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:

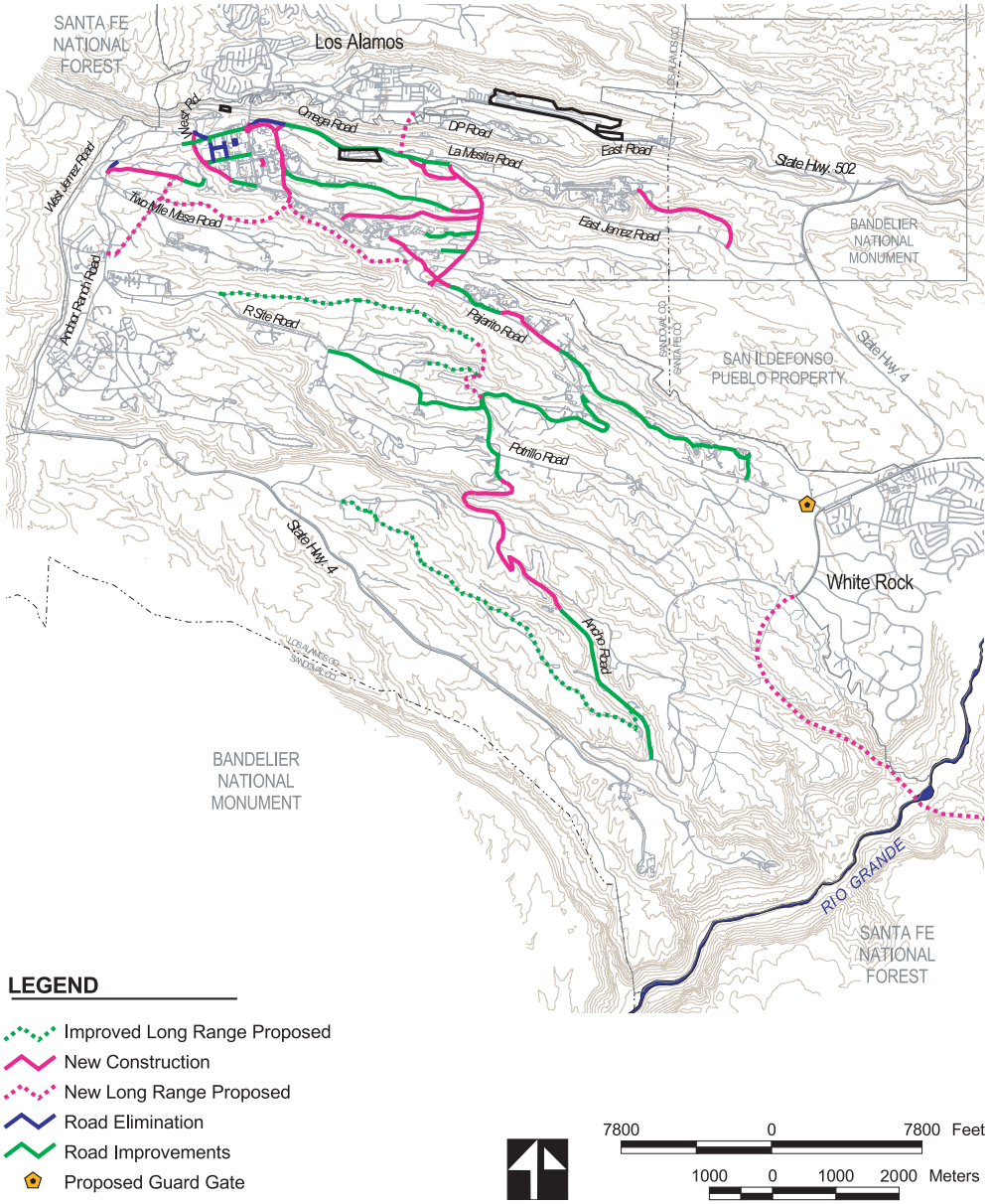
- Future east loop road at TA-03
- Future west loop road at TA-03
- West Jemez Road within TA-03

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

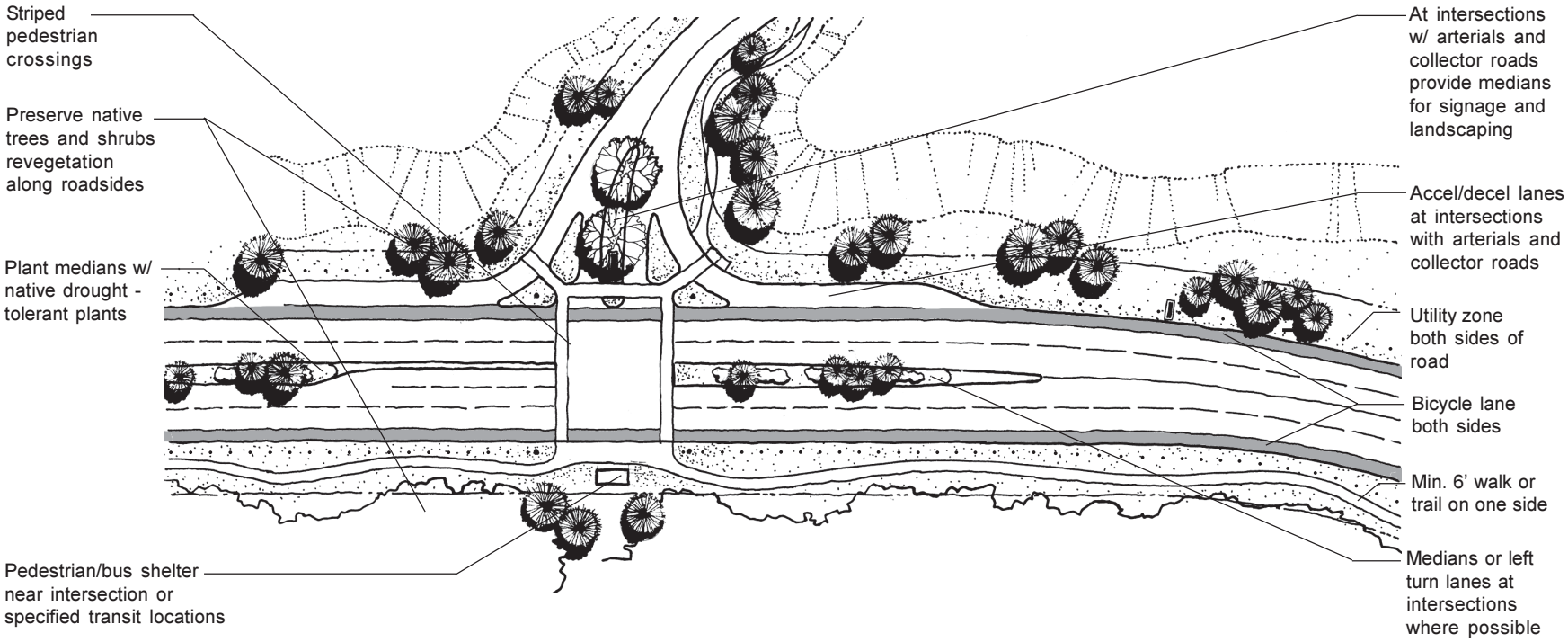
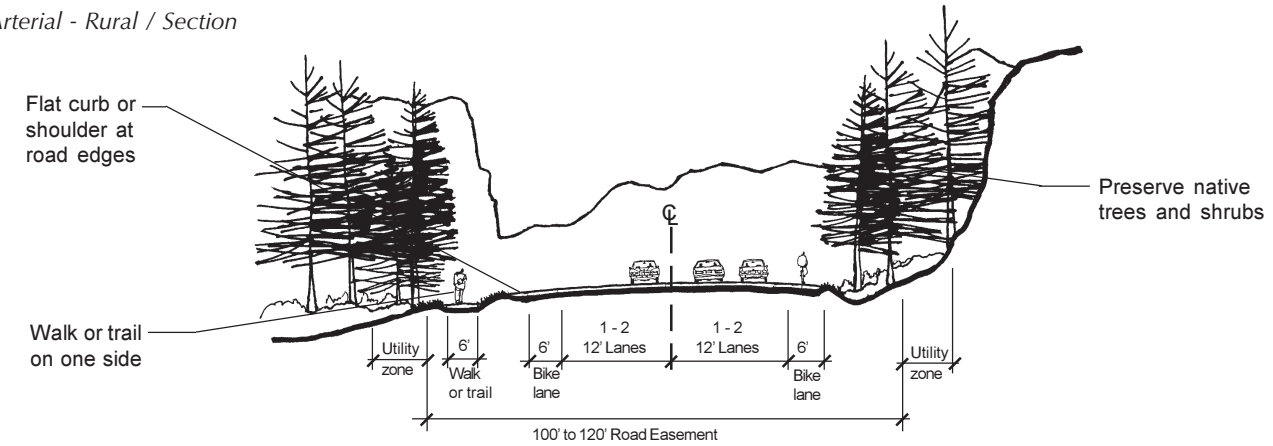


