

# **Asset Management for ADA Compliance Using Advanced Technologies**

**American Public Works Association  
2009 International Public Works Congress**

**Franz Loewenherz  
Senior Transportation Planner  
City of Bellevue**

**September 14, 2009**

# **Presentation Outline**

- 1. ADA Culture of Compliance**
- 2. ADA Sidewalk & Curb Ramp Self Evaluation**
- 3. Data Collection**
- 4. Quality Assurance/Quality Control**
- 5. Roadway Grade Analysis**
- 6. Driveway Cross Slope Analysis**
- 7. ADA Viewer Interface**
- 8. Barrier Ranking Analysis**
- 9. Programming of Asset Improvements**

# **ADA Culture of Compliance**

# Americans with Disabilities Act (ADA)

**Title II – Government Services:** Must ensure that individuals with disabilities are not excluded from programs, services, and activities (pedestrian facilities are an example of a program).



# Title II Elements

[28 CFR 35.105](#)

## Self-Evaluation Report

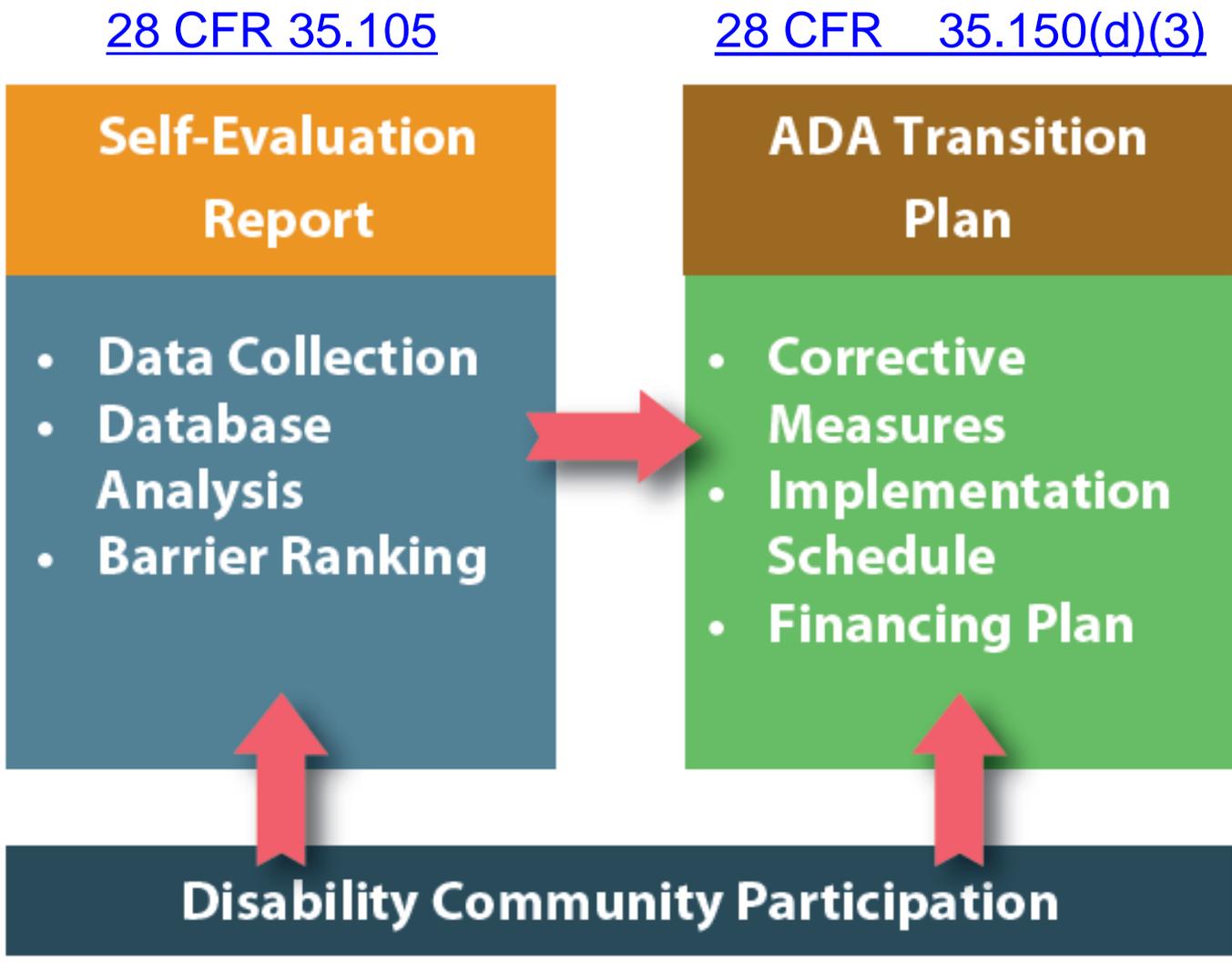
- Data Collection
- Database Analysis
- Barrier Ranking

[28 CFR 35.150\(d\)\(3\)](#)

## ADA Transition Plan

- Corrective Measures
- Implementation Schedule
- Financing Plan

**Disability Community Participation**

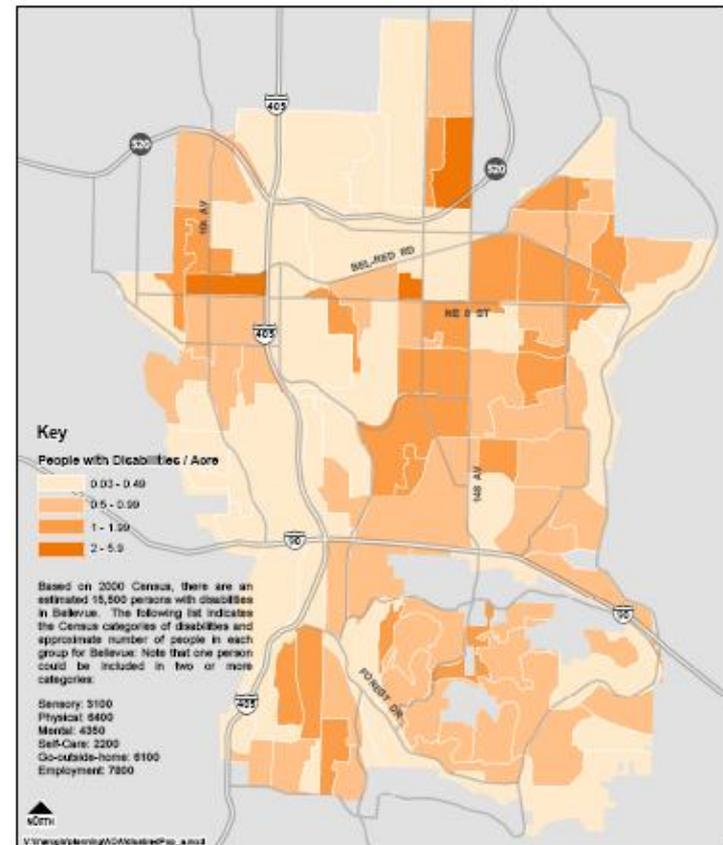


# City of Bellevue (WA)

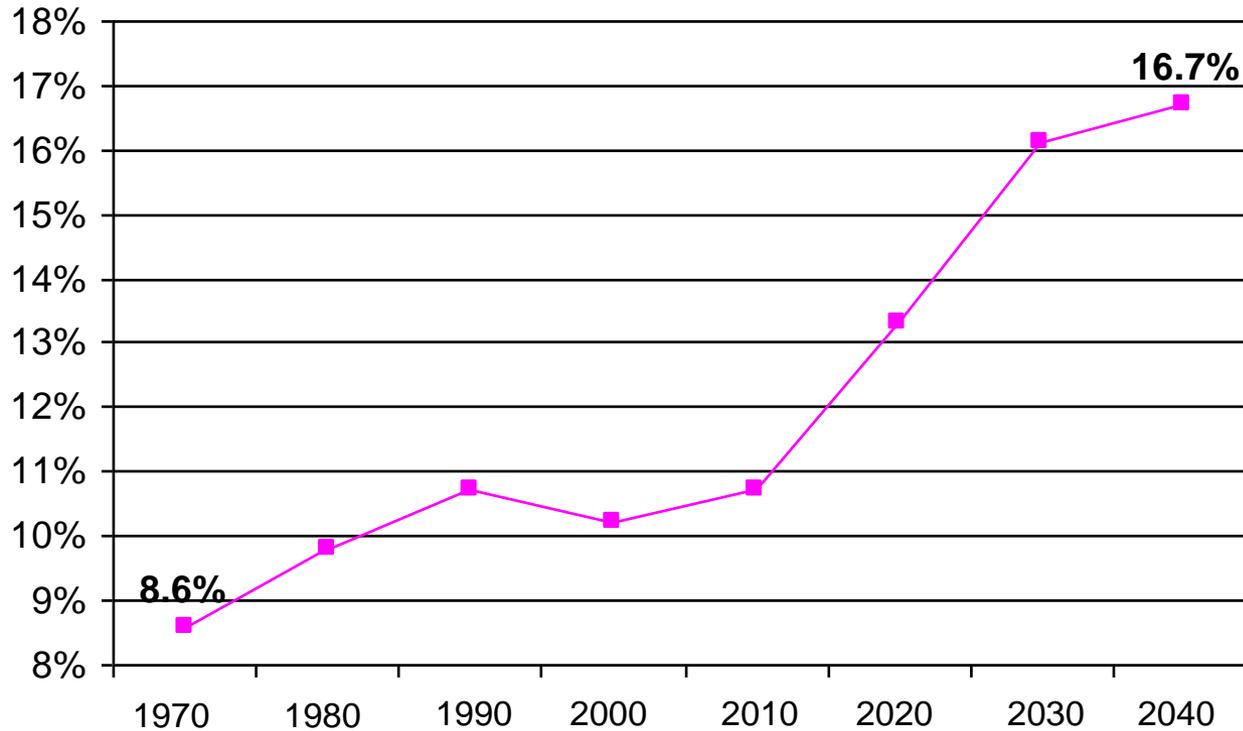


The City of Bellevue is a diverse community of 120,000 residents.

Approximately 15 percent of residents live with developmental, physical, and mental disabilities.

