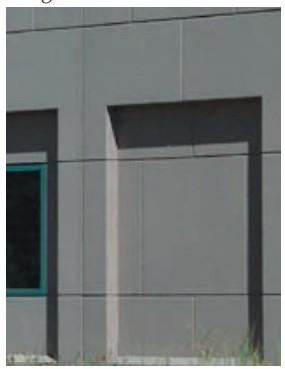


Image V-23: Concrete Block

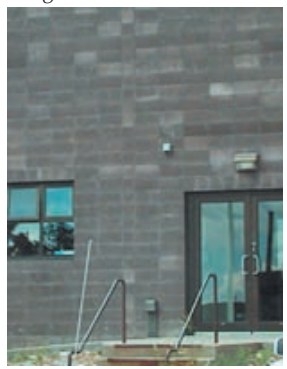


Image V-21: Metal Panels

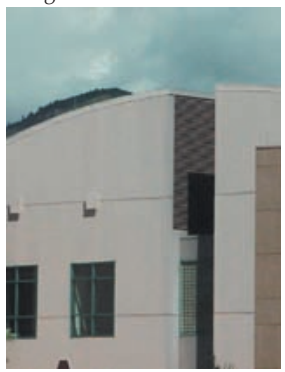


Image V-24: Structural Steel

Image V-22: Stucco

Image V-25: Stone Veneer

D. COLORS AND MATERIALS

1. Defined Color and Materials Palette

Specific types of materials and ranges of colors have been identified for each planning area in order to develop a more unified appearance.

Each planning area's color and materials palette has field and accent colors. Primary field colors cover more than 50% of the facade area, secondary field colors cover less than 50% of the facade area, and accent colors complement the field color to give greater definition and interest to the architecture. In general, the selected field colors reflect the tones and values found in the surrounding rock cliffs and native plants. These colors are primarily warm and neutral shades. Many of the colors are rich and deep rather than bright and light while values are medium to dark. Lighter colors are discouraged because of their high reflectivity and tendency to stand out from the local surroundings.

The field colors have an overall light reflectance value (LRV) of 67% or less. The following guidelines apply when selecting colors for a specific project:

- Primary field colors : 55% to 25% LRV
- Secondary field colors : all colors permitted
- Accent colors: 35% or less LRV

Kwal Howells manufactures the recommended paint color palettes. Designers may work directly with these colors or utilize their own preferred manufacturer provided the colors closely resemble the recommended colors and follow the LRV requirements.

2. Color and Material Application

The following specific guidelines address color and material application:

- Use darker colors at the base of a building to effectively anchor the structure to the ground.
- Change color at logical places in the building's design such as changes in form, massing, material, or between floors.
- Use multiple colors or materials to add interest and variety.
- If a building only has one material or color, the building design should gain interest through its form, massing, fenestration, or façade articulation.
- Integrate material and color changes with the fenestration pattern.
- Use accent colors to highlight window frames, main or equipment doors, entry structures, railings, accent roofs, or metal panels in curtain walls (*Image V-26 and V-27*).

a. Colors for modular and portable buildings

The color scheme for all portables and modular buildings recommended as a default selection throughout the Laboratory is.

Field Color: 8744D "Sweetwood"
Trim Color: 8752W "Stonehenge Shadow"

b. Wall and fence colors

Wall and fence colors and materials of a specific facility should match or compliment the colors and materials of that facility.
Refer to the Site Elements section for additional fencing design guidelines.

Image V-26: Field Color + Material Accent Example

Image V-27: Color Accent Example

E. SPECIFIC PLANNING AREAS COLOR PALETTES

Each of the following five planning areas have been individually analyzed to develop architectural and other visual consistencies. This section discusses each planning area's unique characteristics and identifies that area's defined color palette and design recommendations.