Figure IV-24: Major Arterial - Rural / Section



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

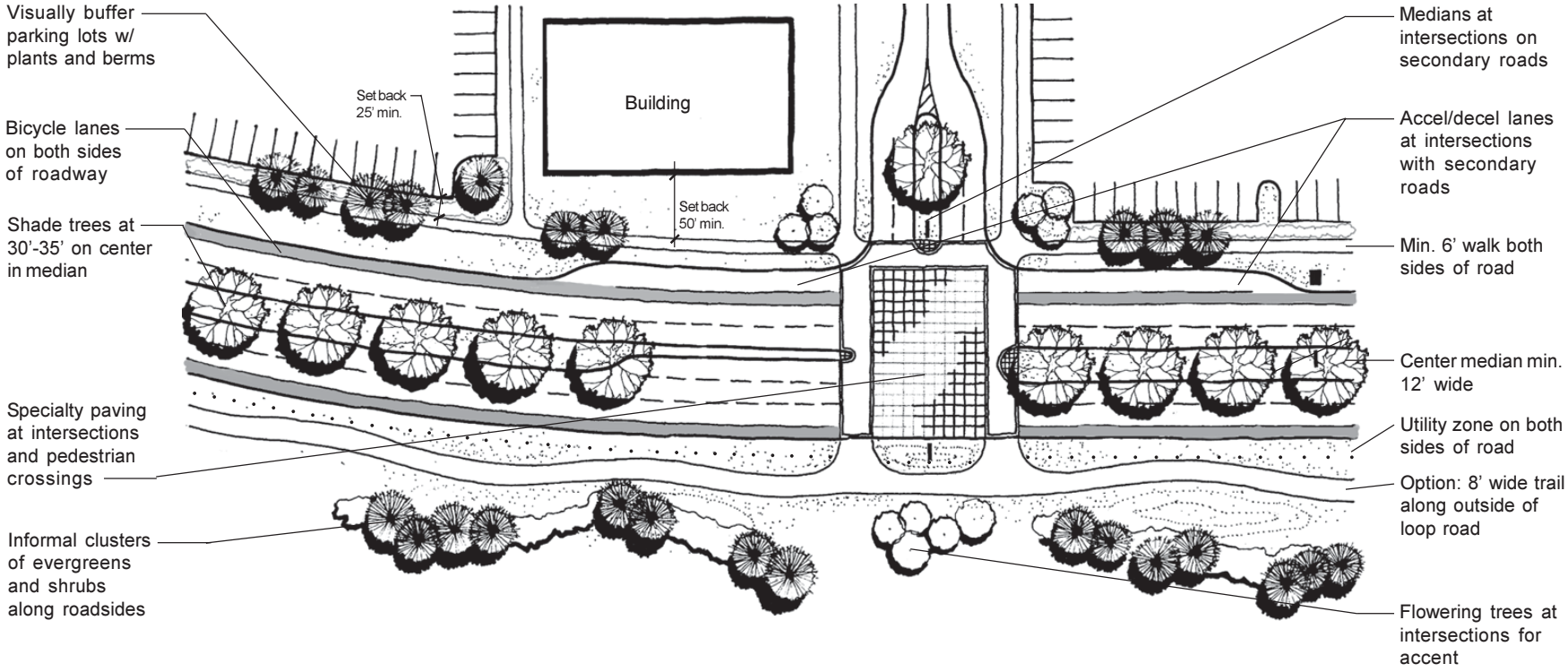
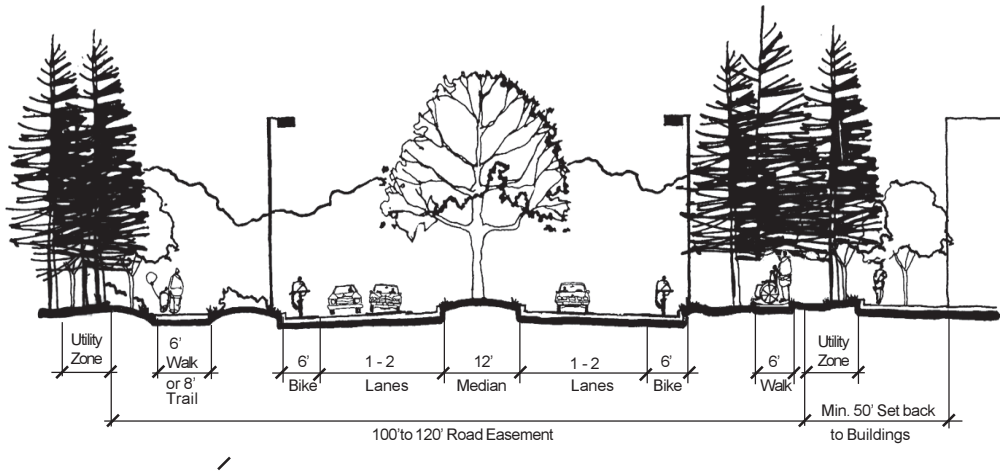


Figure IV-26: Major Arterial - Urban / Section



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

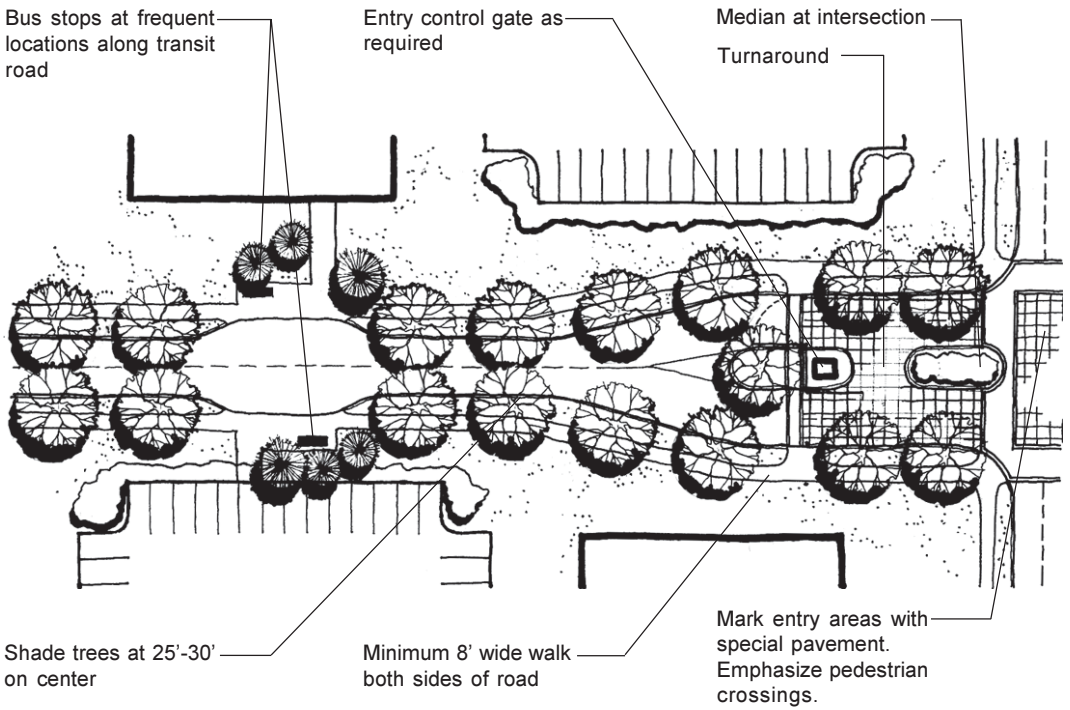
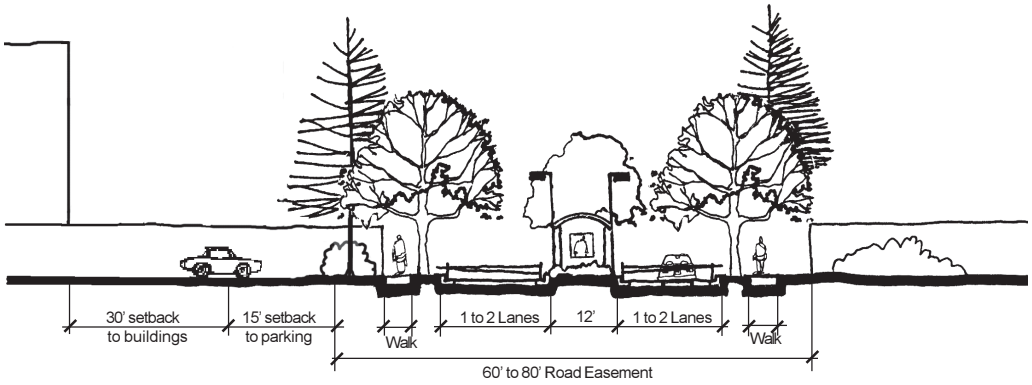