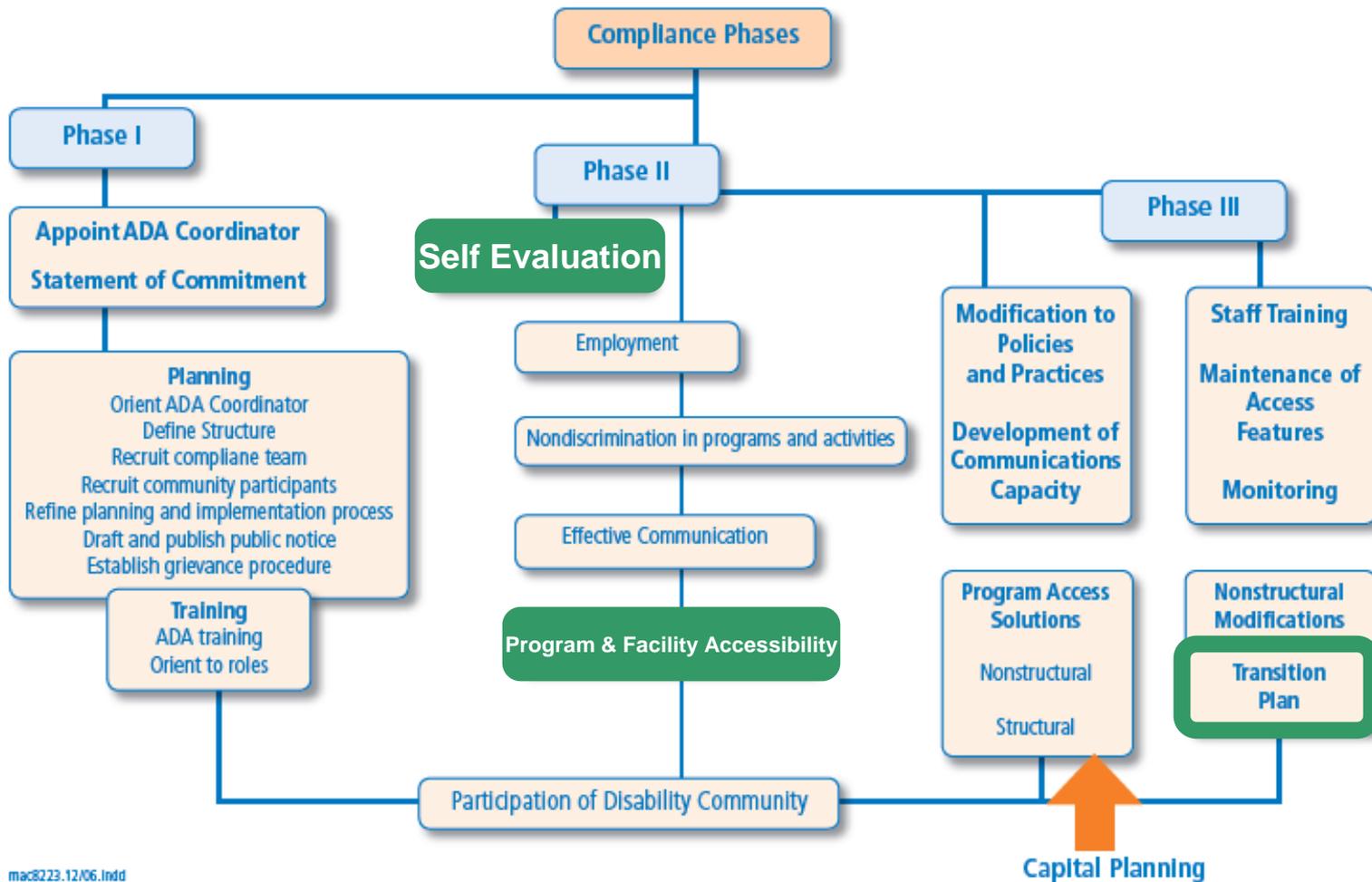


# % Population 65+ (Central Puget Sound)

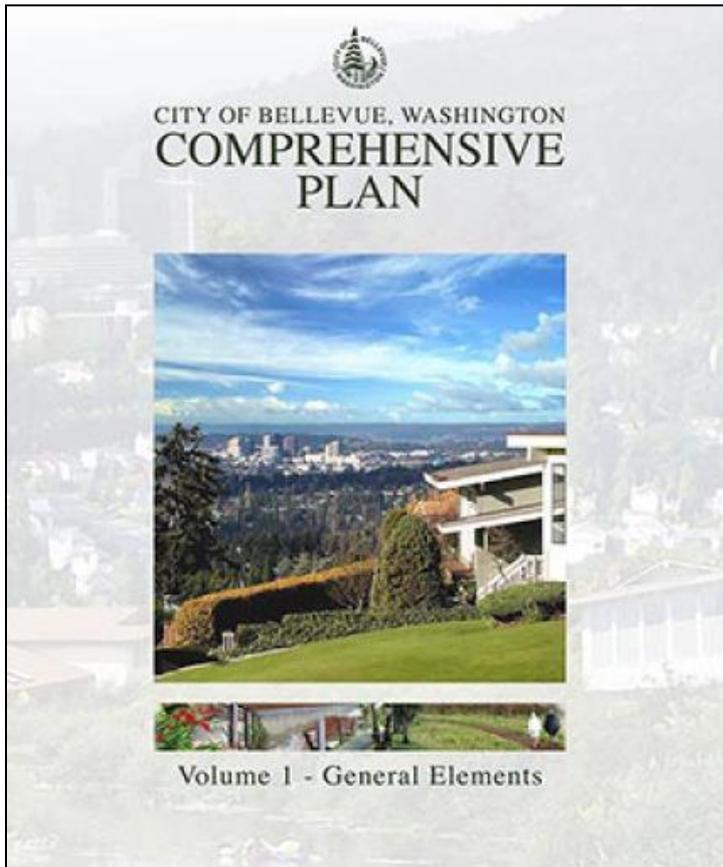


**As the population continues to age, the number of people with mobility disabilities is expected to increase.**

# ADA Title II Compliance Flowchart



# Policy Commitment



**Policy TR-26:** Address the special needs of physically challenged and disabled citizens in planning, designing, implementing, and maintaining transportation improvements, particularly non-motorized improvements, and other transportation facilities, and in delivering transportation services and programs, in accordance with the Americans with Disabilities Act (ADA).

# **Bellevue ADA Sidewalk & Curb Ramp Self Evaluation**

# Sidewalk & Curb Ramp Inventory Overview

Absence of level landing



Top Landing



Tactile Warning



Moveable Obstruction



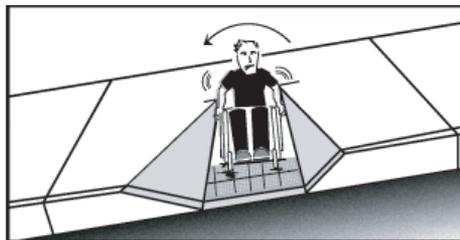
Fixed Obstruction



Heaving



Ramp cross slope



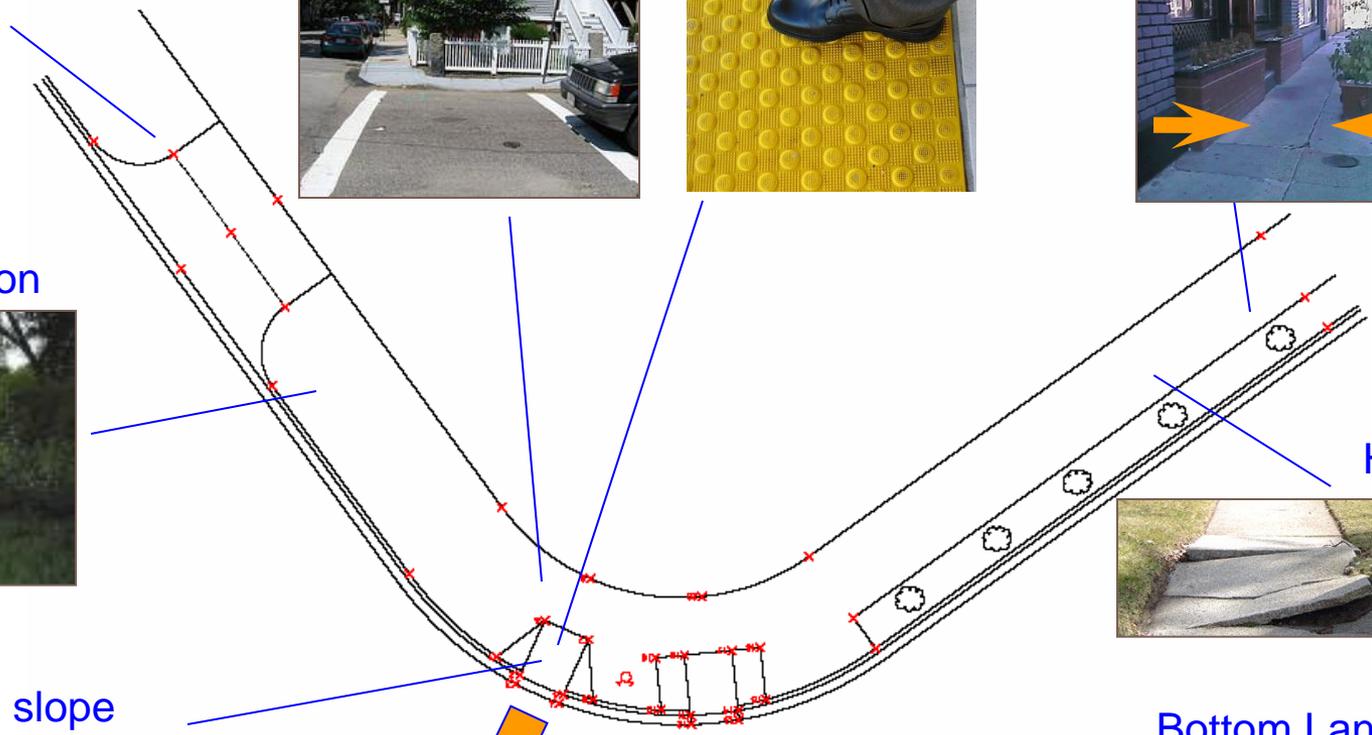
No Ramp



Ramp Transition



Bottom Landing





# Numerous Methodologies

## U.S. Dept of Justice

**Curb Ramps** Construction/Alteration Date (circle one): Before 1/26/92 After 1/26/92

Facility Name/Address \_\_\_\_\_ Date \_\_\_\_\_

Location: \_\_\_\_\_ Surveyors: \_\_\_\_\_

Record your measurements in the blanks when they are provided. Do not circle a response for a question you are directed to skip. If your answer to a question is "no," but the choices are "Y" and "NO," circle "NO" (just spellable). A circled "N" signifies a violation.

Describe each curb ramp's location:

Curb Ramp A: \_\_\_\_\_ Curb Ramp B: \_\_\_\_\_ Curb Ramp C: \_\_\_\_\_

Curb Ramp D: \_\_\_\_\_ Curb Ramp E: \_\_\_\_\_ Curb Ramp F: \_\_\_\_\_ Curb Ramp G: \_\_\_\_\_

Refer. #	Curb Ramp (CR) Questions	Curb Ramp A	Curb Ramp B	Curb Ramp C	Curb Ramp D	Curb Ramp E	Curb Ramp F	Curb Ramp G
1	Is ramp of CR at least 36" wide for full width? (min 5 feet)	Y	N	Y	N	Y	N	Y
2	Does CR have a max slope of 1:20?	Y	N	Y	N	Y	N	Y
3	Does CR have a cross slope of 1:50?	Y	N	Y	N	Y	N	Y
4	Are there any obstructions on the base or along the rise?	Y	N	Y	N	Y	N	Y
5	Does CR have a height of 48" or more?	Y	N	Y	N	Y	N	Y
6	Does CR have a height of 48" or more?	Y	N	Y	N	Y	N	Y
7	Does CR have a height of 48" or more?	Y	N	Y	N	Y	N	Y
8	Does CR have a height of 48" or more?	Y	N	Y	N	Y	N	Y
9	Does CR have a height of 48" or more?	Y	N	Y	N	Y	N	Y
10	Does CR have a height of 48" or more?	Y	N	Y	N	Y	N	Y
11	Does CR have a height of 48" or more?	Y	N	Y	N	Y	N	Y
12	Does CR have a height of 48" or more?	Y	N	Y	N	Y	N	Y
13	Does CR have a height of 48" or more?	Y	N	Y	N	Y	N	Y
14	Does CR have a height of 48" or more?	Y	N	Y	N	Y	N	Y

## Texas DOT

**DISTRICT INVENTORY OF PEDESTRIAN ACCESSIBILITY AT INTERSECTIONS**

Page 1 of 2

District: \_\_\_\_\_ County: \_\_\_\_\_

Control Section: \_\_\_\_\_ Cross Street: \_\_\_\_\_

City: \_\_\_\_\_ Corner (NW, etc.): \_\_\_\_\_

Route: \_\_\_\_\_ No. \_\_\_\_\_ Suffix: \_\_\_\_\_ Reference Marker: \_\_\_\_\_

Inventory performed by: \_\_\_\_\_ Date of survey: \_\_\_\_\_

Location information - Corner is near (within 3 blocks):

hospital or retirement home  school  bus/transit stop  major employers

gov. bldg., public park or public facility (library, civic center, etc.)