NOTE: *Colors shown may differ from exact color. For final color selection refer to samples on file at PM-1.*

Core Area Field Colors

1. Core Area

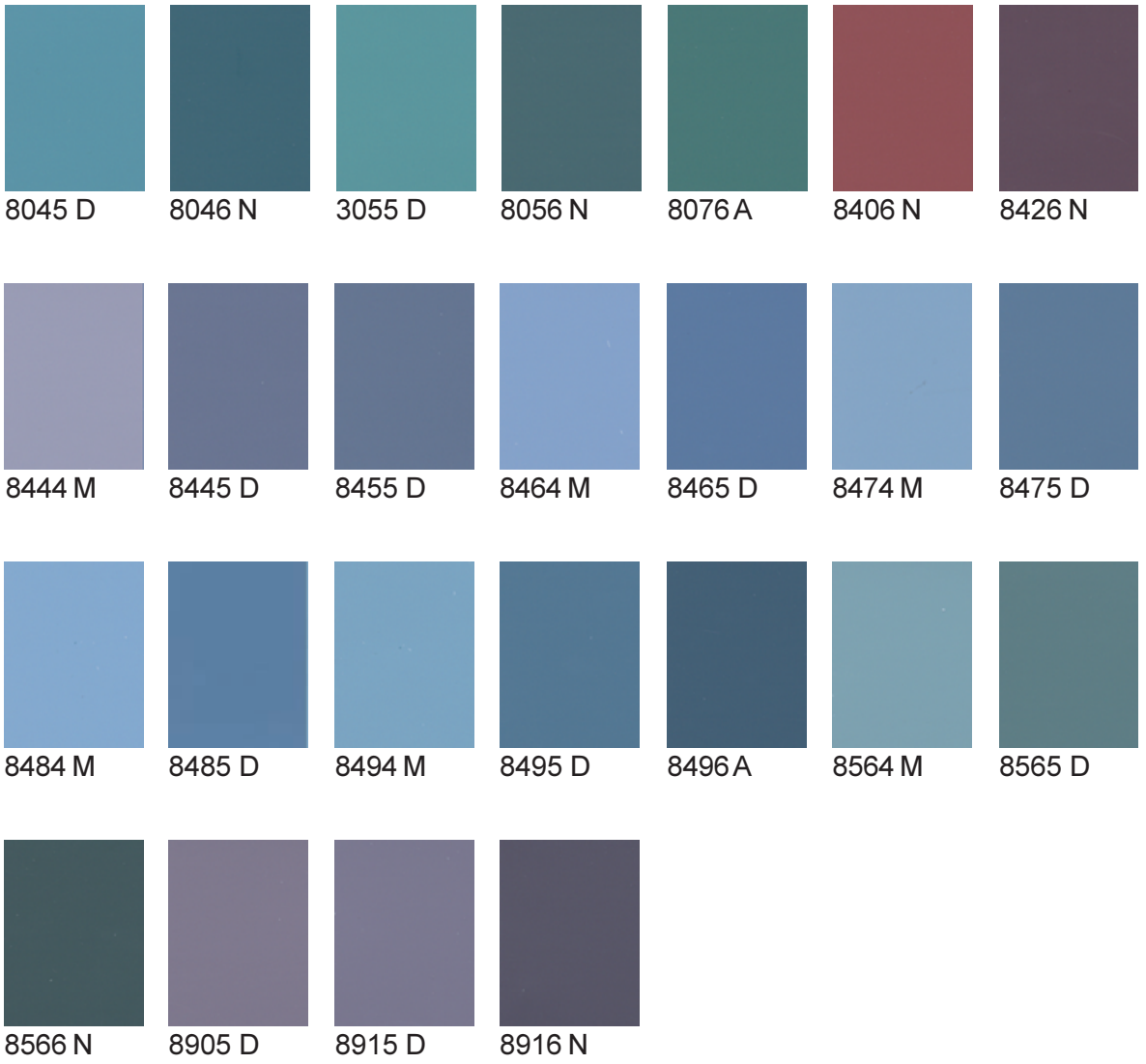
The majority of buildings in the core area are two- to four-story office and administrative structures with specific science structures occupying the edges. The office/administrative buildings tend to be the most visible buildings within the Laboratory and therefore should be the most representative examples of the image the Laboratory desires to project.

The identified field color palette for this area incorporates many of the existing shades of the TA-03 area for visual continuity but expands upon that palette and directs it away from some of the existing shades that have a yellow cast (Otowi). Accent color selection and application should be expressed more boldly in this highly visible area. The accent palette for the core area contains the greatest variety of shades from muted to rich deep colors.