Figure IV-28: Transit Road / Section at Control Gate Area



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

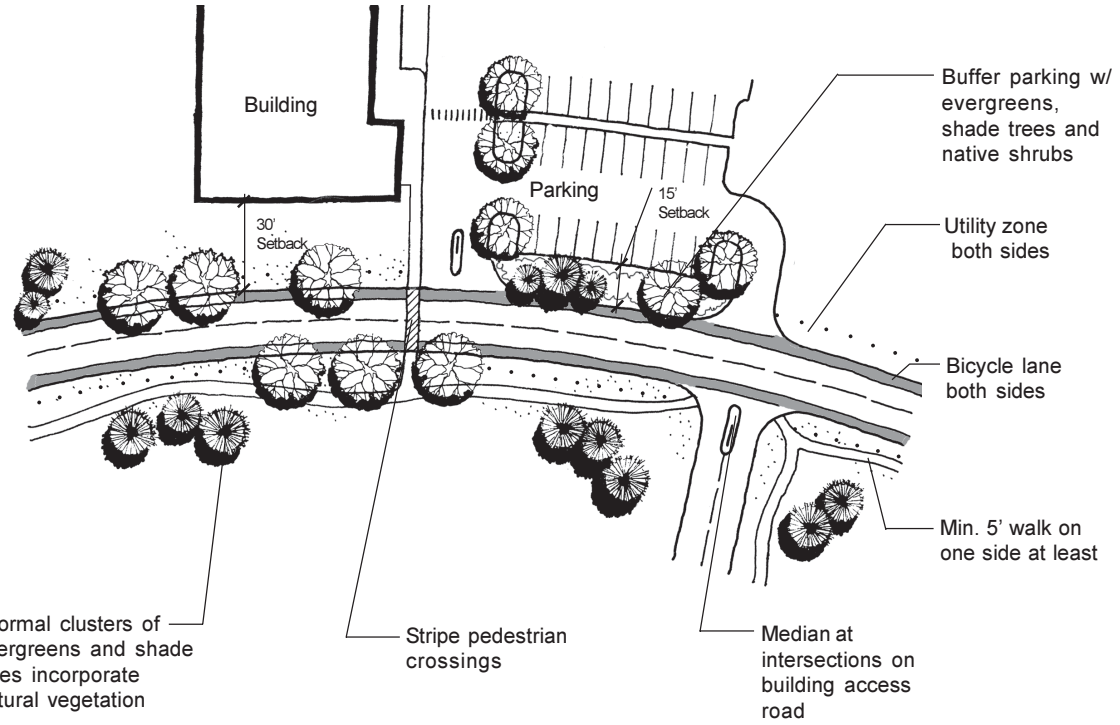
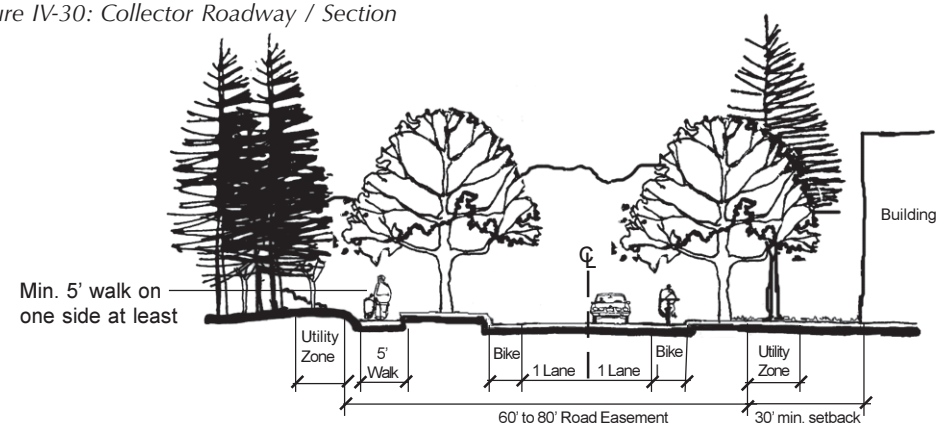


Figure IV-30: Collector Roadway / Section



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

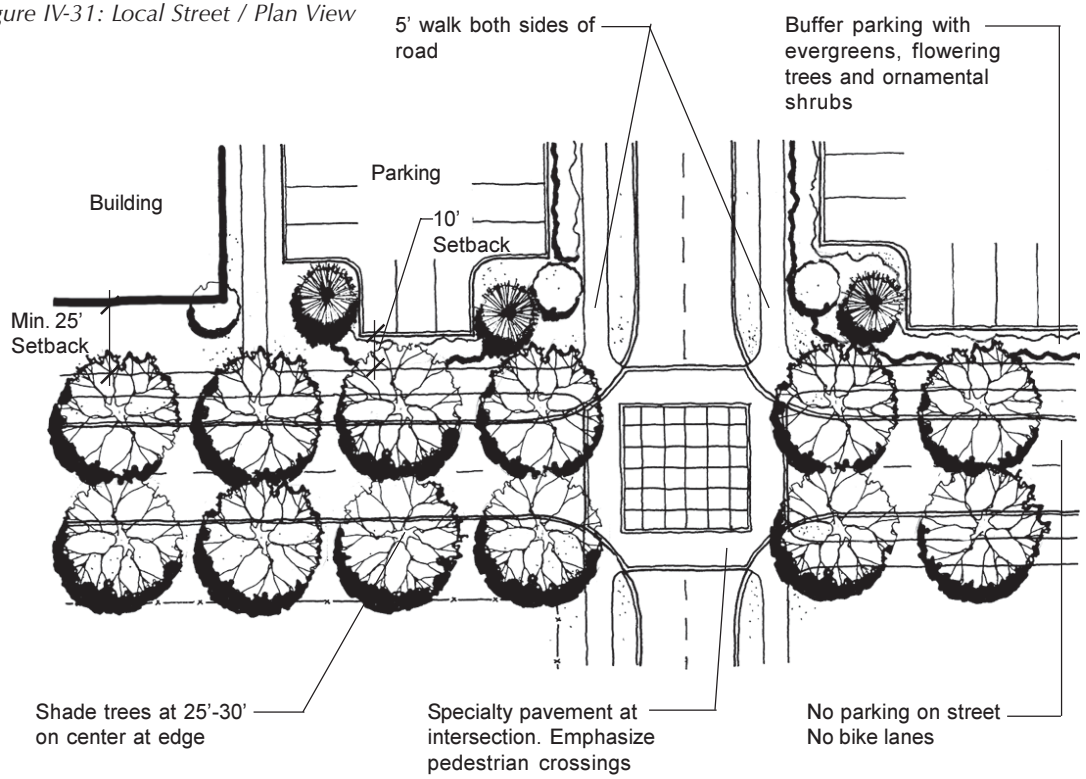
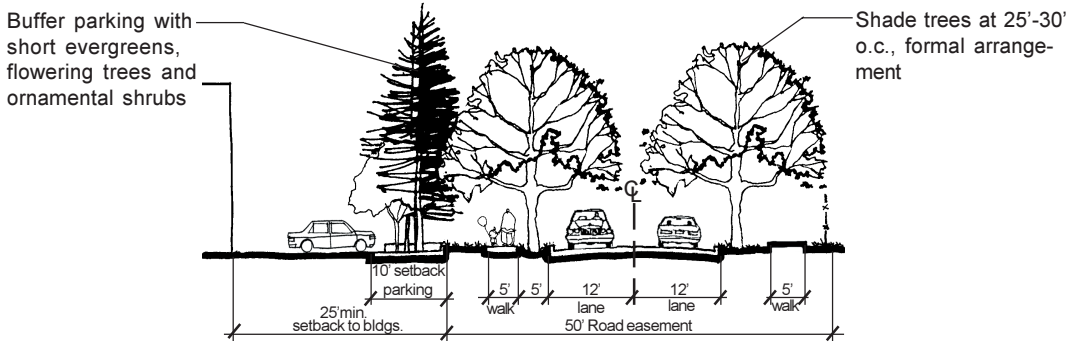


