PEDESTRIAN LOS LEVEL OF SERVICE

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The City of Fort Collins Master Transportation Plan provides level of service (LOS) standards for each travel mode including motor vehicle, public transit, bicycle, and pedestrian. The objectives of these LOS standards guide public and private planning for mobility and accessibility in all transportation modes.

In preparing the Pedestrian LOS standards and methodology, it became evident that pedestrian measures such as pedestrian density and flow rate as defined by the Highway Capacity Manual were inappropriate for Fort Collins, Colorado, a medium-size urban area. Therefore a planning LOS set of procedures was developed to evaluate existing conditions and proposed public and private projects.

It should be further noted that the determination of the methodologies is but half of the LOS analysis procedure. LOS targets or standards were also defined for different areas within the City.

Level of Service Measurements

As an outgrowth of the pedestrian problem definition, a pedestrian facility-specific LOS measurement procedure was established for each of five problem areas. These definitions are presented in the Pedestrian Level of Service Chart. The five problem areas for which LOS procedures were developed are as follows:

- Directness
- Continuity
- Street Crossings
- Visual Interest and Amenity
- Security

Directness

Measurement of the walking trip length.

The measure of directness is simply how well an environment provides direct pedestrian connections to destinations such as transit stops, schools, parks, commercial areas, or activity areas. The grid street pattern typifies the ideal system where one can go north or south, or east or west to easily get to one's destination. The common curvilinear residential subdivision which may have cul-de-sacs that back onto a commercial center, transit stop, school, or park might be physically proximate to a potential pedestrian destination, however, often require a circuitous route which deters pedestrians trips.

The directness LOS measure is based on a ratio of the actual distance from a trip origin to trip destination divided by the minimum distance (as the crow flies) between those two points. Actual destination is further defined by either existing conditions or the proposed public/private development.

A = Actual distance to walk
M = Measured minimum distance
X = Destination

To measure the directness LOS requires selecting one or two trip origin locations in a smaller development and up to five or six representative trip origin locations in a larger development. Trip destinations are then identified.

Trip destinations are those locations to which pedestrians may walk, such as transit stops, schools, parks, trails, and commercial areas. These destinations should be within approximately one-quarter mile, but could be greater (e.g., junior high schools and high schools have a one-mile and one and one half-mile walking distance, respectively). If no pedestrian destinations are within the immediate study area, the directness LOS is not applicable. Connections to arterials that could eventually support transit should be evaluated.

If the directness LOS is defined by the grid system, the minimum distance is the measurement from a representative trip origin to destination by the north/south axis.

The actual distance is either the existing distance to walk from an origin to destination, or the distance if the development was constructed.

The actual/minimum ratio and level of service table is as follows:

LEVEL OF SERVICE	ACTUAL DISTANCE/ MEASURED DISTANCE RATIO
A	< 1.2
B	1.2 - 1.4
C	1.4 - 1.6
D	1.6 - 1.8
E	1.8 - 2.0
F	> 2.0

An actual/minimum (A/M) ratio of less than 1.2 is considered an A, whereas an A/M ratio of 2.0+ would be considered a F. An A/M ratio of below 1.0 could be achieved with the introduction of a diagonal street. Ideally, development proposals should be self-mitigated to achieve acceptable LOS standards prior to submittal to the City.

Continuity

Measurement of the completeness of the sidewalk system.