Each new or renovated building should incorporate at least one accent color from the defined palette in a visually distinctive way. Existing examples of successful accent color application within the core area are the Material Science Laboratory (window frames), the CRC building (accent roofs) and the Physics building (South entry elements and horizontal banding). The Material Science Laboratory demonstrates exemplary use of accent colors.

NOTE: *Colors shown may differ from exact color. For final color selection refer to samples on file at PM-1.*

Core Area Accent Colors



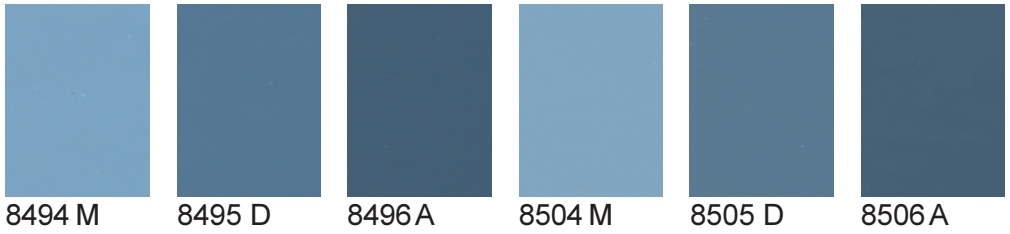
2. LANSCE

The LANSCE area is a collection of specific science structures, office buildings, and support structures. This area's varying topography provides opportunities for existing structures to be relatively screened from view by neighboring mesas. The field color palette for this area is based on existing shades and expands upon it within a defined color range. The accent color palette expands upon the shades of blue in use on many of the exit and service doors.

NOTE: *Colors shown may differ from exact color. For final color selection refer to samples on file at PM-1.*