Comments: \_\_\_\_\_

**A.  No curb ramp**

Curb exists

Sidewalk exists

Pedestrian path exists

Curb cut exists

**B.  Has curb ramp**

ADA compliance certificate received for CSI

(Skip to box C at left)

Number of curb ramps: \_\_\_\_\_

Two per corner

One per corner

## Maryland State Highway

**SHA - ADA CHECKLIST**

This checklist has been developed to provide an itemized list of considerations that will help the designer to determine the best possible accessible facility or route.

**Sidewalk**

YES NO N/A

Is the sidewalk width 5 foot (60") exclusive of curb? If no, what physical constraint(s) exist to cause a reduction in sidewalk width?

Where sidewalk width is less than 5 feet, are passing zones (60" x 60") provided at intervals no greater than every 200 feet.



Summer 2006. Bellevue conducted 2 week assessment with professional staff using equipment for land surveys. Estimated cost in excess of \$1M.

E1. \_\_\_\_\_ F2. \_\_\_\_\_ G2. \_\_\_\_\_ H2. \_\_\_\_\_  
 E3. \_\_\_\_\_ F3. \_\_\_\_\_ G3. \_\_\_\_\_ H3. \_\_\_\_\_  
 RIGHT SIDE LENGTH: \_\_\_\_\_ FT. \_\_\_\_\_ IN.  
 PAN WIDTH: \_\_\_\_\_ FT. \_\_\_\_\_ IN.  
 LEFT SIDE LENGTH: \_\_\_\_\_ FT. \_\_\_\_\_ IN.  
 DISTANCE BETW. RAMP: \_\_\_\_\_ FT. \_\_\_\_\_ IN.

STREET NAME: \_\_\_\_\_

Inspected/measured by (print): \_\_\_\_\_ Date Field Measured: \_\_\_\_\_

**Directions:**  
 Three measurements for all data shall be taken at the ramps and pans, one measurement shall be taken at the centerline of the element and the other two shall be taken 18 inches on either side of the first measurement for the element. None of the three recorded measurements of any element may not exceed the limits indicated above.  
 See reverse side for Compliance with Standards.

Page 1

City of Sacramento

<p>Up to 114" requires 1:2 slope (max.)</p> <p>- Greater than 112" requires 1:12 slope</p>	<p>height</p>	<p><input type="checkbox"/></p>	<p>If there is a single supp with a rise of greater than 1/2", add a short ramp.</p> <p>(see Fig. 1)</p>
<p>Can all objects protruding into the circulation paths be detected by a person with a visual disability using a cane?</p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p>Move or remove protruding objects.</p> <p><input type="checkbox"/> Add a cane-detectable base that extends to the ground.</p> <p><input type="checkbox"/> Place a cane-detectable object on the ground underneath as a warning barrier.</p>

Florida DOT

# Project Approach

1

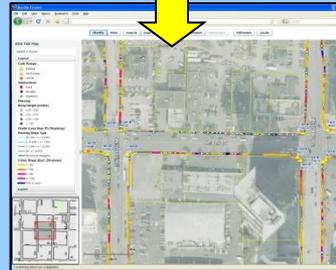
## Data Collection



2

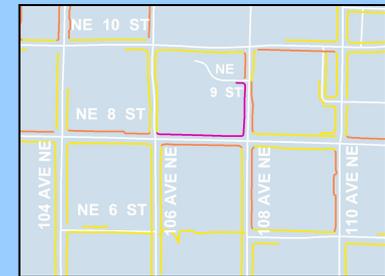
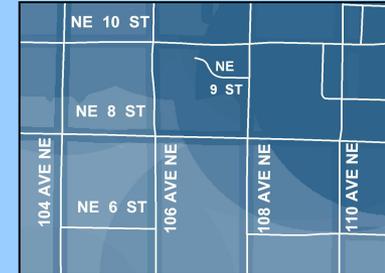
## Database Analysis

```
0807160948r.NGD - Notepad
File Edit Format View Help
Travel Marker
dist_ft dist_ft time(s) grade% xslope% yaw(deg) casename
0.0 0.0 0.00 0.07 -1.87 0.00 0807160948r
5.0 5.0 1.26 0.18 -1.72 -2.81 0807160948r
10.0 10.0 2.50 1.18 -2.27 -5.01 0807160948r
15.0 15.0 3.50 1.80 -2.11 -5.01 0807160948r
20.0 20.0 4.30 1.80 -1.55 -4.32 0807160948r
25.0 25.0 4.99 1.02 -0.99 -4.03 0807160948r
30.0 30.0 5.00 1.57 -0.07 -3.53 0807160948r
35.0 35.0 6.17 1.02 0.59 -3.36 0807160948r
40.0 40.0 6.71 1.72 0.64 0.14 0807160948r
45.0 45.0 7.22 2.98 1.00 0.58 0807160948r
50.0 50.0 7.76 3.94 1.43 0.57 0807160948r
55.0 55.0 8.27 4.15 1.85 0.52 0807160948r
60.0 60.0 8.77 4.53 2.14 0.46 0807160948r
65.0 65.0 9.25 5.52 2.53 0.29 0807160948r
70.0 70.0 9.72 5.70 2.55 0.44 0807160948r
75.0 75.0 10.19 5.62 2.06 0.37 0807160948r
80.0 80.0 10.65 5.72 1.48 1.38 0807160948r
85.0 85.0 11.11 5.51 0.97 1.39 0807160948r
90.0 90.0 11.56 5.34 0.59 1.79 0807160948r
95.0 95.0 12.00 4.58 0.69 2.14 0807160948r
100.0 100.0 12.44 4.74 0.71 2.40 0807160948r
105.0 105.0 12.87 5.24 0.77 2.44 0807160948r
110.0 110.0 13.30 5.19 0.21 2.42 0807160948r
115.0 115.0 13.73 4.96 -0.68 2.69 0807160948r
120.0 120.0 14.15 5.25 -1.67 2.82 0807160948r
125.0 125.0 14.57 5.22 -2.08 3.46 0807160948r
130.0 130.0 15.00 5.70 -2.20 3.56 0807160948r
135.0 135.0 15.42 6.28 -2.94 4.60 0807160948r
140.0 140.0 15.84 6.57 -3.50 1.34 0807160948r
145.0 145.0 16.26 6.92 -3.92 1.19 0807160948r
150.0 150.0 16.68 -4.36 1.15 0807160948r
155.0 155.0 17.10 -5.89 1.25 0807160948r
```



3

## Barrier Ranking



Disability Community Participation

# **Data Collection**

# Inertial Profilers

Profiling systems originally developed by GM Labs in the 1970s.

Used in both the aerospace and roadway construction industries



U.S. Department of Transportation  
Federal Highway Administration



# Technology Development Partnership



**Summer 2007.** Research partnership agreement with FHWA led to 2 month assessment with student interns using a modified ultra-light, slow-speed inertial profiler (ULIP) mounted on a Segway HT.

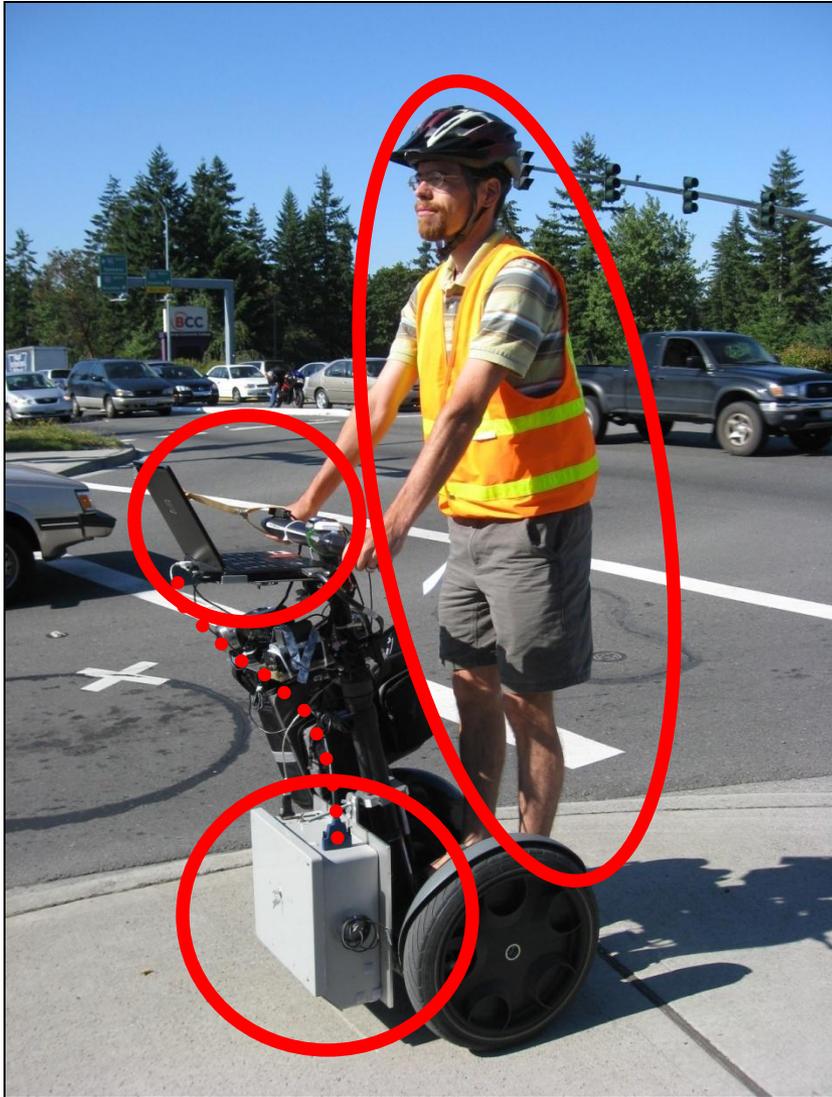


U.S. Department of Transportation  
Federal Highway Administration



*Coordinated staffing & funding commitment from three agencies from three levels of government.*