Figure IV-32: Local Street / Section



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

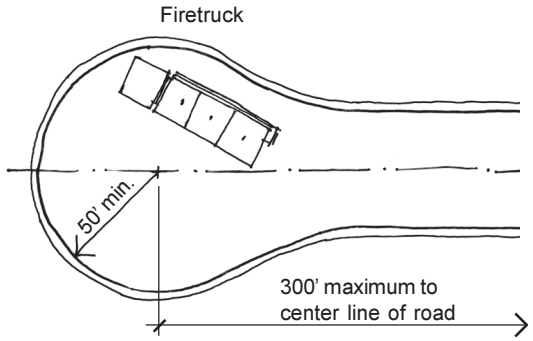


Figure IV-34: Clear Sight Triangle

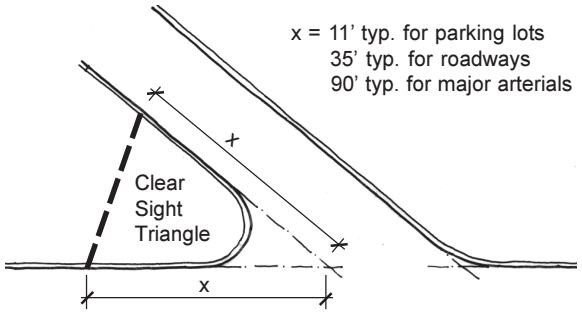


Figure IV-35: Service-Emergency Access Road / Plan

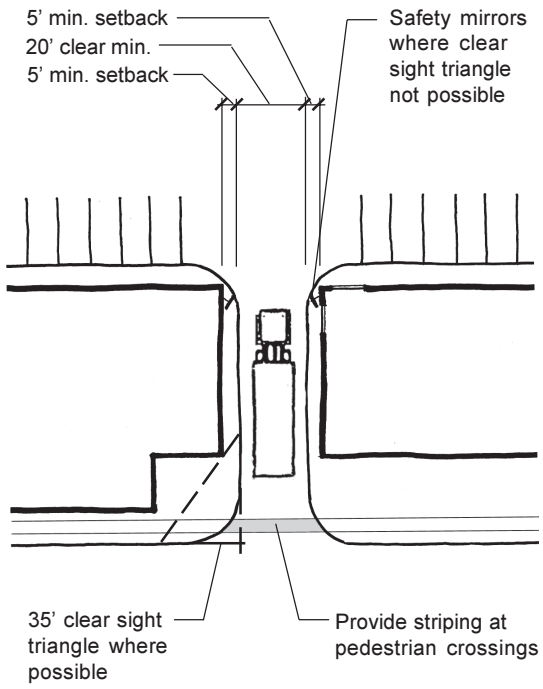
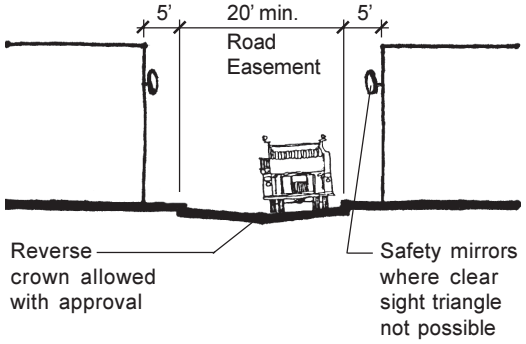


Figure IV-36: Service-Secondary Access Road / Section



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

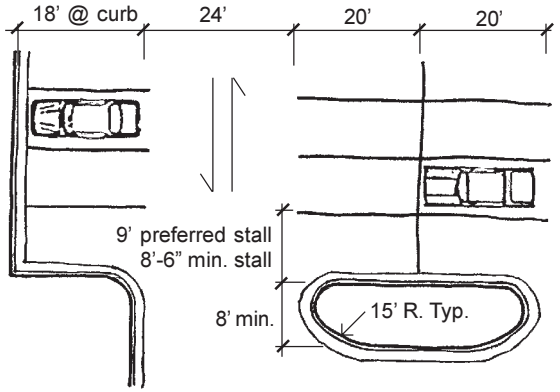


Figure IV-38: Angled Parking Layout

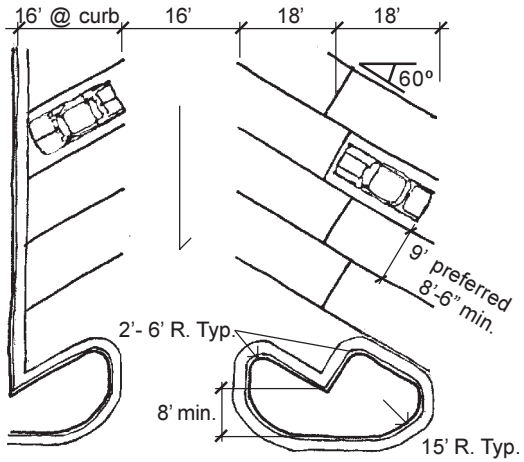


Table IV-2: Parking Stall Design Standards

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

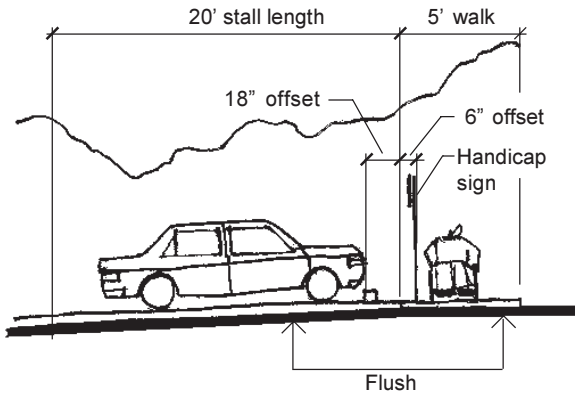
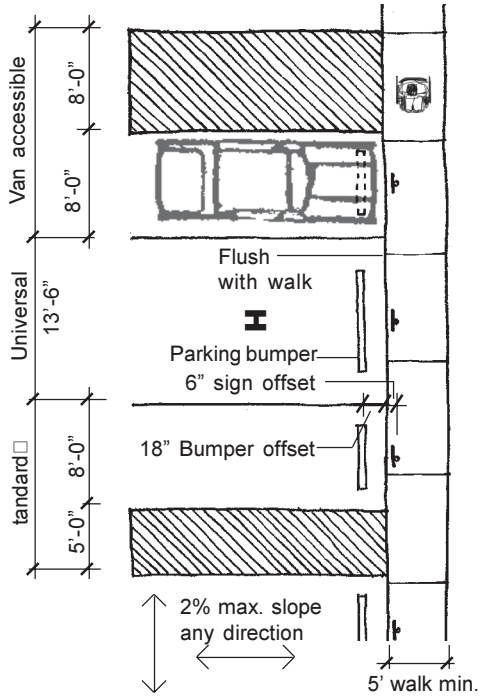