LANSCE Field Colors

LANSCE Accent Colors

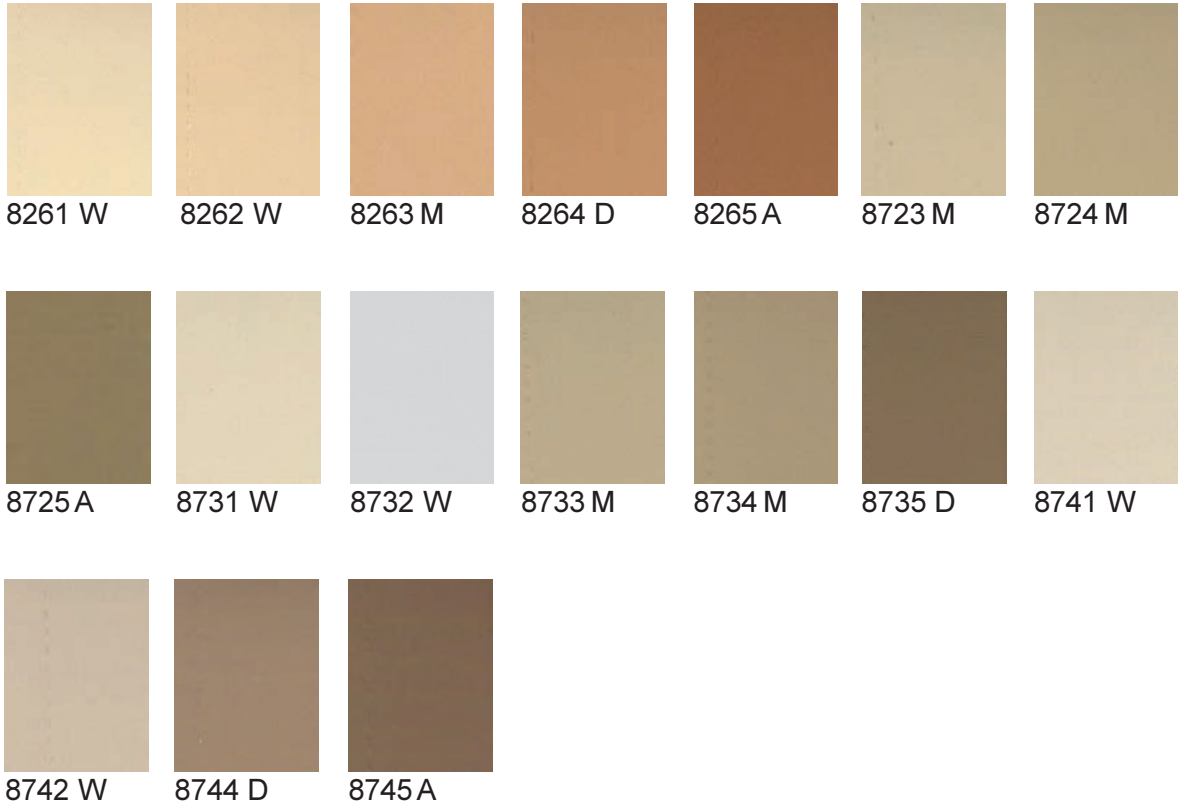


3. Pajarito Corridor West

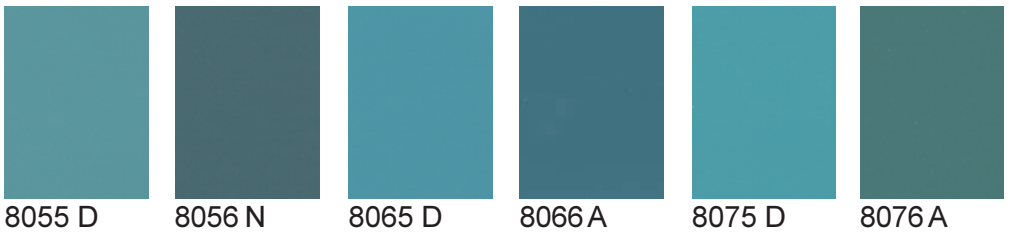
This area is a collection of specific science structures, office buildings and support structures. Many structures have visually exposed storage yards or mechanical areas. The existing field colors in this area are predominantly hues of tan and brown. The redefined field color palette expands upon this limited range to include a greater variety of shades and values. The accent color palette is a collection of muted blue-greens ranging from medium to dark.

NOTE: *Colors shown may differ from exact color. For final color selection refer to samples on file at PM-1.*

Pajarito Corridor West Field Colors



Pajarito Corridor West Accent Colors



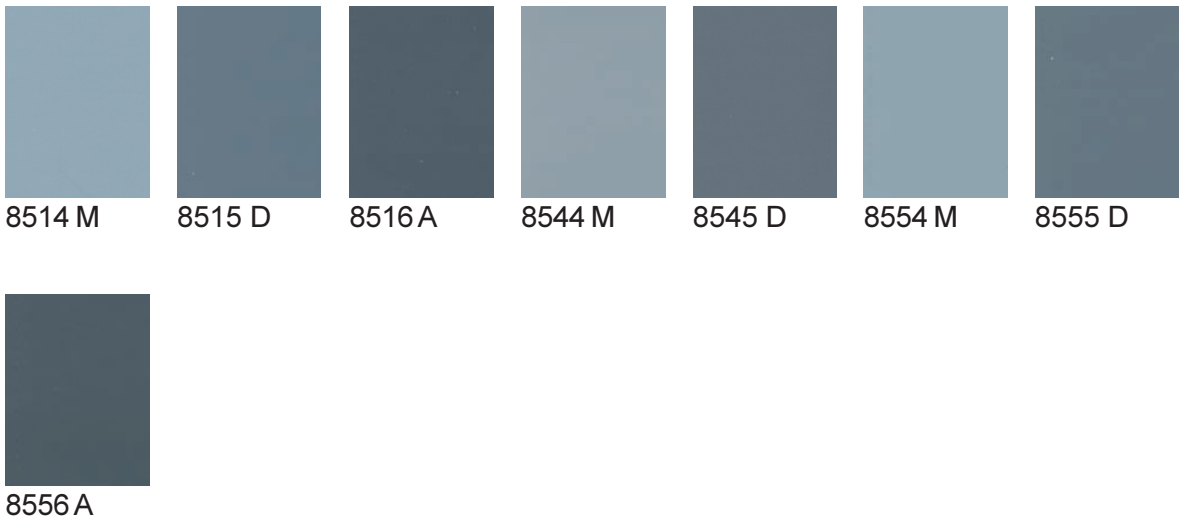
4. Pajarito Corridor East

This area is a collection of metal structures, one-story office or laboratory buildings, temporary buildings and tent structures for storage of hazardous materials. The area is perched at the end of a mesa with minimal tree cover and is visually perceptible from long and short distances. Structures should stay low in height and muted in color. The area's defined field color palette is composed of neutral shades in a medium to dark value range. The accent color palette is a modest selection of muted medium to dark blues.