# ULIP Technology



Starodub, Inc. developed  
*R&D prototype ULIP*

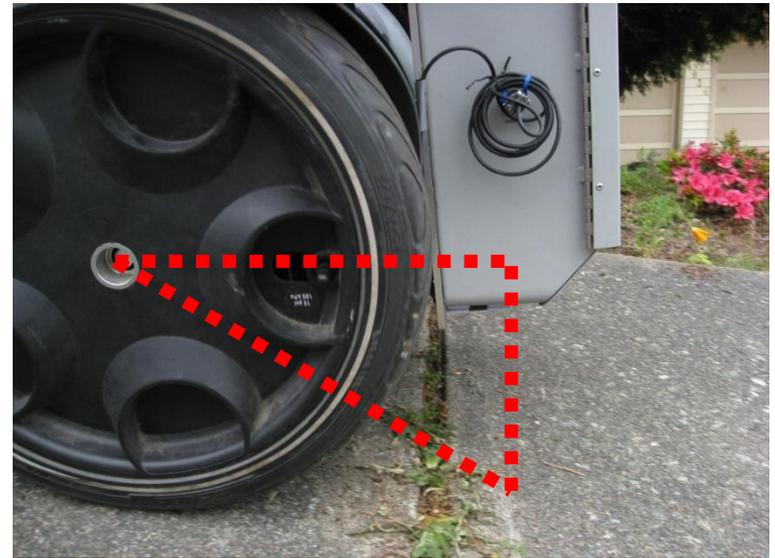
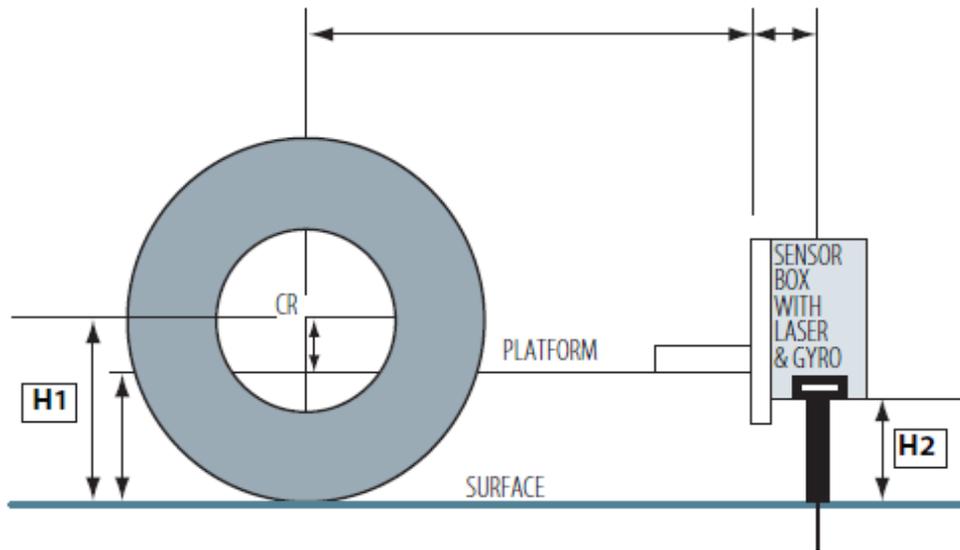
## Sensor box includes:

1. a displacement laser (texture/profile/height),
2. three accelerometers (inertial profiling),
3. a gyroscope (pitch, roll, yaw),
4. optical trigger (reference),
5. GPS (general location), and
6. a DMI (travel distance system).

Computer and data acquisition card are used for data capture.

# ULIP Relative to Surface

Distance Measurement Instrument (DMI) Calibration:  
Requires rider and tire pressure specific calibration.



# ADA Sidewalk Compliance Criteria

Together, these devices enable the City to measure the sidewalk surface at a rate of 10,000 records per second capturing highly accurate information about slope and small surface variations that can make a sidewalk difficult to navigate.

## Running Slope



1:20 (5%) max  
*ADAAG 4.8*

## Cross Slope



1:50 (2%) max  
*ADAAG 4.3.7*

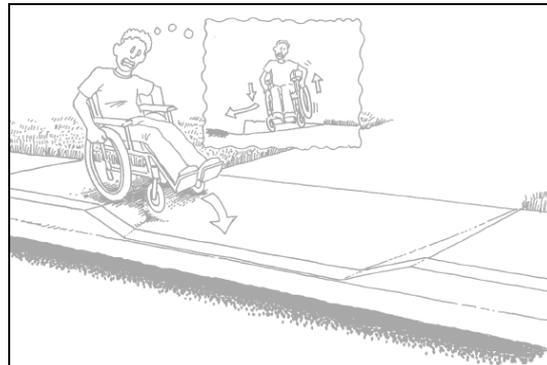
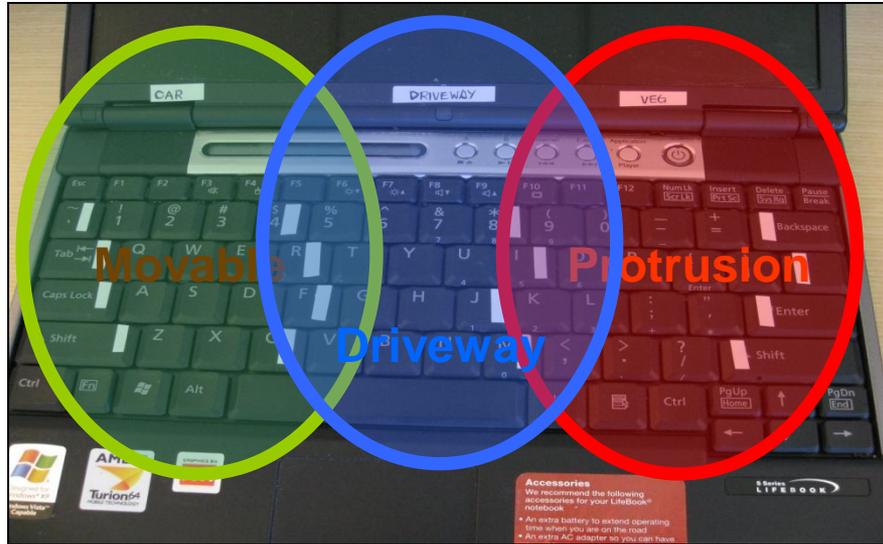
## Change in Level



1/4 inch max  
*ADDAG 4.5.2*

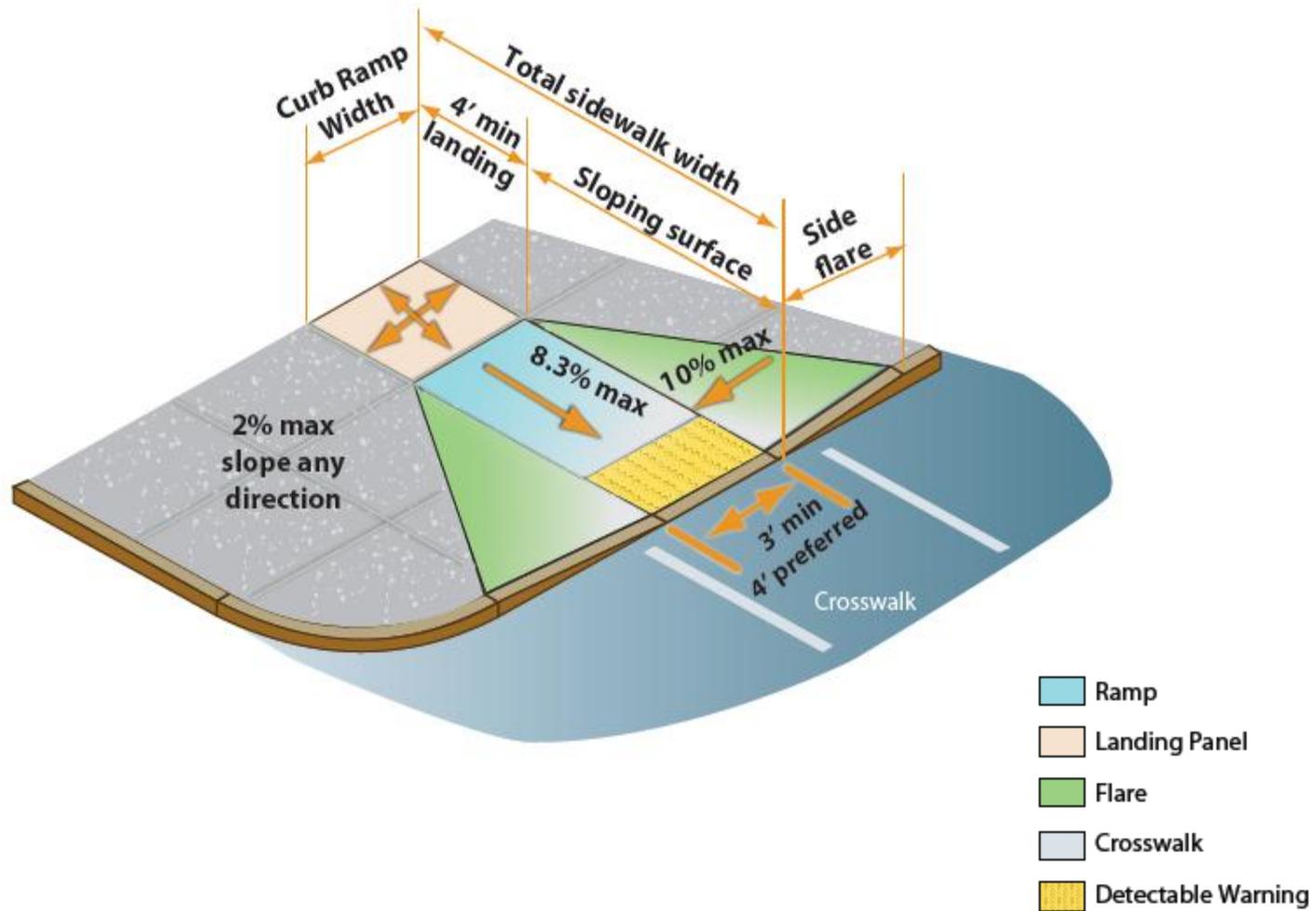
# Movable Obstructions/Driveways/Protrusions

Key-press events: Time/distance coding of user defined features.





# ADA Curb Ramp Compliance Criteria



# Curb Ramp Inventory Toolkit









GMS-2

TOPCON

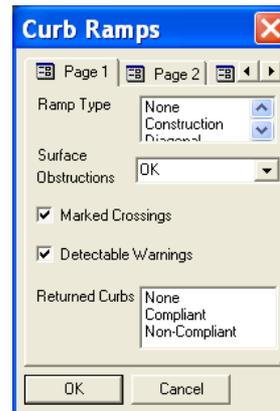
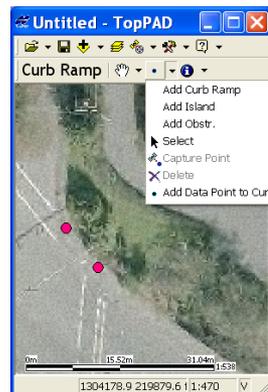
ESC

ENT

# Curb Ramp Documentation

## Topcon GMS-2 handheld GPS receiver:

- Equipped with a digital camera, graphic interface, & data entry form.
- Positional accuracy of GPS receiver is 1-3 meters.
- Receiver can load and display ortho-photos enabling field staff to zoom in and create points on specific curb ramps.
- Spatial resolution of ortho-photos is 1 foot per pixel.