Figure IV-40: Accessible Stalls Layout



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

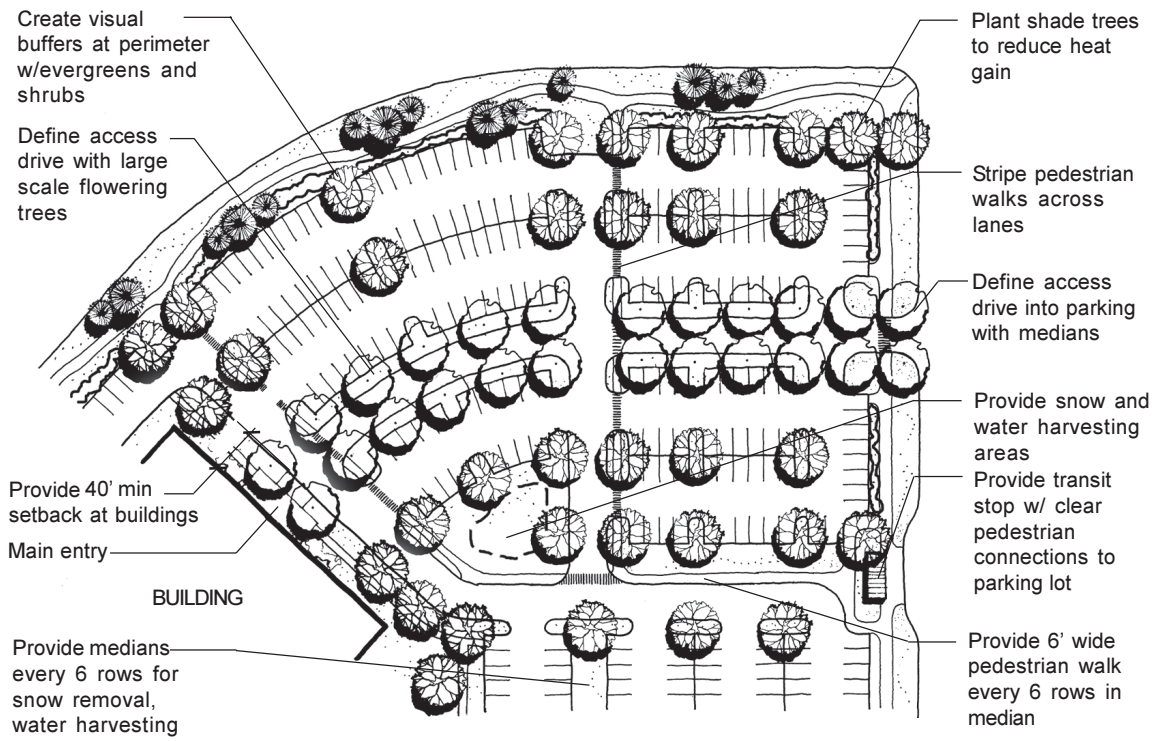


Image IV-7: Large Scale Parking - Existing

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

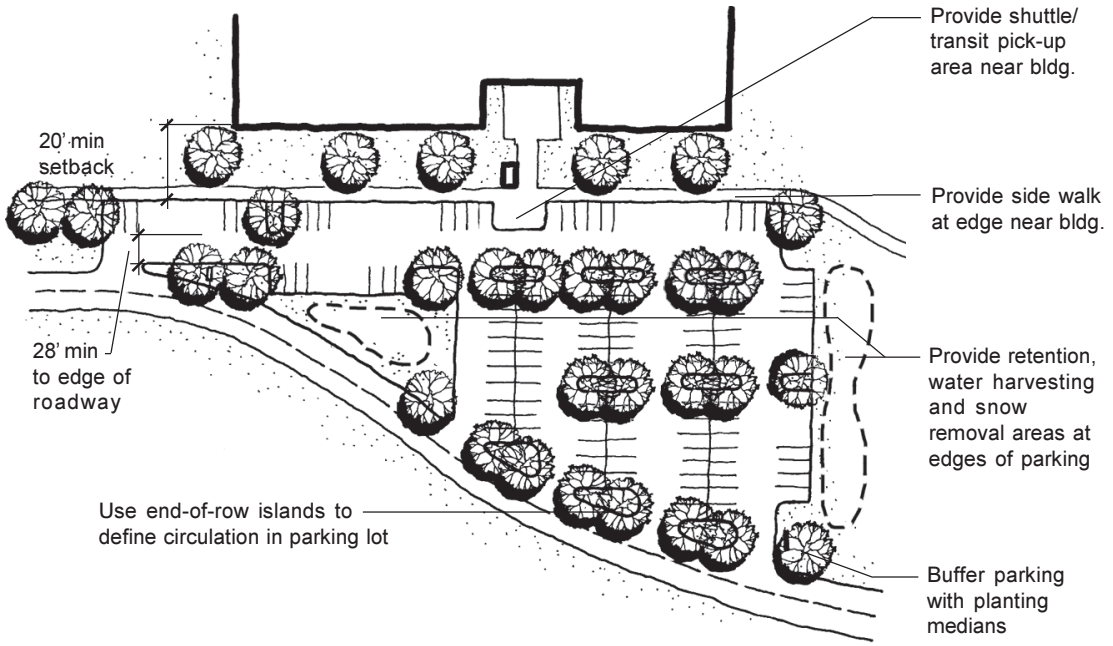


Image IV-9: Small Scale Parking - Existing

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

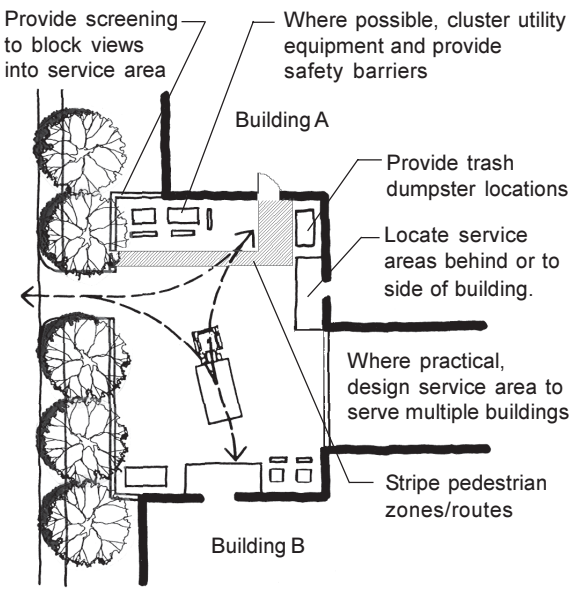
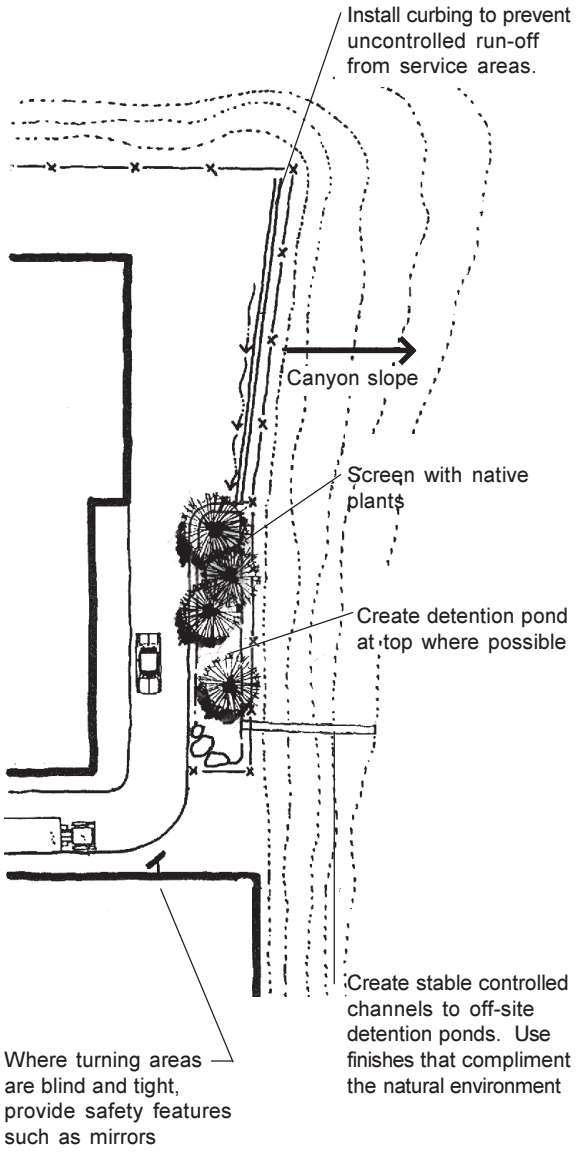