NOTE: *Colors shown may differ from exact color. For final color selection refer to samples on file at PM-1.*

Pajarito Corridor East Field Colors

Pajarito Corridor East Accent Colors



5. Anchor Ranch

This area is heavily screened from outside views by the surrounding forest. Currently, this area is a collection of primarily one-story office buildings, concrete science buildings and storage structures. Metal roofs shelter some of the one-story structures, portables and the concrete fire house. The field and accent color palettes are designed to compliment the forested setting with a range of brown and tan field colors and muted green accent colors.

NOTE: *Colors shown may differ from exact color. For final color selection refer to samples on file at PM-1.*

Anchor Ranch Field Colors

Anchor Ranch Accent Colors

APPENDIX

APPENDIX

A. ACRONYM LIST

ADA	Americans with Disabilities Act
ADP	Area Development Plan
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
ASSHTO	American Association of Street, Highway and Transportation Officials
CD	Critical Decision
CSP	Comprehensive Site Plan
DOE	Department of Energy
ESA	Engineering Sciences and Applications Division
ESH	Environment, Safety and Health Division
ESH-20	Environment, Safety and Health Division 20 Group
GDBF	Guide for the Development of Bicycle Facilities
HID	High Intensity Discharge
ICC	International Code Council
IDS	Intrusion Detection Systems
IESNA	Illumination Engineering Society of North America
ISSM	Integrated Security and Safeguards Management
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Science Center
LEED	Leadership in Energy and Environmental Design
LEM	Laboratory Engineering Manual
LIR	Laboratory Implementation Regulation
LVR	Light Reflectance Value
MUTCO	Manual of Uniform Traffic Control Devices
NEC	National Electric Code
NFPA	National Fire Protection Act
NMNSPA	New Mexico Night Sky Protection Act
PM	Project Management Division
PM-1	Project Management 1 Group
R&D	Research and Development
S	Security and Safeguards Division
S-1	Security 1 Group
SS	Security and Safeguards
SSSP	Site Security and Safeguards Plan
TA	Technical or Tech Area
TEC	Total Estimated Cost
TPC	Total Project Cost
UBC	Uniform Building Code
U.S.	United States of America
UFAS	Uniform Federal Accessibility Standards

APPENDIX

B. PLANT LIST

This list is a list of plants approved for use at Los Alamos National Laboratory. It is not a list of all plants that grow in the local area.		Mature Height				Flower			Shade/Sun			Moisture					Seasonal Interest					Use	
Botanic Name	***Common Name***	*Under 12"*	*1' to 3'*	*3' to 6'*	*Over 6'*	*Spring*	*Summer*	*Fall*	*Full Shade*	*Part Shade*	*Full Sun*	*Dry*	*Average*	*Moist*	**Native**	**Drought Tolerant**	*Flowers*	*Fruit*	*Full Color*			**Urban**	**Rural**
TREES																							
Abies concolor	White Fir				●						●		●	●	●	●						●	
Pinus ponderosa	Ponderosa Pine				●						●	●			●	●						●	●
Acer ginnala	Amur Maple				●						●		●			●			●			●	
Acer glabrum	Rocky Mountain Maple				●						●		●		●	●		●	●			●	
Acer s. grandidentatum	Western Sugar (Bigtooth) Maple				●						●		●		●	●			●			●	
Celtis occidentalis	Common Hackberry				●	●					●	●	●		●	●		●				●	●
Crataegus crusgalli var. inermis	Thornless Cockspur Hawthorn				●	●					●		●			●		●				●	●
Juniperus scopulorum	Rocky Mountain Juniper				●						●	●			●	●		●					●
Juniperus monosperma	One-seed Juniper				●						●	●			●	●		●					●
Pinus edulis	Pinon Pine				●						●	●	●		●	●	●					●	●
Pinus flexilis	Limber Pine				●					●	●	●	●		●	●							
Populus tremuloides	Quaking Aspen				●						●		●	●	●				●				
Quercus gambelii	Gambel Oak				●					●	●	●	●		●	●							
Fraxinus pennsylvanica	Green Ash				●						●		●						●			●	
Platanus occidentalis	American Planetree				●						●		●									●	
Gleditsia triacanthos var. inermis	Thornless Honeylocust				●						●		●									●	
Malus spp.	Crabapple				●	●					●		●				●					●	
Pyrus spp.	Ornamental Pear				●	●					●		●			●	●					●	