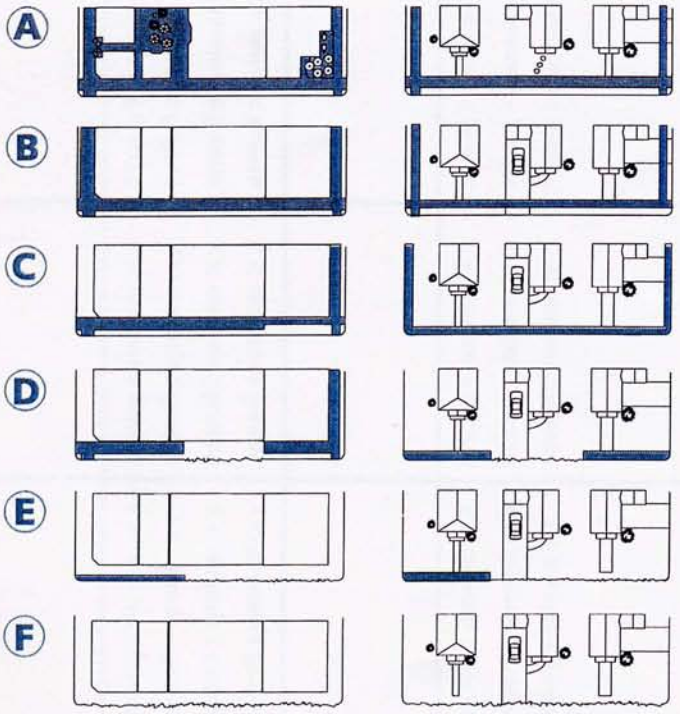
A continuous pedestrian system from origin to destination is critical for pedestrian mobility. Continuity is a measure of both the physical consistency and type of pedestrian sidewalk, and the visual connection from one block to the next.

LOS A is achieved when the pedestrian sidewalk appears as a single entity with a major activity area or public open space.

LOS B provides a quality continuous stretch of pedestrian networks which are physically separated with landscaped parkways.

LOS C provides for a continuous pedestrian network on both sides of the streets; however, these sidewalks may not be built to current standards.

LOS D reflects areas where there may not be sidewalks on both sides of the



street or there are breaches in the system.

LOS E reflects areas where there are significant breaks in the system.

LOS F is a complete breakdown in the pedestrian flow where each pedestrian selects a different route because no pedestrian network exists.

Street Crossings

Measurement of the pedestrian safety in crossing a street.

If one cannot safely cross a street to get to one's destination, there is little likelihood that a change in mode from the automobile will take place. Because street crossings place the pedestrian in the middle of the street involving both the pedestrian and automobile driver, the measurement of a street crossing becomes very complex. Achieving a high LOS for street crossings requires significant investment.

Street crossing LOS was correlated to the pedestrian exposure to the automobile and design elements which positively reflect the pedestrian presence. The following are key street crossing elements that need to be examined when measuring a street crossing's LOS.

Number of Lanes
The greater the number of lanes to cross, the greater the exposure of the pedestrian to vehicles. In addition, wider streets tend to carry higher volumes of traffic and higher speeds.

Median Refuge Areas
Painted medians offer little refuge, other than getting out of a lane of traffic. Substantive raised medians of significant width increase a sense of safety for the crossing pedestrian.

Crosswalks
Crosswalks are present and well marked.

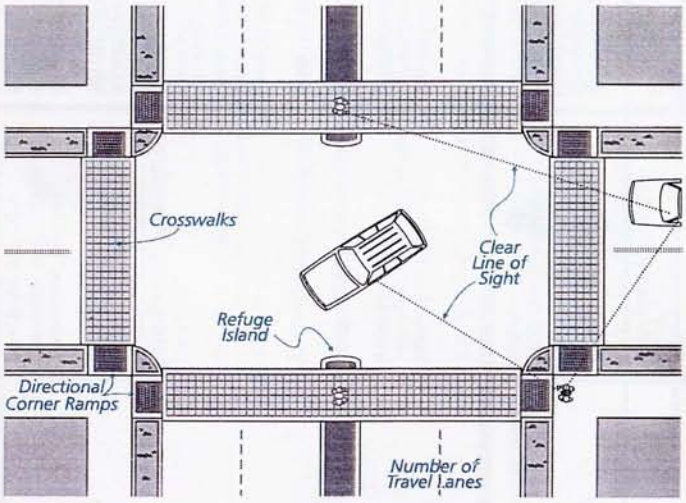
Signal Indication
Signal heads are easily visible to the pedestrian and the motorist.

Lighting Levels
Intersection and crosswalks are well lit so that the pedestrian is visible at night.