# GMS-2 Curb Ramp Data Dictionary

**Ramp type:** Directional; Perpendicular; Diagonal; Construction; None (indicates no ramp where ramp is needed)

**Gutter running slope:** Standard ( $\leq 5\%$ ); Non-standard ( $> 5\%$ )

**Gutter cross-slope:** Standard ( $\leq 2\%$ ); Non-standard ( $> 2\%$ )

**Transition:** Free of heaves, gaps, and obstructions (yes/no)

**Clear space at bottom:** 4' x 4' of clear space at the bottom of a diagonal ramp, within marked crosswalk (yes/no)

**Detectable warnings:** 2' x 4' yellow panel of truncated domes adjacent to gutter transition (yes/no)

**Marked crossings:** Curb ramp wholly contained within crosswalk markings (yes/ no)

**Landing slope:** Landing slope does not exceed 2% in any direction (yes/no)

**Landing panel:** None (non-standard;  $\geq 48$  in. (best practices); 36-47 in. (standard);  $< 36$  in. (non-standard))

**Ramp width:**  $\geq 48$  in. (best practices); 36-47 in. (standard);  $< 36$  in. (non-standard)

**Ramp slope:**  $< 8.3\%$  (standard); 8.3% - 10% (non-standard);  $> 10\%$  (non-standard)

**Ramp cross-slope:**  $< 2\%$  (standard); 2% - 4% (non-standard);  $> 4\%$  (non-standard)

**Ramp flares:** None;  $\leq 10\%$  (standard); 10.1% - 12% (non-standard);  $> 12\%$  (non-standard)

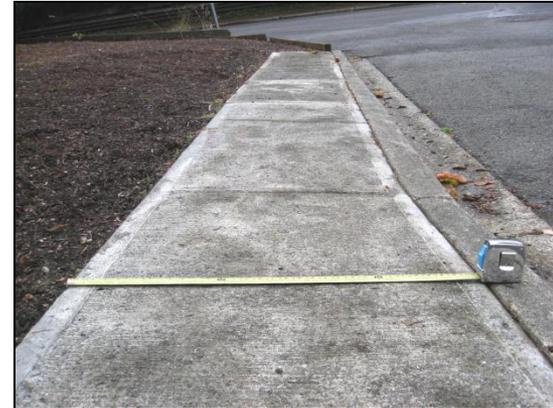
**Returned curbs:** None (if no ramp flares); Standard (ramp is situated such that pedestrians will not walk across returned curbs); Non-standard (returned curbs may present tripping hazard)

# GMS-2 Sidewalk Data Dictionary

## Fixed Obstructions



## Narrow Sidewalks



# **Quality Assurance/Quality Control**

# Nationally Recognized Best Practice

ADA COMPLIANCE AT TRANSPORTATION  
AGENCIES:  
A REVIEW OF PRACTICES

*Requested by:*

American Association of State Highway  
and Transportation Officials (AASHTO)

Standing Committee on Highways

*Prepared by:*

Cesar Quiroga, Ph.D., P.E.  
Research Engineer

and

Shawn Turner, P.E.  
Research Engineer

TEXAS TRANSPORTATION INSTITUTE  
The Texas A&M University System  
College Station, Texas

September 2008

The information contained in this report was prepared as part of NCHRP Project 20-07, Task 249,  
National Cooperative Highway Research Program, Transportation Research Board

“Efforts such as those at the City of Bellevue, Washington, that rely on the collection of large datasets at extremely fine spatial and temporal disaggregation levels have the potential to significantly automate the identification of non-compliant locations in the field.”

*NCHRP 20-07 Task 249*

*- Texas Transportation Institute*

# Attribute Accuracy of Data

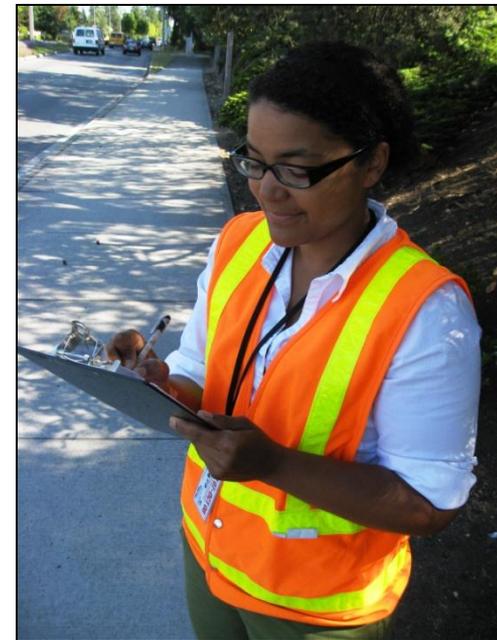
Field technicians check the slope and grade of sidewalk segment with smart level for QAQC validation of ULIP data.



**Cross Slope**

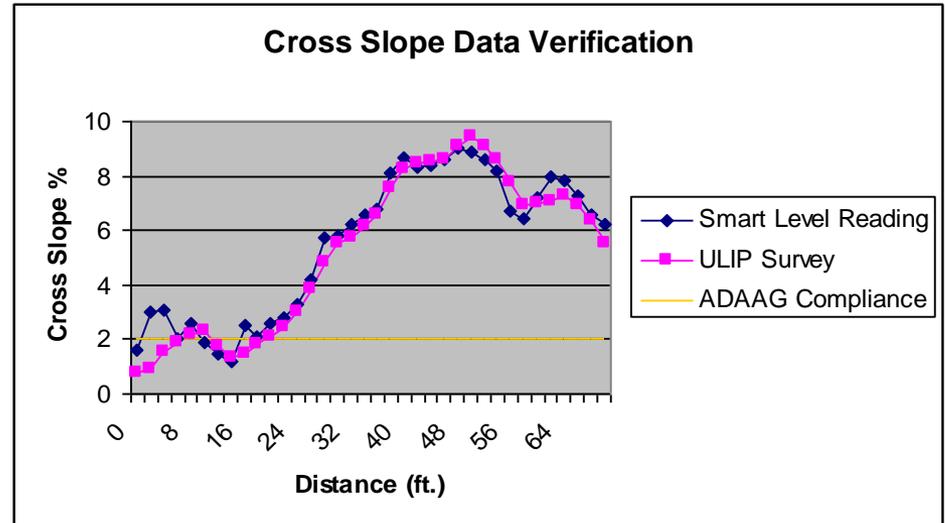
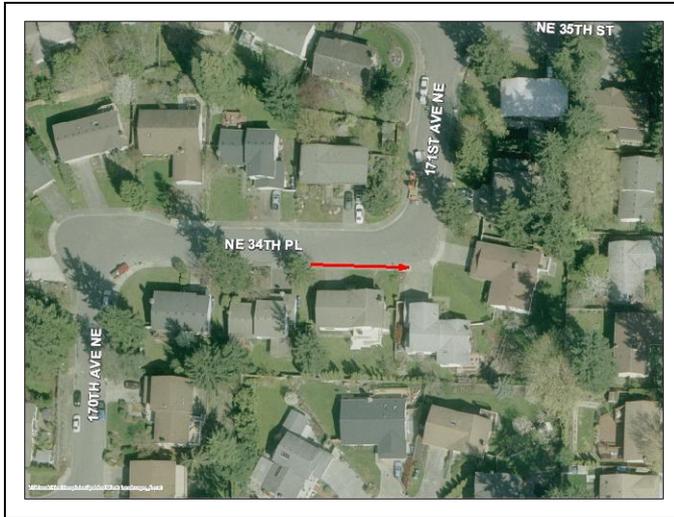


**Running Slope**

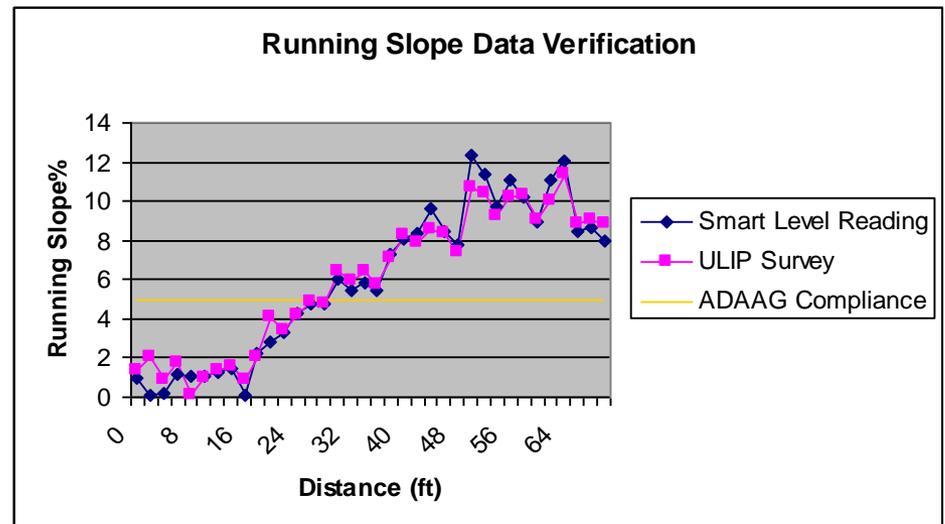


**Data Acquisition**

# Validation Report: Smart Level/ULIP

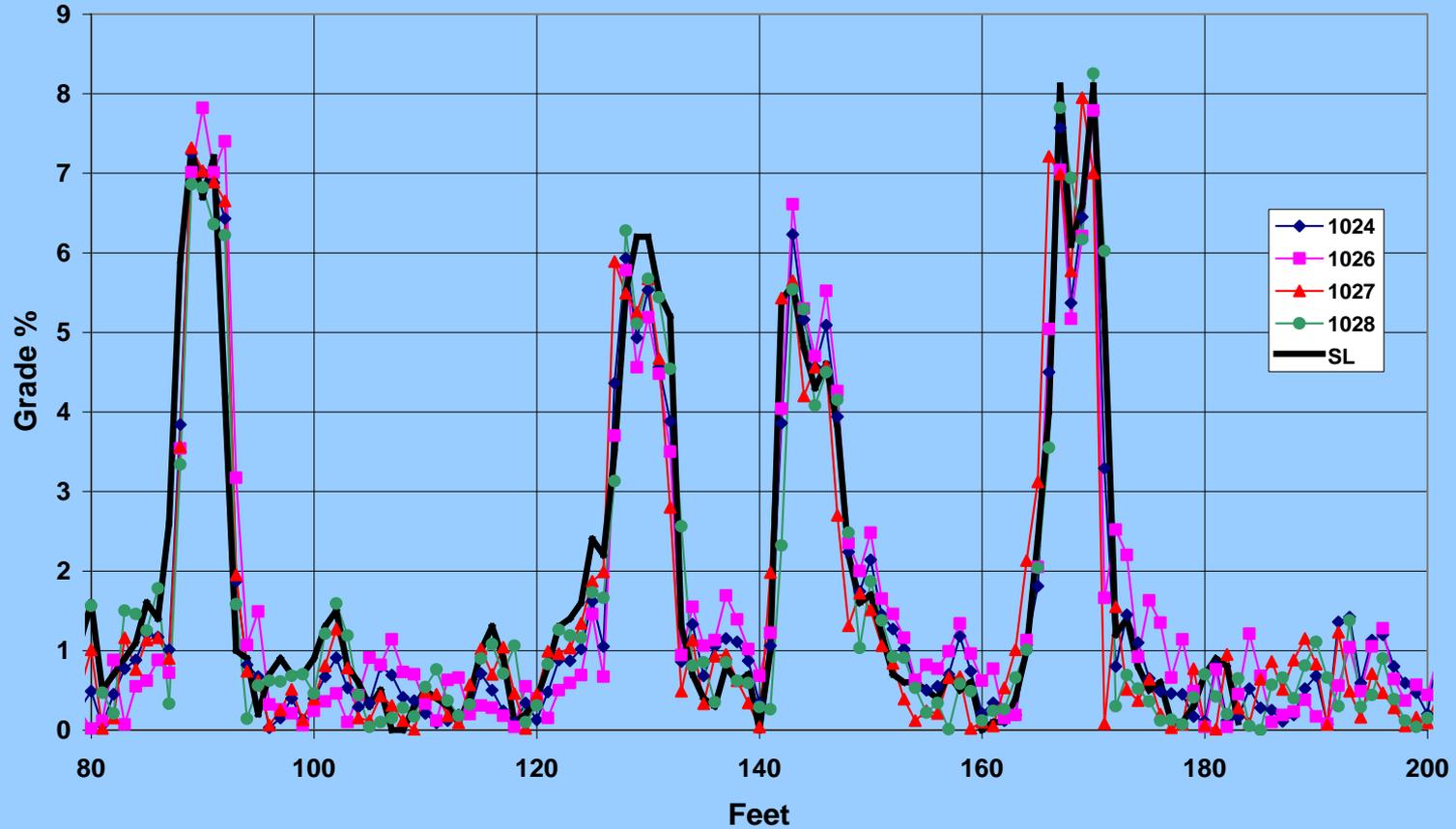


- ULIP data consistently follows with the Smart Level's peaks and troughs at test sites.
- Rise versus Running Distance compared to ADAAG.