Figure IV-44: Service Areas At Canyon Edges



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

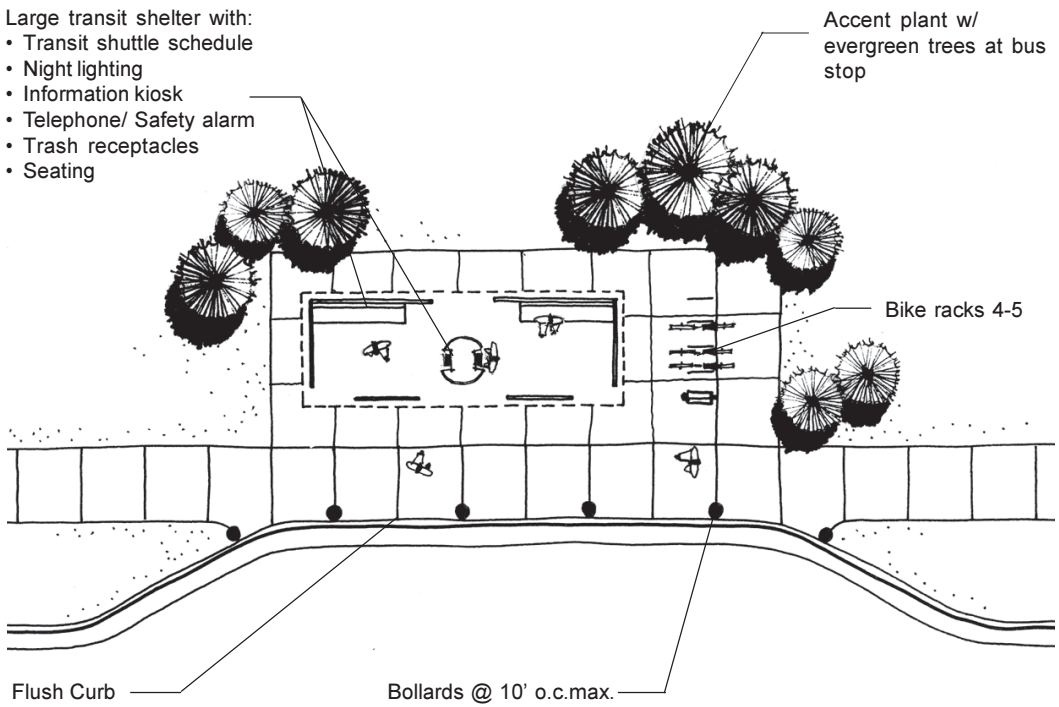
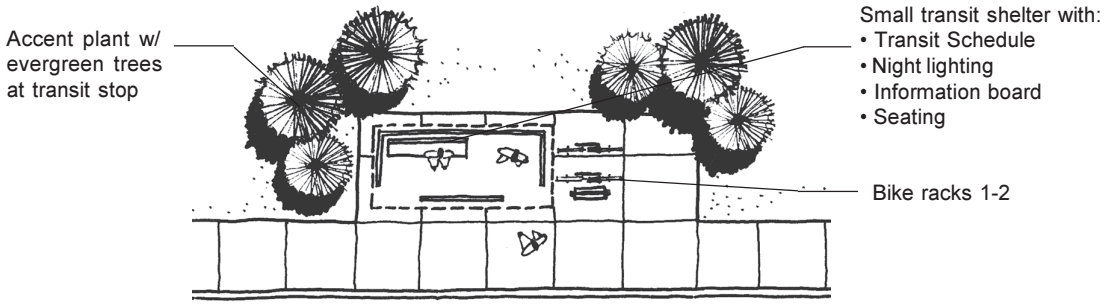


Figure IV-46: Minor Transit Stop Layout / Plan View



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

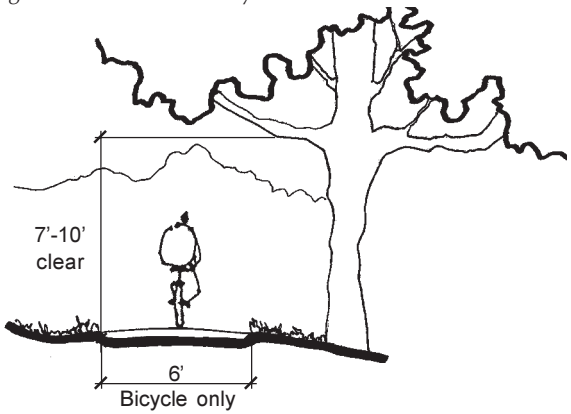


Figure IV-48: Class 1 Mixed Pedestrian / Bicycle Trail

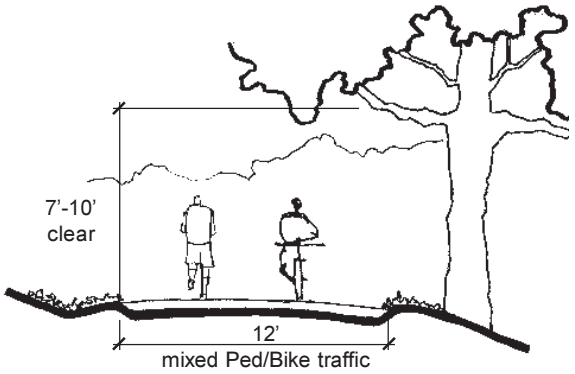
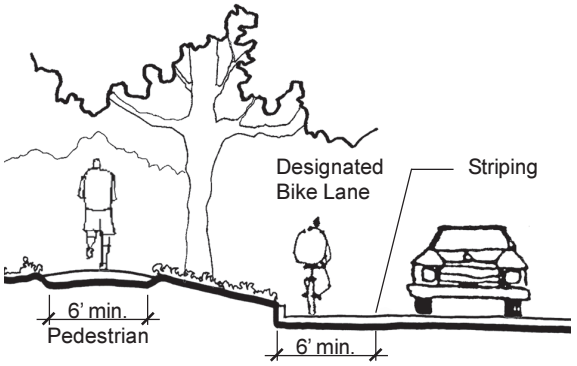