Pedestrian Signal Indication
Some signals have the walk phase automatically set for each cycle. This is desirable for all activity areas, as it states the importance of the pedestrian. An alternative is the pedestrian button, where the pedestrian presses the button, waits for the cycle to repeat, and gets the walk phase. The third type of signal does not have any walk phase. For an actuated signal this type of pedestrian indication is unacceptable, since the only way a pedestrian gets a green light is when an automobile on the side street activates the cycle.

Pedestrian Character
Signing, striping, and roadway character strongly suggest the presence of a pedestrian crossing.

Sight Distance
Unobstructed view between the motorist and the pedestrian. This can be a particular problem when a vehicle driver intends to make a left turn under the permissive left turn phase and has



Pedestrian Signal Indication

Fort Collins Pedestrian Levels of Service

	A	B	C	D	E	F
Directness	Excellent and direct connectivity through full utilization of urban space, streets, transit, activity centers with clear linear visual statements. (A/M Ratio <1.2)*	Excellent and direct connectivity with clear linear and visual connection to transit facilities, streets and activities. (A/M Ratio 1.2 to 1.4)*	Minimum acceptable directness connectivity standard. Urban space become less coherent with the beginnings of discomfort with visual clarity and lack of linearity. (A/M Ratio 1.4 to 1.6)*	Increasing lack of directness, connectivity and linearity with incoherent and confusing direction and visual connection to pedestrian destinations. (A/M Ratio 1.6 to 1.8)*	Poor directness and connectivity. Pedestrians perception of a linear connection to desired destination falters and serves only the person with no other choice. (A/M Ratio 1.8 to 2.0)*	No directness or connectivity. Total pedestrian disorientation, no linearity and confusing. (A/M Ratio >2.0)*
Continuity	Pedestrian sidewalk appears as a single entity with a major activity area or public open space.	Continuous stretches of sidewalks which are physically separated by a landscaped parkway.	Continuous stretches of sidewalks which may have variable widths, with and without landscaped parkways.	Pedestrian corridors are not well connected with several breaches in the pedestrian network.	Significant breaks in continuity.	Complete breakdown in pedestrian traffic flow as each pedestrian selects a different route as no network exists.
Signals**	3 or fewer lanes to cross; signal has clear vehicular and pedestrian indications; well marked crosswalks; good lighting levels; standard curb ramps; automatic pedestrian signal phase; amenities, signing, sidewalk, and roadway character strongly suggest the presence of a pedestrian crossing; drivers and pedestrians have unobstructed views of each other.	4 or 5 lanes to cross; signal has clear vehicular and pedestrian indications; well marked crosswalks; good lighting levels; pedestrian refuge area: raised medians at least 6' wide with low plantings or features; standard curb ramps; automatic pedestrian signal phase; amenities, signing, sidewalk, and roadway character strongly suggest the presence of a pedestrian crossing; drivers and pedestrians have unobstructed views of each other. Missing 2 elements of A	6 or more lanes to cross; signal has clear vehicular and pedestrian indications; well-marked crosswalks; good lighting levels; pedestrian refuge area: raised median at least 6' wide with low plantings or features; standard curb ramps; automatic pedestrian signal phase; amenities, signing, sidewalk, and roadway character strongly suggest the presence of a pedestrian crossing; drivers and pedestrians have unobstructed views of each other. Missing 4 elements of A Missing 2 elements of B	Missing 5 elements of A Missing 4 elements of B Missing 2 elements of C	Missing 6 elements of A Missing 5 elements of B Missing 4 elements of C	Missing 7 elements of A Missing 6 elements of B Missing 5 elements of C