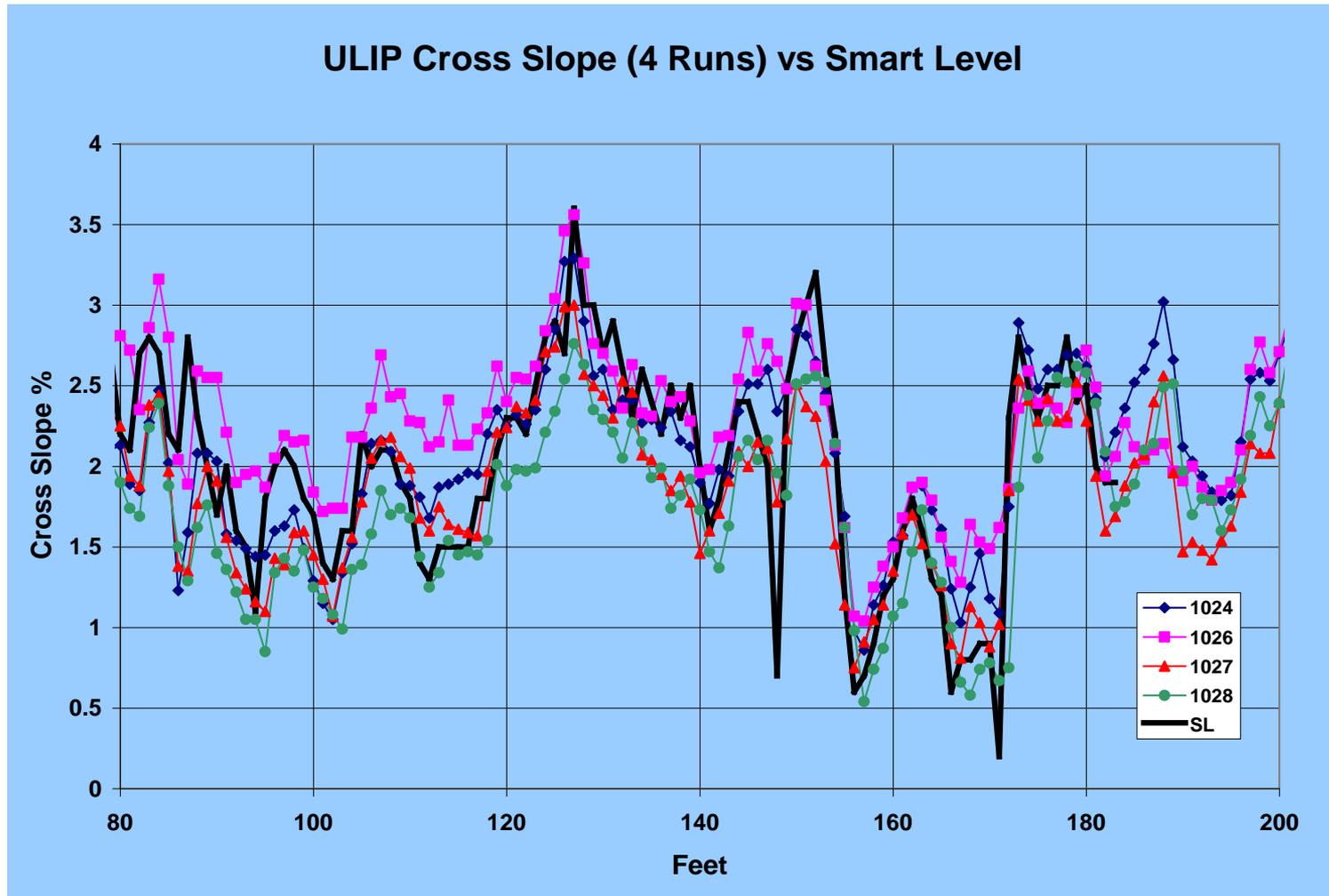


# ULIP Path Repeatability for Grade

ULIP Grade (4 runs) vs Smart Level



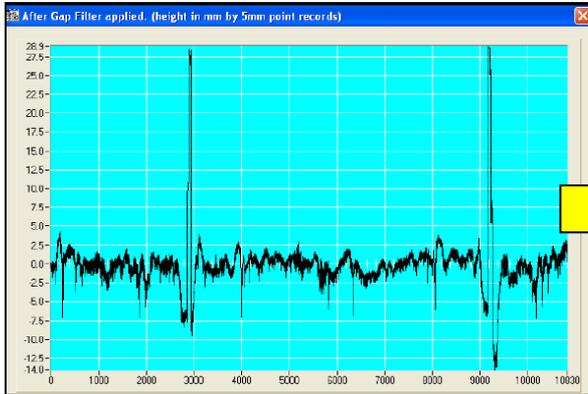
# ULIP Path Repeatability for Cross Slope



Site was a sidewalk with two successive driveway crossings.

# Change in Level Output Reports

## Field Validation Mode



## ASCII text file

0807160948r.NGD - Notepad

Travel	Marker	Dist_Ft	Dist_Ft	Time(s)	Grade%	xSlope%	Yaw(deg)	Casename
0.0	0.0	0.00	0.00	0.00	0.00	0.00	-1.82	0807160948r
5.0	5.0	1.26	0.58	-1.72	-2.81	0807160948r		0807160948r
10.0	10.0	2.50	1.18	-2.87	-5.05	0807160948r		0807160948r
15.0	15.0	3.50	1.80	-2.11	-4.01	0807160948r		0807160948r
20.0	20.0	4.30	1.80	-1.55	-4.32	0807160948r		0807160948r
25.0	25.0	4.99	1.62	-0.99	-4.03	0807160948r		0807160948r
30.0	30.0	5.60	1.57	-0.07	-3.53	0807160948r		0807160948r
35.0	35.0	6.17	1.62	0.59	-1.36	0807160948r		0807160948r
40.0	40.0	6.71	1.72	0.64	0.14	0807160948r		0807160948r
45.0	45.0	7.25	2.06	1.00	0.59	0807160948r		0807160948r
50.0	50.0	7.76	3.94	1.43	0.57	0807160948r		0807160948r
55.0	55.0	8.27	4.15	1.85	0.52	0807160948r		0807160948r
60.0	60.0	8.77	4.55	2.14	0.46	0807160948r		0807160948r
65.0	65.0	9.25	5.32	2.53	0.29	0807160948r		0807160948r
70.0	70.0	9.72	5.70	2.55	0.44	0807160948r		0807160948r
75.0	75.0	10.19	5.82	2.08	0.37	0807160948r		0807160948r
80.0	80.0	10.65	5.72	1.48	1.38	0807160948r		0807160948r
85.0	85.0	11.11	5.51	0.97	1.39	0807160948r		0807160948r
90.0	90.0	11.56	5.34	0.59	1.79	0807160948r		0807160948r
95.0	95.0	12.00	4.58	0.69	2.14	0807160948r		0807160948r
100.0	100.0	12.44	4.74	0.71	2.40	0807160948r		0807160948r
105.0	105.0	12.87	5.24	0.77	2.44	0807160948r		0807160948r
110.0	110.0	13.30	5.19	0.25	2.42	0807160948r		0807160948r
115.0	115.0	13.73	4.96	-0.68	2.69	0807160948r		0807160948r
120.0	120.0	14.15	5.21	-1.57	2.82	0807160948r		0807160948r
125.0	125.0	14.57	5.22	-2.08	3.46	0807160948r		0807160948r
130.0	130.0	15.00	5.70	-2.20	3.56	0807160948r		0807160948r
135.0	135.0	15.42	6.26	-2.94	2.60	0807160948r		0807160948r
140.0	140.0	15.84	6.67	-3.50	1.34	0807160948r		0807160948r
145.0	145.0	16.26	7.25	-3.92	1.19	0807160948r		0807160948r
150.0	150.0	16.68	7.74	-4.30	1.15	0807160948r		0807160948r
155.0	155.0	17.10	7.67	-3.89	1.55	0807160948r		0807160948r

## Data in City's GIS



## QA/QC



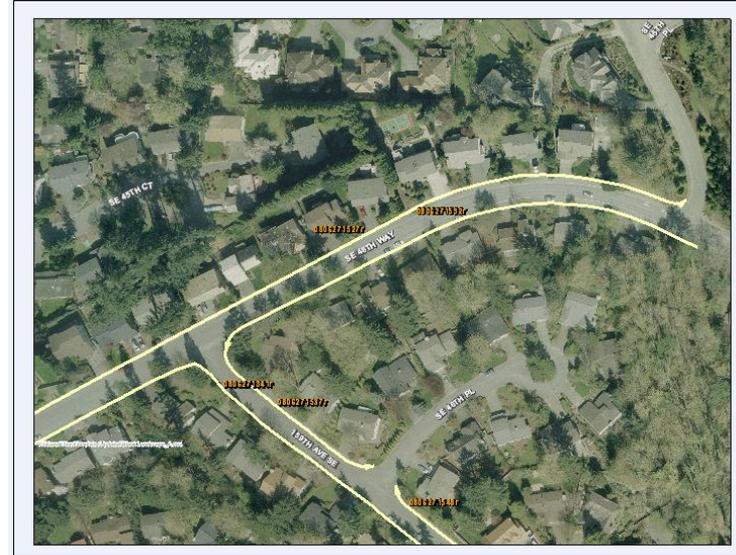
# Positional Accuracy of Data

## Streaming GPS



Bellevue testing with global navigation satellite system (GPS) found the accuracy of latitude/longitude data degraded in areas with tall buildings or thick tree canopies.