Figure IV-49: Class 2 Bicycle Trail



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

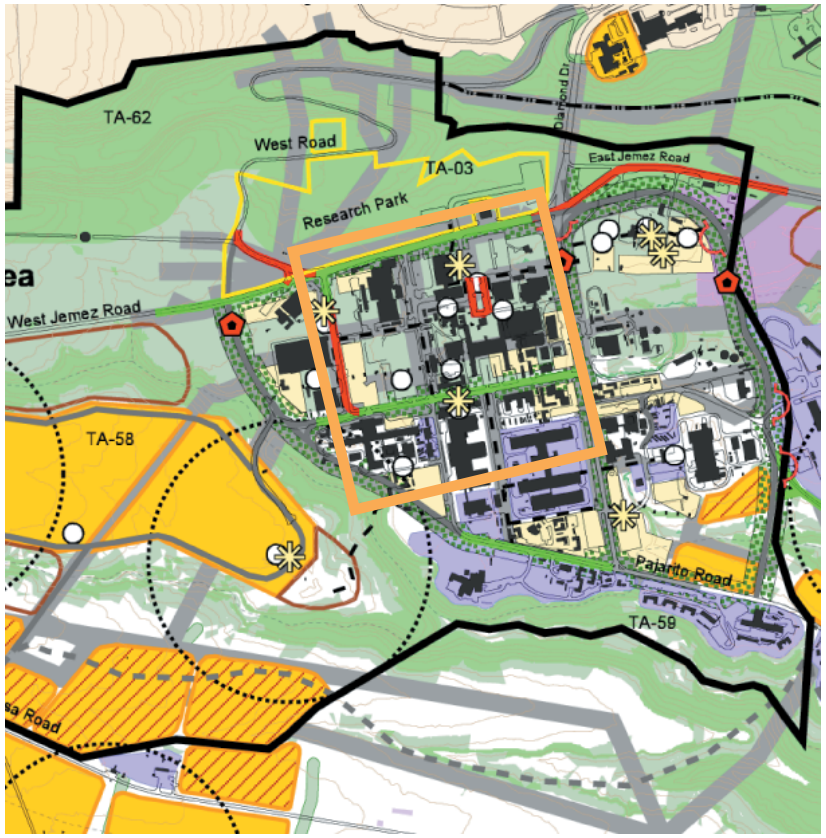


Figure IV-51: Pedestrian System - Concept Diagram / TA-03 Core Area

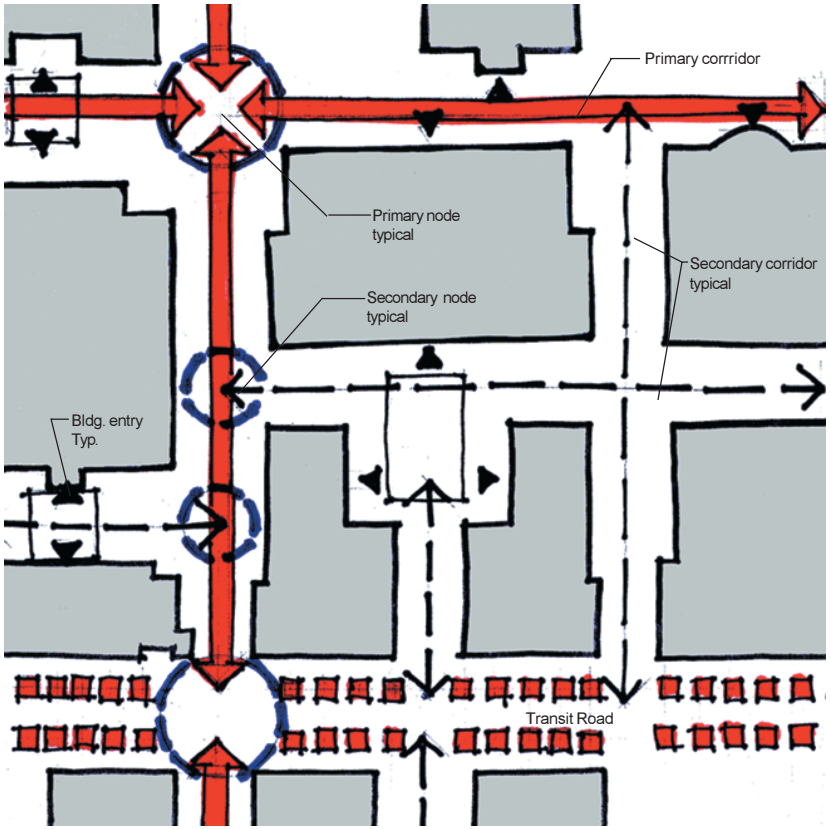


Figure IV-52 applies the standards in the *Design Principles* to each pedestrian corridor and sidewalk type.

- 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

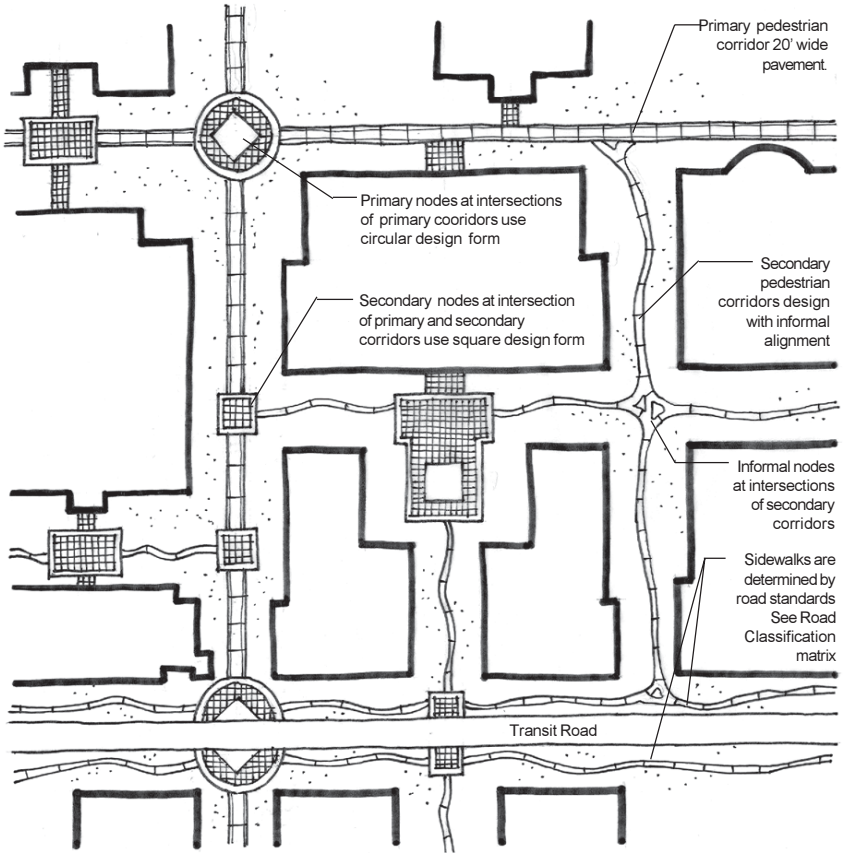
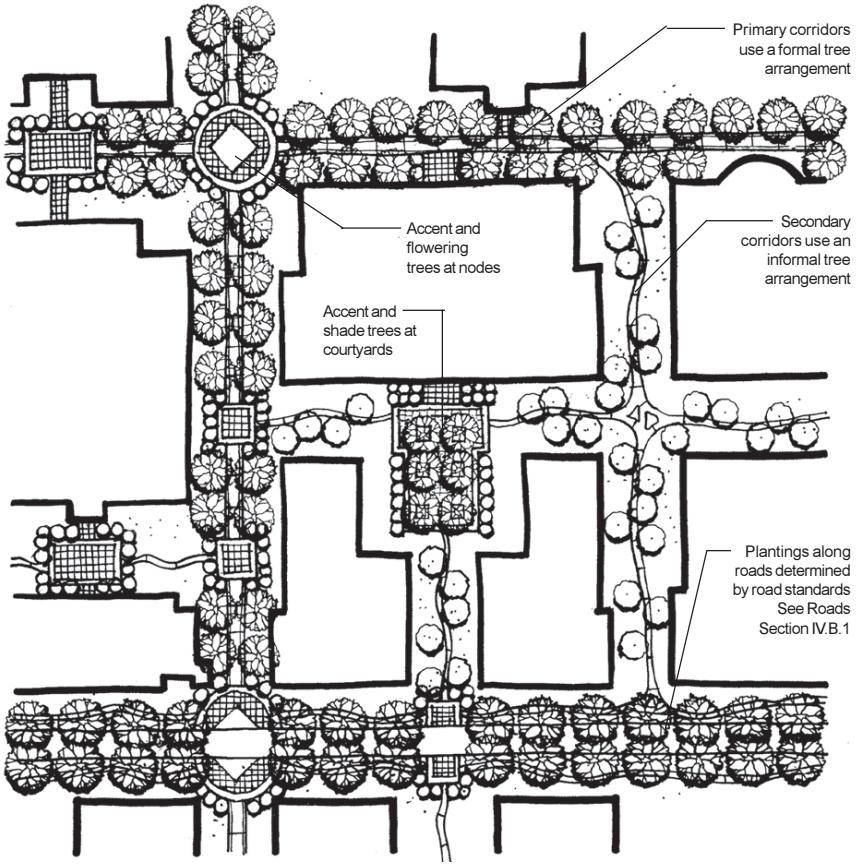