Unsignalized, crossing the major street***	3 or fewer lanes to cross; well-marked crosswalks; good lighting levels; standard curb ramps; signing, sidewalk, and roadway character strongly suggest the presence of a pedestrian crossing; drivers and pedestrians have unobstructed views of each other.	4 or 5 lanes to cross; well-marked crosswalks; good lighting levels; pedestrian refuge area: raised median at least 6' wide with low plantings or features; standard curb ramps; signing, sidewalk, and roadway character strongly suggest the presence of a pedestrian crossing; drivers and pedestrians have unobstructed views of each other. Missing 1 element of A	6 or more lanes to cross; well-marked crosswalks; good lighting levels; pedestrian refuge area: raised median at least 6' wide with low plantings or features; standard curb ramps; signing, sidewalk, and roadway character strongly suggest the presence of a pedestrian crossing; drivers and pedestrians have unobstructed views of each other. Missing 2 elements of A Missing 1 element of B	Missing 3 elements of A Missing 2 elements of B Missing 1 element of C	Missing 4 elements of A Missing 3 elements of B Missing 2 elements of C	Missing 5 elements of A Missing 4 elements of B Missing 3 elements of C
Unsignalized, crossing the minor street***	Well-marked crosswalks; good lighting levels; standard curb ramps; signing, sidewalk, and roadway character strongly suggest the presence of a pedestrian crossing; drivers and pedestrians have unobstructed views of each other.	Missing 1 element of A	Missing 2 elements of A	Missing 3 elements of A	Missing 4 elements of A	Missing 5 elements of A
Mid-block major street crossing***	3 or fewer lanes to cross; signing, sidewalk and roadway character strongly suggest the presence of a pedestrian crossing; drivers and pedestrians have unobstructed views of each other; well marked crosswalks; good lighting levels; standard curb ramps.	4 or 5 lanes to cross; raised median at least 6' wide with low plantings or features; signing, sidewalk and roadway character strongly suggest the presence of a pedestrian crossing; drivers and pedestrians have unobstructed views of each other; well marked crosswalks; good lighting levels; standard curb ramps. Missing 1 element of A	6 or more lanes to cross; raised median at least 6' wide with low plantings or features; signing, sidewalk and roadway character strongly suggest the presence of a pedestrian crossing; drivers and pedestrians have unobstructed views of each other; well marked crosswalks; good lighting levels; standard curb ramps. Missing 2 elements of A Missing 1 element of B	Missing 3 elements of A Missing 2 elements of B Missing 1 element of C	Missing 4 elements of A Missing 3 elements of B Missing 2 elements of C	Missing 5 elements of A Missing 4 elements of B Missing 3 elements of C
Visual Interest and Amenity	Visually appealing and compatible with local architecture. Generous sidewalk width, active building frontages, pedestrian lighting, street trees and quality street furniture.	Generous sidewalks, visual clarity, some street furniture and landscaping, no blank street walls.	Functionally operational with less importance to visual interest or amenity.	Design ignores pedestrian with negative mental image.	Comfort and convenience non-existent, design has overlooked needs of users.	Total discomfort and intimidation.
Security	Sense of security enhanced by presence of other people using sidewalks and visibility from adjacent buildings. Good lighting and clear sight lines.	Good lighting levels and unobstructed lines of sight.	Unobstructed lines of sight.	Sidewalk configuration and parked cars may inhibit vigilance from the street.	Major breaches in pedestrian visibility from street, adjacent land uses and activities.	Streetscape is pedestrian intolerant.