## Sensor-based inertial navigation

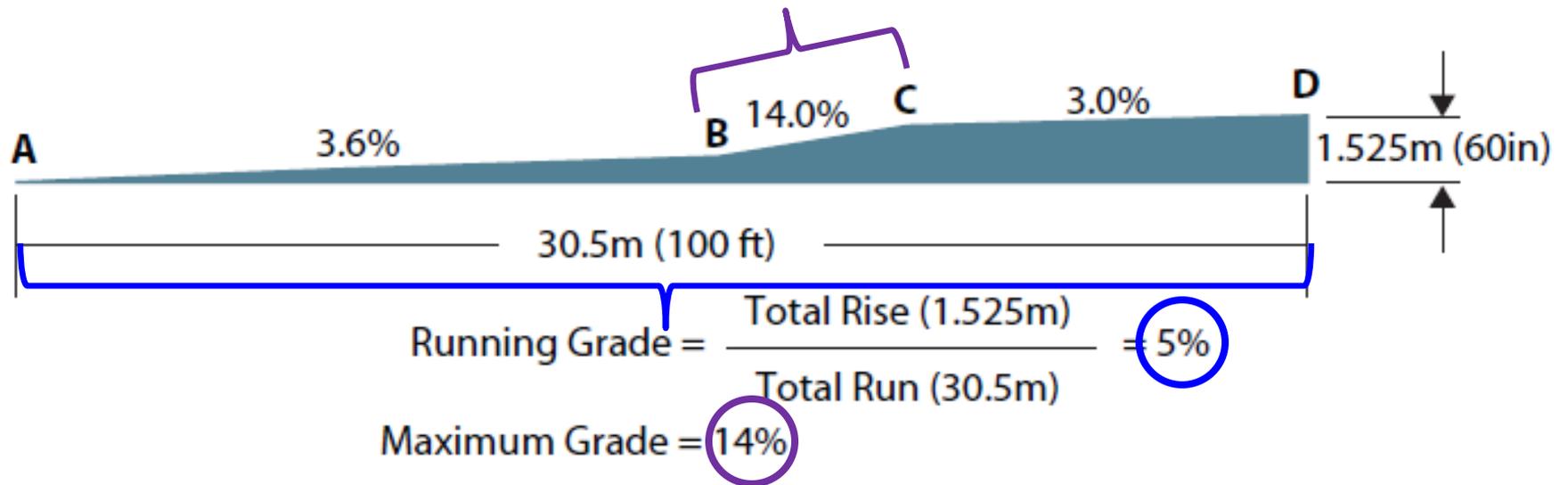


Start/end points for each data collection run entered on an ortho-photo image on the ULIP's notebook computer screen. The gyroscope and distance measurement instrument were used to compute path of travel.

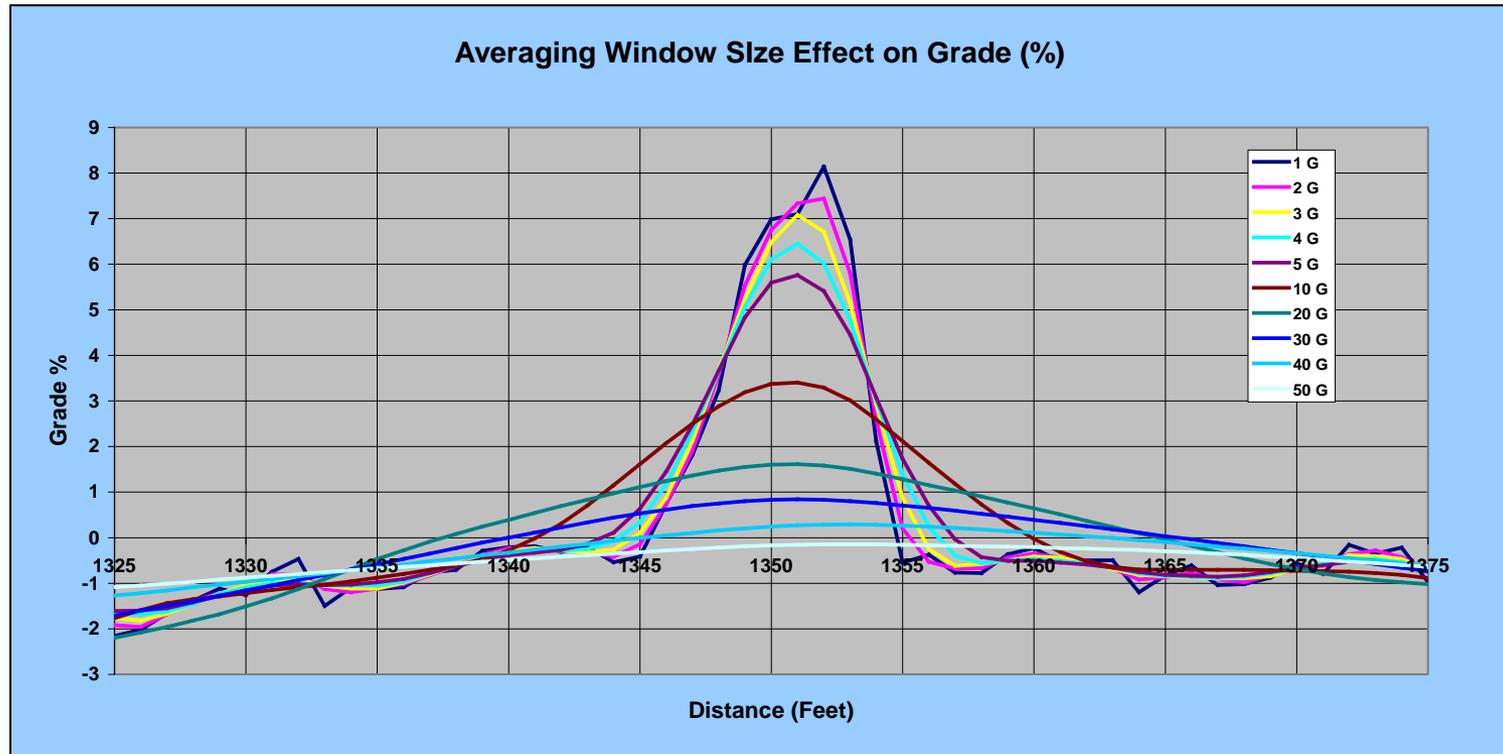
# **Roadway Grade Analysis**

# Measurement of Grade

Maximum grade is defined as a limited section of path that exceeds the typical running grade.



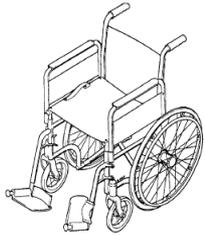
# Raw Data Allows for Infinite Re-analysis



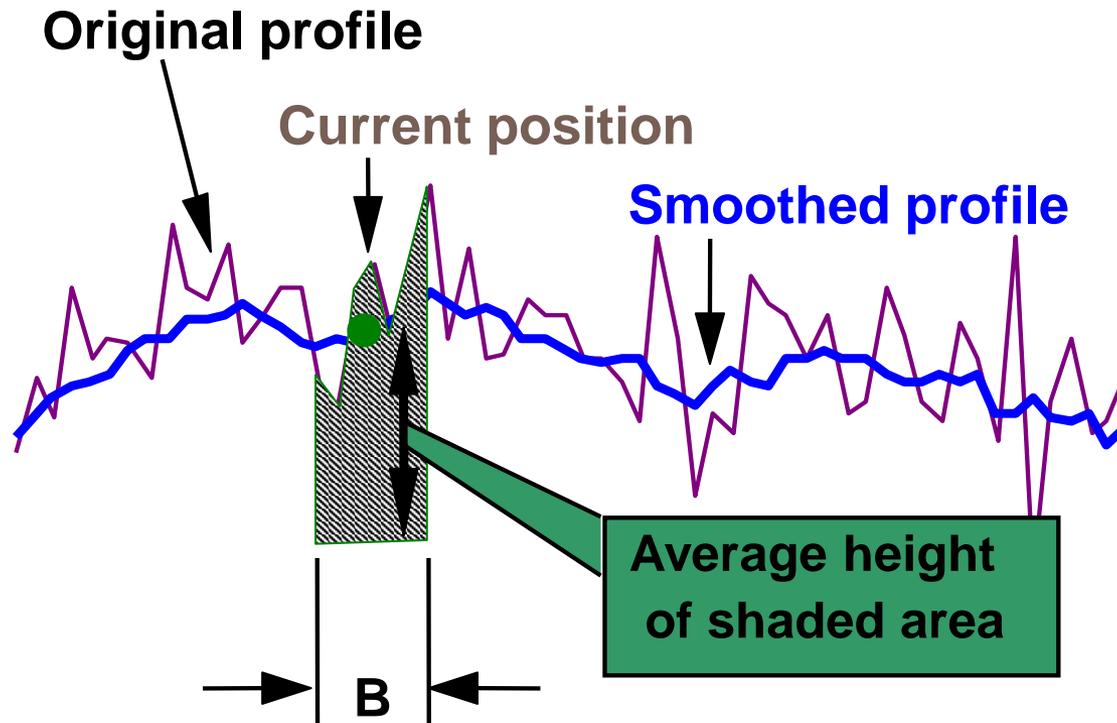
## Grade and Cross Slope Averaging Window Size:

- In the ULIP Geometry Equation, the user specifies the grade and cross slope window size in feet to be applied in a moving average computation.
- The graph illustrates the effect of moving average window size. The larger the value, the more dampened out the features.

# User-Specified Window Size

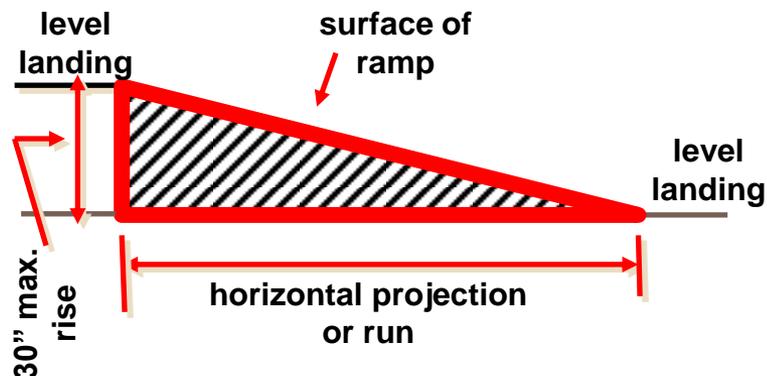


*FHWA guidance on grade and cross-slope:  
“should be measured over 2 ft intervals, the approximate  
length of a wheelchair wheelbase, or a single walking pace.”*



# Grade Compliance Criteria

An accessible route with a running slope greater than 1:20 (5%) is a ramp and shall comply with ADAAG 4.8. (ADAAG 4.3.7)



- Maximum slope 8.33%
- Maximum rise for any run shall be 30"
- Minimum clear width shall be 36"
- Level landings at bottom and top of each ramp

Slope	Maximum Rise (inches)	Construction Type
1:20 to 1:16 (5% to 6.3%)	30	New const. & modifications
1:16 to 1:12 (6.3% to 8.3%)	30	New const. & modifications
1:12 to 1:10 (8.3% to 10%)	6	Modifications only
1:10 to 1:8 (10%- 12.5%)	3	Modifications only

# Grade (Ramp Type) Classification

Ramp type 1 meets the definition of a ramp ( $\geq 5\%$ ) but is not regarded as having a non-standard grade.