Botanic Name	Common Name	Mature Height				Flower			Shade/Sun			Moisture					Groth Rate					Use	
		Under 12"	*1' to 3'*	*3' to 6'*	*Over 6'*	*Spring*	*Summer*	*Fall*	*Full Shade*	*Part Shade*	*Full Sun*	*Dry*	*Average*	*Moist*	**Native**	**Drought Tolerant**	*Erosion Control*	*Screening*	*Slow*	*Moderate*	*Rapid*	**Urban**	**Rural**
SHRUBS																							
Artemesia tridentata	Big Sagebrush			●							●	●			●	●	●				●		●
Atriplex canescens	Four-Wing Saltbush			●							●	●			●	●	●				●		●
Caragana arborescens	Siberian Peashrub				●	●				●		●	●		●	●		●			●		●
Caryopteris x. clanodnensis	Blue-mist Shrub				●			●				●	●	●									
Chaenomeles speciosa	Common Floweringquince		●	●		●				●	●	●	●			●				●		●	
Chamaebatiaria millefolium	Fernbush			●		●				●	●	●			●	●		●			●	●	●
Chrysothamnus nauseosus	Rubber Rabbitbrush			●				●			●	●			●	●	●				●		●
Cotoneaster divaricatus	Spreading Cotoneaster			●		●				●	●		●				●			●	●	●	
Cowania mexicana	Cliffrose			●			●				●	●			●	●			●			●	●
Cercocarpus ledifolius	Curl-leaf Mountain Mahogany			●							●	●			●	●		●	●			●	●
Cercocarpus intricatus	Littleleaf Mountain Mahogany			●						●	●	●			●	●		●	●			●	●
Cercocarpus montanus	Mountain Mahogany			●						●	●	●			●	●		●	●				●
Cornus sericea 'Isanti'	Isanti Redosier Dogwood			●			●		●	●			●	●							●	●	
Elaeagnus commutata	Silverberry				●	●					●	●	●		●	●		●			●	●	●
Fallugia paradoxa	Apache Plume				●		●				●	●			●	●	●				●	●	●
Foresteria neomexicana	New Mexico Olive				●	●				●	●	●	●		●	●		●			●	●	
Forsythia 'Arnold Dwarf'	Arnold Dwarf Forsythia			●		●				●	●	●	●				●				●	●	
Forsythia 'Northern Sun'	Northern Sun Forsythia				●	●				●	●	●	●				●				●	●	

Botanic Name	Common Name	Mature Height				Flower			Shade/Sun			Moisture					Groth Rate					Use	
		Under 12"	1' to 3'	3' to 6'	Over 6'	Spring	Summer	Fall	Full Shade	Part Shade	Full Sun	Dry	Average	Moist	Native	Drought Tolerant	Erosion Control	Screening	Slow	Moderate	Rapid	Urban	Rural
SHRUBS CONTINUED....																							
Juniperus spp.	Juniper Species			●						●	●	●	●				●			●		●	
Juniperus communis	Common Juniper		●						●	●		●	●		●	●	●			●			●
Lonicera involucrata	Twinberry			●			●		●	●		●	●			●				●		●	
Lonicera spp.	Honeysuckle Species				●	●	●			●	●		●							●		●	●
Mahonia aquifolium 'Compactum'	Compact Oregon Grape			●		●				●			●						●			●	
Mahonia repens	Creeping Mahonia		●			●				●			●						●			●	
Perovskia atriplicifolia	Russian Sage		●				●				●	●				●							
Pinus mugo	Mugo Pine and Varieties		●	●	●				●	●	●		●	●				●	●			●	●
Potentilla fruticosa 'Gold Drops'	Gold Drop Bush Cinquefoil		●				●				●	●	●			●				●		●	●
Potentilla fruticosa 'Klondike'	Klondike Bush Cinquefoil		●				●				●	●	●			●				●		●	●
Potentilla fruticosa 'Katherine Dykes'	Katherine Dykes Bush Cinquefoil		●				●				●	●	●			●				●		●	●
Prunus americana	American Plum				●	●					●	●	●		●	●					●	●	●
Prunus besseyi	Western Sand Cherry			●		●					●	●	●		●	●				●		●	●
Prunus virginiana melanocarpa	Common Chokecherry				●	●				●	●		●			●				●		●	●
Ribes alpinum 'Aureum'	Yellow-leaved Alpine Currant			●		●				●	●	●	●							●		●	●
Ribes alpinum 'Cereum'	Squaw Currant			●		●					●	●								●		●	
Ribes inermis	Whitestem Gooseberry			●		●			●	●	●	●	●		●					●		●	
Rosa foetida	Austrian Copper Rose				●	●					●	●	●			●					●	●	