* A/M Ratio: Actual distance between pedestrian origin/destination divided by minimum distance defined by a right angle grid street system.
** A signalized intersection LOS will go up one level of service with a dedicated pedestrian signal phase and/or a colored or textured crosswalk.
*** Unsignalized crossing at intersection of major street (minor arterial to major arterial) and minor street (local, connector and collector).

difficulty seeing around the opposing left-turning vehicle.

Corner Ramps
Directional corner ramps are preferred because they notify drivers of intended pedestrian walking direction.

Street Crossing Types

There are four types of street crossings. Each has inherent differences.

Signalized Intersections
Signalized intersections pose major pedestrian crossing problems due to high volumes, turning vehicles, vehicles that stop in the crosswalk, a significant number of lanes to cross, signal indication that is difficult to read or understand, lack of visual connection with automobiles, lack of vehicle driver respect, lack of raised median protection, no corner ramps, and no or inconvenient pedestrian buttons.

Unsignalized Intersection Crossing the Major Street
Problems are similar to signalized intersections with even greater concern for the number of lanes to cross, speed of vehicles, and lack of adequately marked crosswalks with good lighting, raised median, visibility, and corner ramps.

Unsignalized Intersection Crossing the Minor Street
The problem at these locations is the vehicle traveling along the arterial turning right or left onto the minor street, while being urged along by a following vehicle.

Mid-Block Crossing
Similar to unsignalized major street crossing, including number of lanes to cross, lack of crosswalk presence, lighting, raised median, and corner ramps.

Street Crossing LOS Measurements

For each street crossing type, the ideal condition as defined in the Pedestrian LOS Chart assigns the highest LOS to the crossing with the greatest number of design elements with the minimum number of lanes. As pedestrian design elements are added, the LOS improves. As lanes are added, the LOS is lowered.

Visual Interest and Amenity

Measurement of the pedestrian systems attractiveness and features.

The attractiveness of the pedestrian network can range from visually appealing to appalling. Compatibility with local architecture and enhancements, such as fountains, benches, and lighting improve visual interest of the area for pedestrians.

Security

Measurement of the pedestrians' sense of security.

Pedestrians require a sense of security, both through visual line of sight with vehicle drivers and separation from vehicles. Major portions of the city's sidewalks along arterials are narrow and adjacent to high-volume, high-speed travel lanes. Other sidewalks are intimidating because they are not visible to the motorist and surrounding activities. Pedestrian sidewalks and corridors should also be examined based on lighting levels and sight distance.

Pedestrian Facilities Plan

While there is one set of LOS measurement for all pedestrian facilities, acceptable LOS thresholds vary by type of activity area. It would not be logical to require the same LOS standard everywhere. As an example, the needs and

standards for a downtown area which is highly pedestrian-dependent, is significantly different in character and need than an outlying residential area not proximate to schools or transit. Therefore a pedestrian facilities plan should be developed to identify the existing and/or anticipated pedestrian activity areas from which to assign LOS standards. There are five designations defined in this plan:

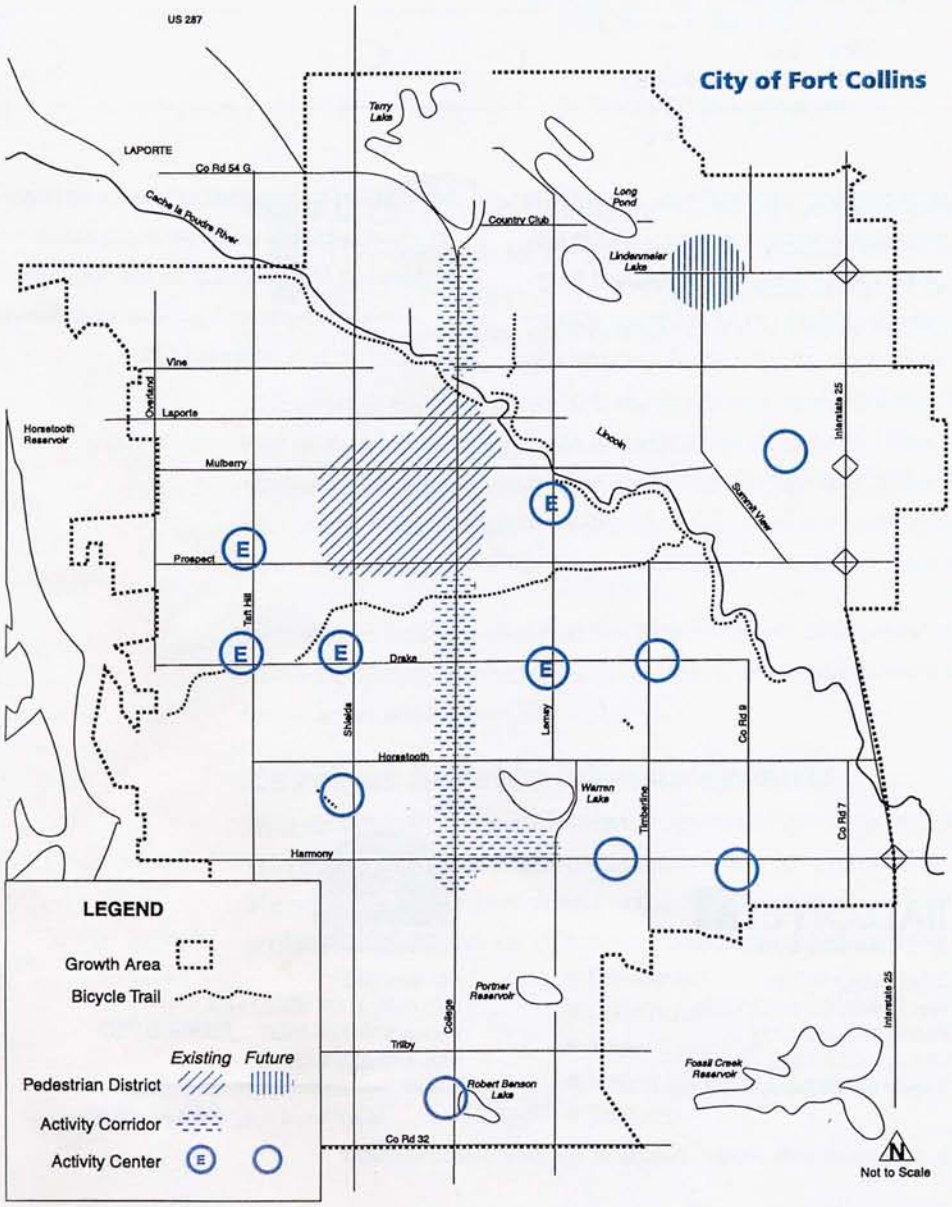
Pedestrian Districts
This area reflects the highest pedestrian environment desired, a location where all LOS standards are A or B. This area would be appropriate for downtown and university areas, which typically have the highest pedestrian activity in a city. This pedestrian district would also reflect proposed activity areas as defined by the city's comprehensive plan.

Activity Corridor/Centers
This area is defined by the primarily commercial corridors. Other areas have a very high automobile dependency. By providing pedestrians linear connections between retail uses and the adjacent residential areas, pedestrian activity along these corridors could be significantly improved. Pedestrians are more likely to walk to areas within one-quarter mile of neighborhoods and retail areas with higher pedestrian LOS.

School Walking Areas
These include all routes within a one-mile walking radius of an existing public school and around sites designated for future public schools.

Transit Corridors
Areas within one-quarter mile of existing transit and routes identified in the Transit 20 Year Plan.

Other
This category includes all locations not falling within one of the four previous areas.



LOS Thresholds

The following defines the minimum acceptable standards by Pedestrian Facilities Plan Area. It should be noted that numerous locations within a city will not achieve the minimum LOS. Because of limited funding, improvements should be prioritized toward activity areas, routes to schools, parks, and transit. To cap the current problem, new developments, both public and private, as well as major street improvements and redevelopment, should adhere to the pedestrian LOS standards.

Target Levels of Service by Pedestrian Facilities Plan Areas

	Directness	Continuity	Street Crossings	Visual Interest and Amenity	Security
Pedestrian Districts	A	A	B	A	A
Activity Corridors and Centers	B	B	C	B	B
School Walking Areas	B	B	B	C	B
Transit Corridors	B	C	C	C	B
Other Areas within City	C	C	C	C	C

Applications

Vehicle, transit, bicycle, and pedestrian LOS analysis is required for all proposed public and private developments and arterial improvements. Street improvements may require pedestrian improvements to facilitate acceptable pedestrian street crossings. Street improvements are unacceptable if they reduce pedestrian LOS below acceptable levels. Private developments may be required to construct off-site pedestrian improvements to achieve acceptable pedestrian LOS, similar to the request to provide off-site mitigations to achieve acceptable automobile LOS.

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