Figure IV-53: Pedestrian System - Landscape Concept / TA-03 Core Area



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

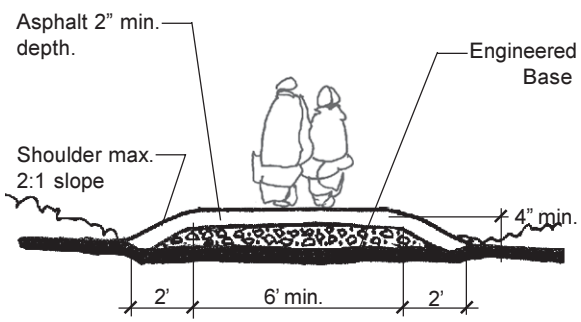


Figure IV-55: Gravel Trail - Section

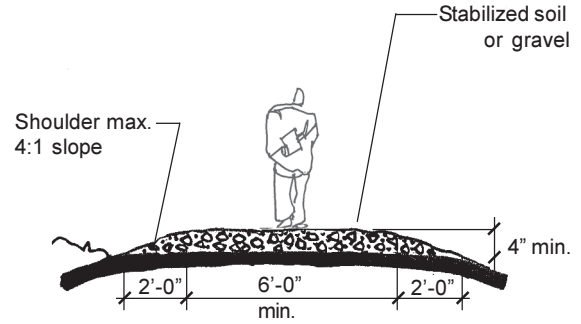
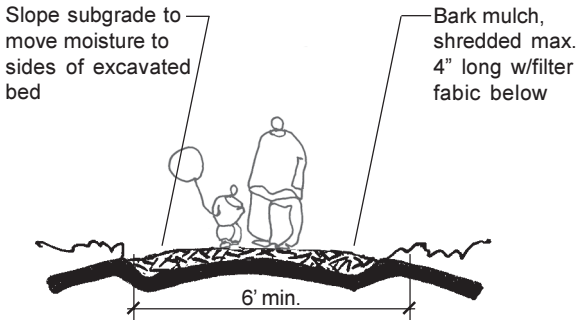


Figure IV-56: Bark Mulch Trail - Section



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

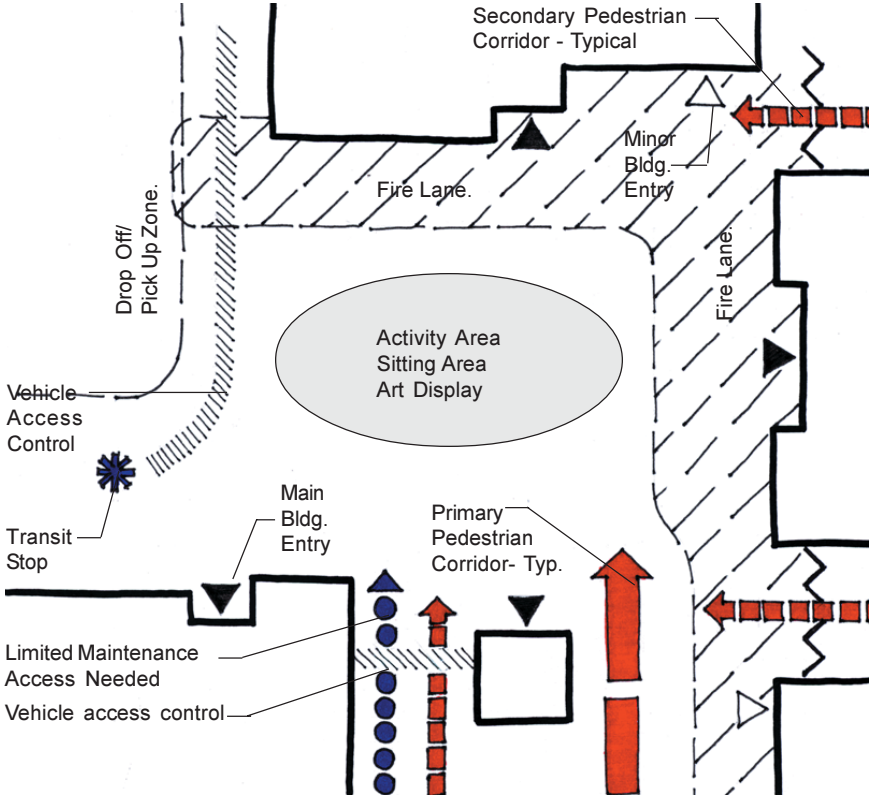
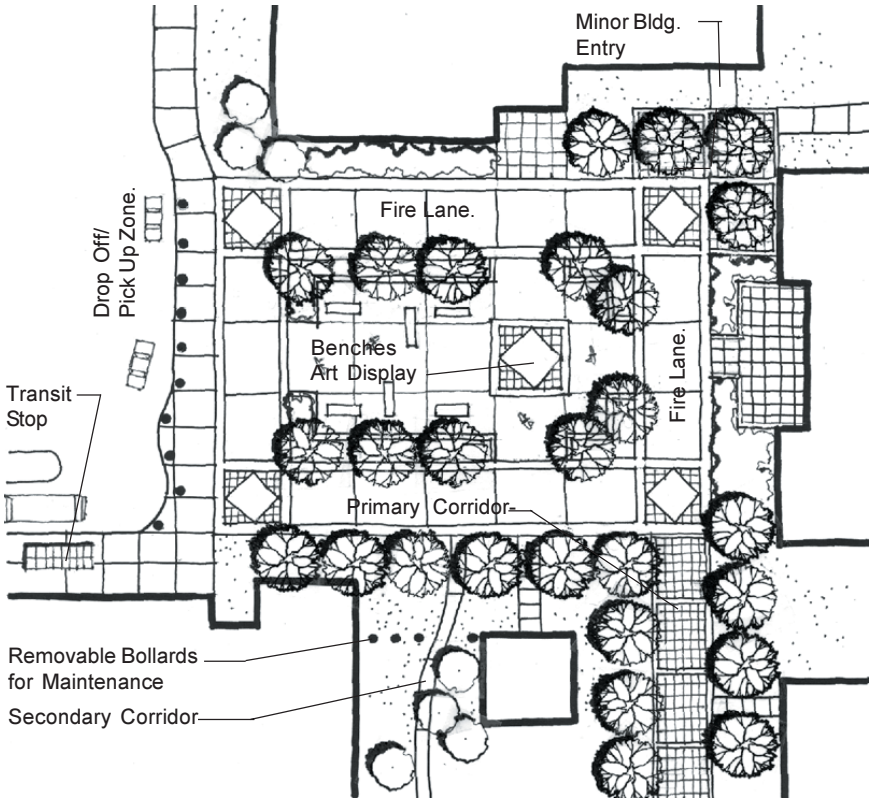


Figure IV-58: Plaza Design - Schematic Plan



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

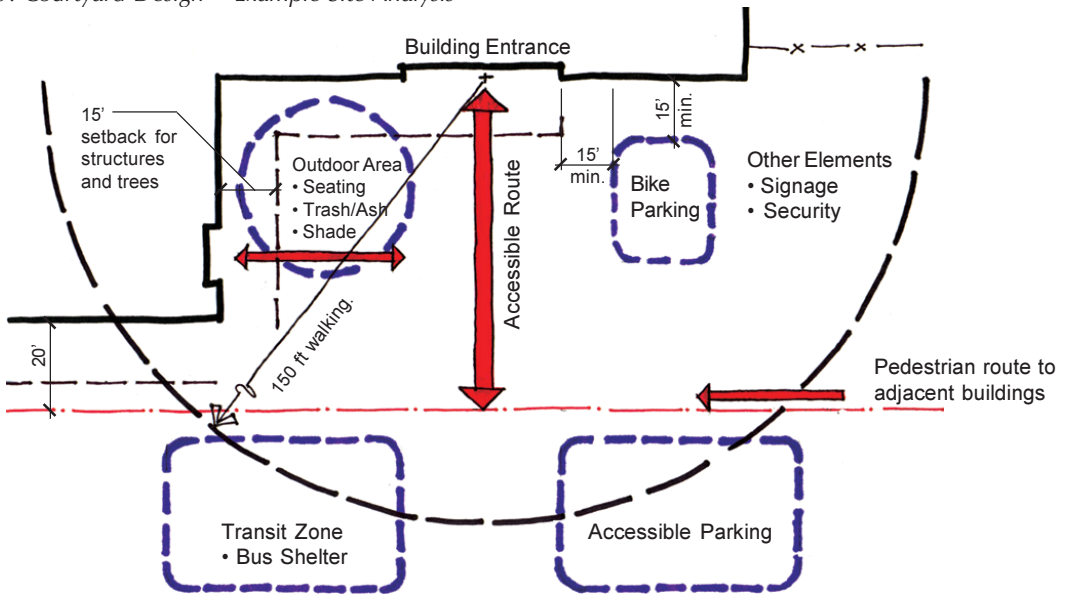


Figure IV-60: Courtyard Design Recommendations - Plan