Botanic Name	Common Name	Mature Height				Flower			Shade/Sun			Moisture					Groth Rate					Use	
		Under 12"	1' to 3'	3' to 6'	Over 6'	Spring	Summer	Fall	Full Shade	Part Shade	Full Sun	Dry	Average	Moist	Native	Drought Tolerant	Erosion Control	Screening	Slow	Moderate	Rapid	Urban	Rural
SHRUBS CONTINUED....																							
Salix exigua	Coyote Willow				●	●					●		●	●	●		●				●	●	●
Shepherdia argentea	Silver Buffaloberry				●	●					●	●			●	●	●			●		●	●
Spiraea spp.	Spirea species			●		●				●	●		●					●		●		●	
Syringa patula 'Miss Kim'	Miss Kim Korean Lilac			●		●				●	●	●	●							●		●	
Syringa spp.	Common Lilac Species				●	●				●	●	●	●							●		●	●
Viburnum lentago	Nannyberry Viburnum				●	●			●	●	●	●	●			●	●			●		●	●
Yucca baccata	Banana Yucca		●				●				●	●			●	●				●		●	
Yucca glauca	Narowleaf Yucca		●				●				●	●			●	●		●		●			

Botanic Name	Common Name	Mature Height				Flower			Shade/Sun			Moisture					Growth Rate					Use	
		Under 12"	1' to 3'	3' to 6'	Over 6'	Spring	Summer	Fall	Full Shade	Part Shade	Full Sun	Dry	Average	Moist	Native	Drought Tolerant	Erosion Control	Screemomg	Slow	Moderate	Rapid	Urban	Rural
GRASSES																							
Calamagrostis acutiflora 'Stricta'	Feather Reed Grass		•								•	•				•	•				•	•	•
Festuca ovina var. glauca	Blue Fescue	•									•	•				•	•				•	•	•
Helictotrichon sempervirens	Blue Avena (Oat) Grass		•								•	•				•	•				•	•	•
Miscanthus sinensis 'Gracillimus'	Maidenhair Grass		•								•	•				•	•				•	•	•

Botanic Name	Common Name	Percentage PLS Per Pound Sunny Location	Total Seeds per Pound Shady Location
Native Grass Pure Live Seed Rates			
Bouteloua gracilis	Blue Grama Grass	40 - 45%	825,000
Bouteloua curtipendula	Sideoats Grama	65 - 75%	191,000
Agropyron desertorum	Crested Wheatgrass	70 -80%	200,000
Schizachyrium scoparium	Little Bluestem	50 - 60%	379,000
Muhlengergia wrightii	Spike Muhly	55 - 60%	1,635,000
Hilaria jamesii	Galleta	30 - 40%	159,000
Oryzopsis hymenoides	Indian Rice Grass	65 - 75%	235,000
Agropyron smithii	Western Wheatgrass	75 - 85%	110,000
Buchloe dactyloides	Buffalo Grass	70 - 80%	56,000
Festuca arizonica	Arizona Fescue	70 -80%	550,000
Festuca ovina	Sheep Fescue	80 -90%	
Festuca thurberi	Thurber Fescue		
Festuca rubra var. rubra	Creeping Red Fescue	75 - 85%	615,000
Agropyron dasystachyum	Streambank Wheatgrass	80 - 90%	170,000
Recommended Seed Rate Per Foot:			
Average	70 - 75 seeds per foot		
Severe Sites	80 - 90 seeds per foot		