Pedestrian Level of Comfort

The Pedestrian Level of Comfort analysis (PLOC) was created by the Montgomery County Planning Department for two reasons:

1) To identify locations in the existing walking network that are uncomfortable due to inadequate or incomplete sidewalks and crossings.
2) To quantify how different investments will increase connectivity.

The approach was inspired by the Bicycle Level of Traffic Stress (LTS) analysis conducted for the Montgomery County Bicycle Master Plan.

The Pedestrian Level of Comfort analysis is a work in progress. The Planning Department will be retaining assistance from a private contractor in FY 2019 to refine the methodology and the metrics that will be used to evaluate pedestrian connectivity. The sections below describe the pedestrian level of comfort and metrics as they exist in Fall 2018.

Pedestrian Connectivity Methodology

PLOC scores range from High-Quality to Unacceptable.

- **High-Quality**: This walking environment enables parents to walk with young children with a moderate level of supervision.
- **Acceptable**: This walking environmental is comfortable for families, but parents would hold the hands of young children.
- **Unacceptable**: This walking environment is uncomfortable, and most adults will only walk if they have no other option.

Sidewalks and crossings are scored based on a “weakest link” approach in which the comfort of a segment of the network is governed by its most uncomfortable characteristic. For example, along the north side of Randolph Road, south of Selfridge Road, the lack of an adequate width buffer between the sidewalk and the road gave the walking routes on both sides of the street an “unacceptable” rating.

Sidewalk and street crossings are evaluated using different methodologies. Sidewalk scoring considers the following inputs:

- **Adjacent Planned Land Uses**
  - Urban
    - Mixed-use or high-density land use zones
    - Within ½ mile of rail or 1/4-mile from bus rapid transit stations
  - Suburban
- **Walkway Width (sidewalk or sidepath):**
  - Less than 3.5 feet
  - 3.5 to less than 5 feet
  - 5 feet to less than 8 feet
  - 8 feet or more
- **Walkway Type**
  - Pedestrians only
• Shared with bicyclists

• Walkway Quality:
  o Presence of a buffer that is at least 5 feet wide
  o Frequency of obstructions

• Traffic Volume on Adjacent Roadway

Each leg of the intersection is analyzed as a separate street crossing. Street crossings are scored using the following inputs:

• Adjacent Planned Land Uses
  ▪ Mixed-use or high-density land use zones
  ▪ Within ½ mile of rail or 1/4-mile from bus rapid transit stations

• Presence of Traffic Control
  o Traffic Signal
  o Stop Sign
  o No Traffic Control

• Presence of a Right Turn on Red Restriction

• Cross Street Characteristics
  o Number of Lanes
  o Posted Speed Limit

• Presence of a Median

• Presence of a Crosswalk Marking

Veirs Mill Corridor Master Plan Pedestrian Scenarios

In addition to evaluating existing conditions, pedestrian connectivity is evaluated upon implementation of the short-term recommendations and the long-term recommendations. The short-term recommendations include the installation of walkways on Veirs Mill Road and on residential streets that provide a connection between existing and proposed transit and schools, parks and community facilities. The long-term recommendations include improvements such as pedestrian refuge islands, elimination of dual left-turn lanes, channelized right-turn lanes and additional protected crossing opportunities.

Pedestrian Connectivity Analysis

Two approaches are used to evaluate pedestrian connectivity:

1. An areawide analysis that evaluates how well specific areas are connected based on estimates of pedestrian travel; and
2. A destination analysis that evaluates how well dwelling units within a certain distance of the destination are connected to specific locations, including schools and transit stops.

Areawide Connectivity Methodology

The areawide connectivity analysis identifies how short and long-term transportation recommendations impact pedestrian access within specific areas. Connectivity is measured by comparing the number of dwelling units accessible within an area in each scenario (existing conditions, short term and long term)
to the number of dwelling units accessible to a destination in the “fully walkable” scenario. The network for each scenario is based on those segments of the pedestrian environment that are considered to have at least an “acceptable” PLOC score. The objective of this approach is to understand how short and long-term transportation recommendations impact pedestrian connectivity throughout the master plan area and for many types of pedestrian trips\(^1\). See the section “Pedestrian Travel Estimation” for a discussion of the methodology for estimating pedestrian trips.

The table below shows the pedestrian connectivity rates by scenario for each of the four districts identified in the Veirs Mill Corridor Master Plan, as well as the overall connectivity for the plan area. Under existing conditions, overall connectivity is 52%. This grows to 59% with the short-term recommendations in the plan and to 84% with the plan’s long-term recommendations. The greatest pedestrian connectivity improvements occur in the Connecticut / Randolph District, which shows a pedestrian connectivity increase of 48%. While the Robindale and Connecticut / Randolph reach connectivity rates of nearly 100% in the long-term scenario and the Newport Mill District reaches 86% greater, the Twinbrook District only reaches 66% connectivity. This is because many of the pedestrian trips that start or end in the Twinbrook District are traveling to and from nearby areas of the City of Rockville and Twinbrook that are outside of the plan area, where pedestrian connectivity is not improved by the Veirs Mill Corridor Master Plan.

Table 1: Areawide Pedestrian Connectivity Analysis

<table>
<thead>
<tr>
<th>District</th>
<th>Existing</th>
<th>Short Term</th>
<th>Long Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twinbrook</td>
<td>54%</td>
<td>51%</td>
<td>73%</td>
</tr>
<tr>
<td>Robindale</td>
<td>61%</td>
<td>81%</td>
<td>96%</td>
</tr>
<tr>
<td>Connecticut/Randolph</td>
<td>42%</td>
<td>65%</td>
<td>98%</td>
</tr>
<tr>
<td>Newport Mill</td>
<td>52%</td>
<td>81%</td>
<td>87%</td>
</tr>
<tr>
<td>Overall</td>
<td>50%</td>
<td>65%</td>
<td>87%</td>
</tr>
</tbody>
</table>

**Destination Connectivity Methodology**

The destination connectivity analysis identifies how short and long-term transportation recommendations impact pedestrian access to specific destinations. Connectivity is measured by comparing the number of dwelling units accessible to a destination in each scenario (existing conditions, short term and long term) to the number of dwelling units accessible to a destination in the “fully walkable” scenario. A distance of 0.5 miles from the destination along the “fully walkable” pedestrian network is used to generate the catchment area for all scenarios. As with the areawide connectivity analysis, the network for each scenario is based on those segments of the pedestrian environment that are considered to have at least an “acceptable” PLOC score.

Since people need to access bus stops on both sides of the road, bus stop pairs that serve opposing directions are evaluated together. For each bus stop pair, the number of residential units within the 0.5-mile catchment area that are connected to both bus stops is determined for each phase of the plan.

\(^1\) Home Based and Non Home Based work, personal business, dining, shopping, leisure and school trips.
These figures are then compared to the “fully walkable” scenario to determine the level of connectivity. The results in Table 2 show that due to the lack of acceptable crossings on Veirs Mill Road, no dwelling units currently have an acceptable level of connectivity to their closest bus stop pair. With the recommendations in the short-term phase of the plan, pedestrian connectivity grows to 2% and in the long term with the provision of additional protected crossings, such as signalized intersections and other intersection improvements, pedestrian connectivity grows to 82%.

Table 2: Bus Stop Pedestrian Connectivity Analysis

<table>
<thead>
<tr>
<th>Bus Stop</th>
<th>Existing</th>
<th>Short Term</th>
<th>Long Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twinbrook Pkwy</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Aspen Hill Rd</td>
<td>0%</td>
<td>8%</td>
<td>100%</td>
</tr>
<tr>
<td>Arbutus Ave / Parklawn Memorial</td>
<td>0%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>#12704/#12701</td>
<td>0%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Robindale Rd</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Gaynor Rd / Parkland Dr</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Turkey Branch Pkwy / Edgebrook Rd</td>
<td>0%</td>
<td>83%</td>
<td>83%</td>
</tr>
<tr>
<td>Havard St</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Gridley Rd</td>
<td>0%</td>
<td>0%</td>
<td>96%</td>
</tr>
<tr>
<td>Randolph Rd</td>
<td>0%</td>
<td>0%</td>
<td>73%</td>
</tr>
<tr>
<td>Bushey Dr</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Ferrara Ave</td>
<td>0%</td>
<td>0%</td>
<td>88%</td>
</tr>
<tr>
<td>Connecticut Ave</td>
<td>0%</td>
<td>0%</td>
<td>81%</td>
</tr>
<tr>
<td>Centerhill St / Gail St</td>
<td>0%</td>
<td>0%</td>
<td>94%</td>
</tr>
<tr>
<td>Claridge Rd</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Pendleton Dr</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Newport Mill Rd</td>
<td>0%</td>
<td>0%</td>
<td>99%</td>
</tr>
<tr>
<td>Monterrey Dr / Norris Dr</td>
<td>0%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Monterrey Dr / Schoolhouse Cir</td>
<td>0%</td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td>Galt Ave / College View Dr</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>13%</td>
<td>82%</td>
<td></td>
</tr>
</tbody>
</table>
Pedestrian Travel Estimation

Pedestrian travel is estimated using an adaptation of the “Pedestrian Flow Modeling for Prototypical Maryland Cities” report developed by the University of Maryland National Center for Smart Growth on behalf of the Maryland Department of Transportation.\(^2\)

The pedestrian flow analysis requires three major inputs:

1. A walking network is developed for each scenario comprised of all sidewalks and crossings with PLOC values of an “acceptable” or higher rating.
2. Trip production and attraction zones (census blocks).
3. Land use information derived from parcels summarized at the census block level.

There are four steps to estimating pedestrian travel:

Step 1: Estimating Productions: The pedestrian flow analysis first estimates the number of productions generated by each census block. Separate production rates are calculated for work, eat, shop, leisure and personal business for both home and non-home-based trips. The production rates are largely based on the accessibility of “opportunities” from each census block. Accessibility is a function of the intensity of the opportunity discounted by the time it takes to reach the opportunity. Production rates for each trip type are then multiplied by the number of residential units (home-based trips) or total floor space (non-home-based trips).

Step 2: Estimating Attractions: Trip attractions are estimated by multiplying the geography’s total floor area for land uses germane to the particular trip type being estimated, by a factor. For this exercise, land use is static among all scenarios requiring this step to be estimated only once.

Step 3: Trip Distribution: Trip distribution creates a zone-to-zone matrix of pedestrian flows for each trip type in which all trip productions are linked to an attraction. Trip distribution is conducted using a gravity model that assumes that the “number of trips between zone i and zone j is proportional to the number of trips produced in zone i, the number of trips attracted to zone j, and inversely proportional to the impedance separating the two zones”. Trips flows for each individual trip purpose are added together to obtain the total pedestrian flow between census blocks. Each flow is then assigned a production and attraction district based on the location of the census geography’s centroid. As with the trip production step, trip distribution is completed using the walking network for each scenario.

Pedestrian connectivity is then determined for each district by dividing the estimated number of pedestrian trips for each pedestrian network scenario (existing conditions, after implementing short-term recommendations and after implementing long-term recommendations) by the estimated number of pedestrian trips in the “fully walkable” pedestrian network scenario.