Ramp type 30 has a rise of 30 in and run between 30 to 50 ft. ( $5\% \geq x \leq 8.33\%$ )

Ramp type 6 has a rise of 6 in and run between 6 & 5 ft. ( $8.33\% \geq x \leq 10\%$ )

Ramp type 3 has a rise of 3 in and run between 2 & 2.5 ft. ( $10\% \geq x \leq 12.5\%$ )

Ramp type 99 has a rise greater than 1.5 over 1 ft. ( $> 12.5\%$ )

	Slope	Max Rise (in.)	Max Run (ft.)		Grade Type
$\geq$	5.0%	0	0		1
$\geq$	5.0%	30	50	1:20	30
	5.5%	30	45.5		
	6.0%	30	41.7		
	6.5%	30	38.5		
	7.0%	30	35.7		
	7.5%	30	33.3		
	8.0%	30	31.3		
<	8.33%	30	30.0	1:12	
	8.33%	6	6.0	1:12	6
	8.5%	6	5.9		
	9.0%	6	5.6		
	9.5%	6	5.3		
<	10.0%	6	5.0	1:10	
>	10.0%	3	2.5	1:10	3
	10.5%	3	2.4		
	11.0%	3	2.3		
	11.5%	3	2.2		
	12.0%	3	2.1		
$\leq$	12.5%	3	2.0	1:8	
>	12.5%	>1.5	1.0		99



**Grade Slope**

**Ramp Type**

- 3
- 6
- 30
- 99
- ▶ Compliant Sidewalk

Source: ADASegway/Maps/Reasability/Sample

 = 50 feet

City of Bellevue  
IT Department  
GIS Services

Plot Date: 3/9/2007

 NORTH



# Somerset

## Non Standard Grade Slope

Map Location



This map is a graphic representation derived from the City of Bellevue Geographic Information System. It was designed and intended for City of Bellevue staff use only. It is not guaranteed to survey accuracy. This map is based on the best information available on the date shown on the map. Any reproduction or use of this map, or portion thereof, is prohibited without express written authorization by the City of Bellevue.

NOTE: If you have specific questions concerning information contained on this map, please contact the sponsoring department as shown on the map.

This material is owned and copyrighted by the City of Bellevue.

# Determination of “Technical Infeasibility”

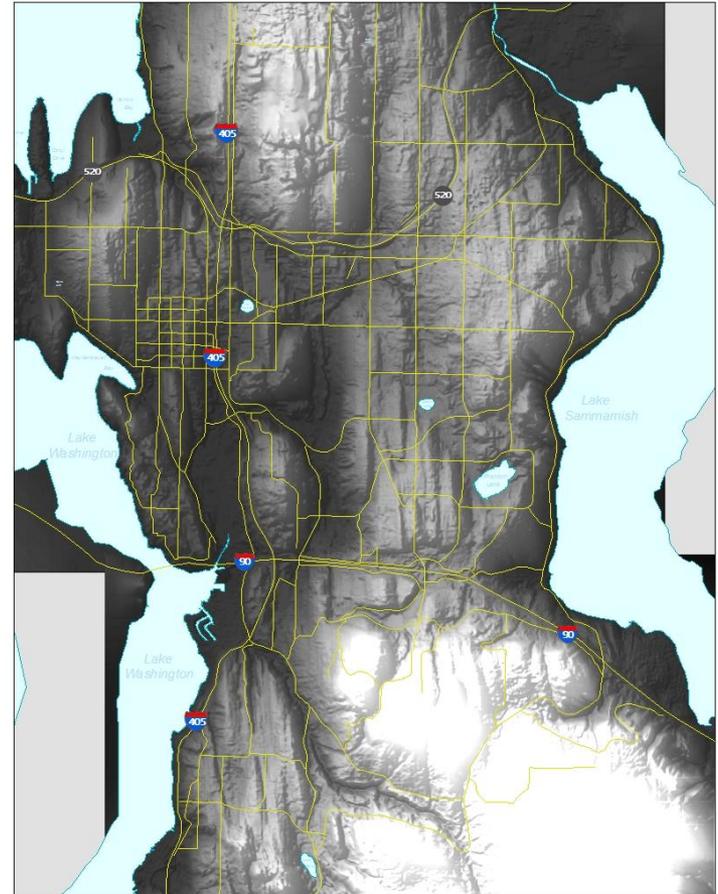


***“Because of the constraints imposed by right-of-way width, the pedestrian access route (PAR) is relieved of the slope limits that would apply to an accessible route on a site provided it matches the general grade of the adjacent roadway.”***

***- Revised Draft Guidelines for Accessible Public Rights-of-Way; R301.4***

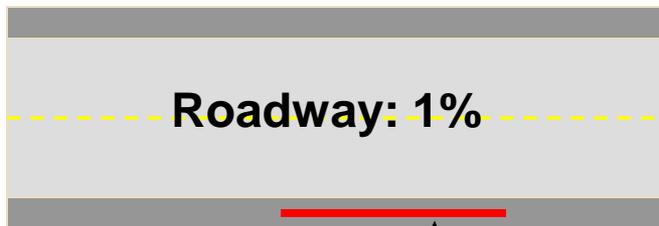
# Digital Elevation Model

- DEM (Digital Elevation Model) data in GIS used to determine grade of streets for this analysis.
- A DEM is a grid in which each cell represents an elevation. The City contracts with private vendors for updated DEM information approximately every 2 years.
- For a given section of road, grade is calculated as  $\text{Rise}/\text{Run}$ . In this equation the length of the road section provides the Run. The DEM provides the Rise.



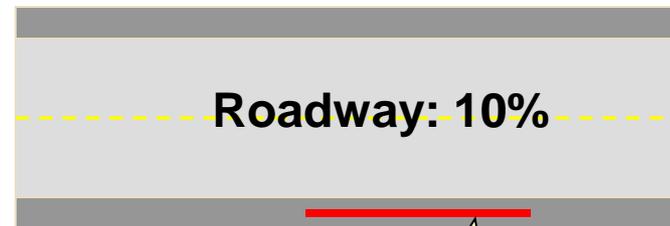
# GIS Script

The GIS script loops through all non-standard sidewalk grade cases. For each location, the sidewalk grade is compared with the grade of the adjacent street (DEM), allowing for identification of sidewalks where high grade values are due to topographic factors. Once this information is recorded for each location, criteria can be defined to filter out locations which are considered “technically infeasible”.



**Sidewalk: 10%**

Non-Standard  
Running Slope  
Location

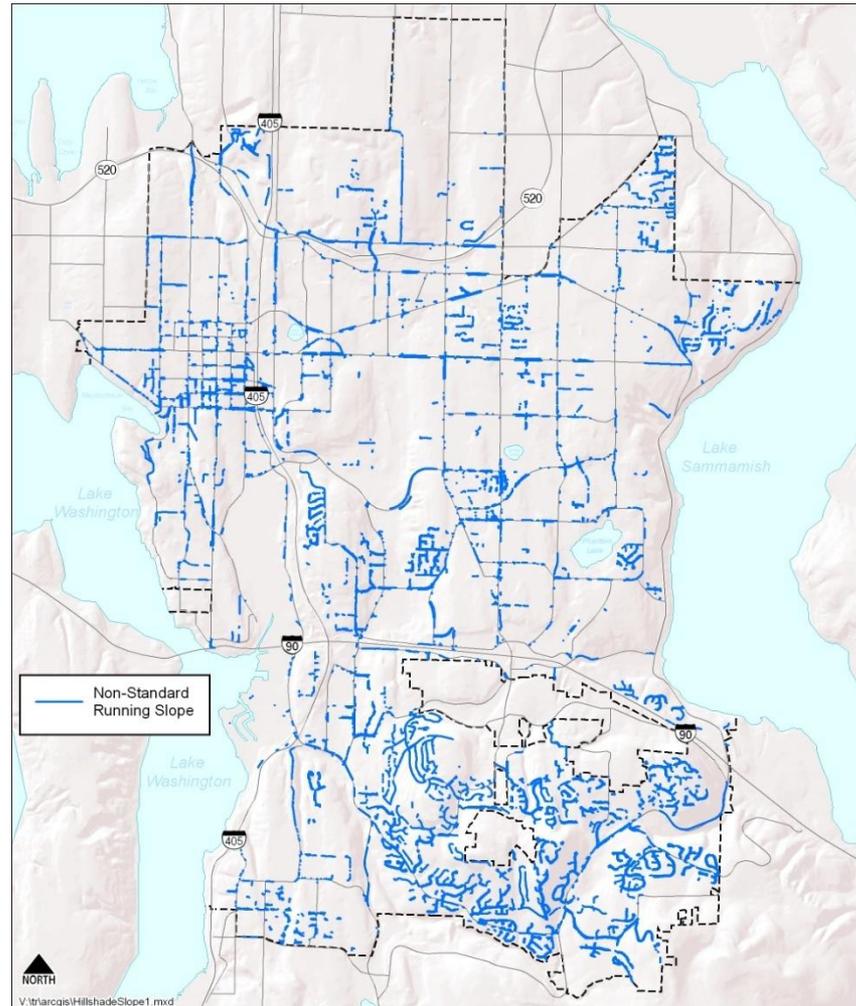


**Sidewalk: 10%**

Compliant due  
to technical  
infeasibility

# Digital Elevation Model Calculation

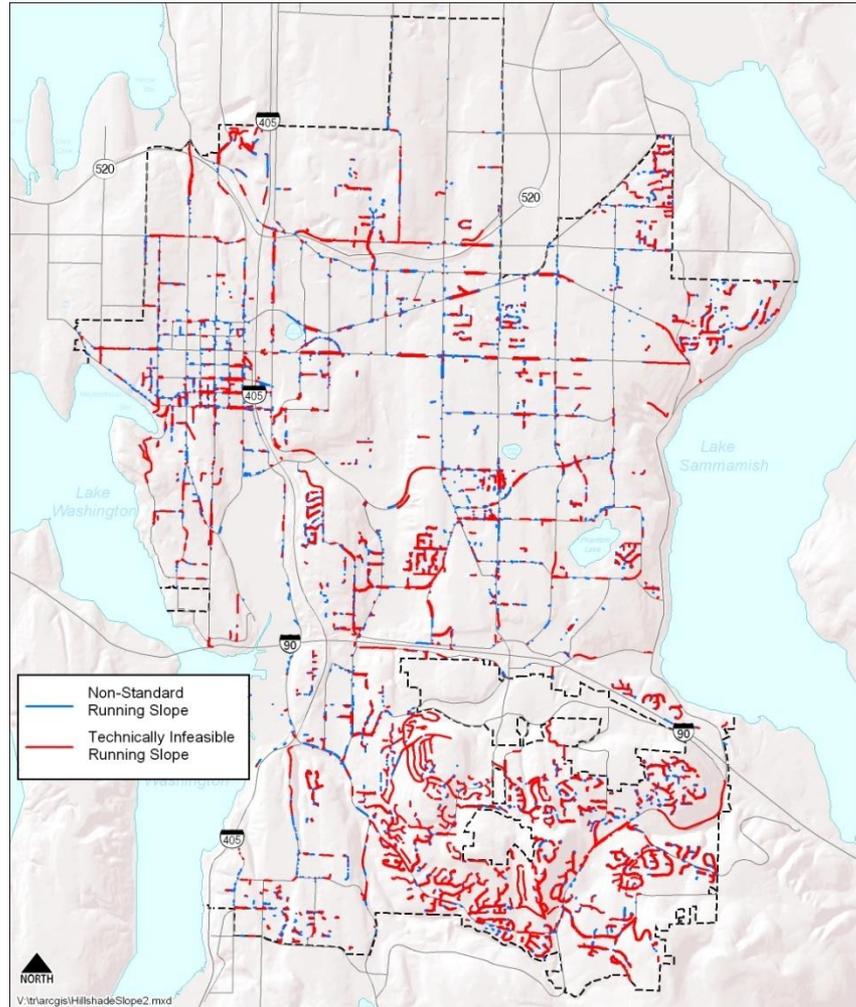
134 miles



# Digital Elevation Model Calculation

**134 miles**

**95 miles**

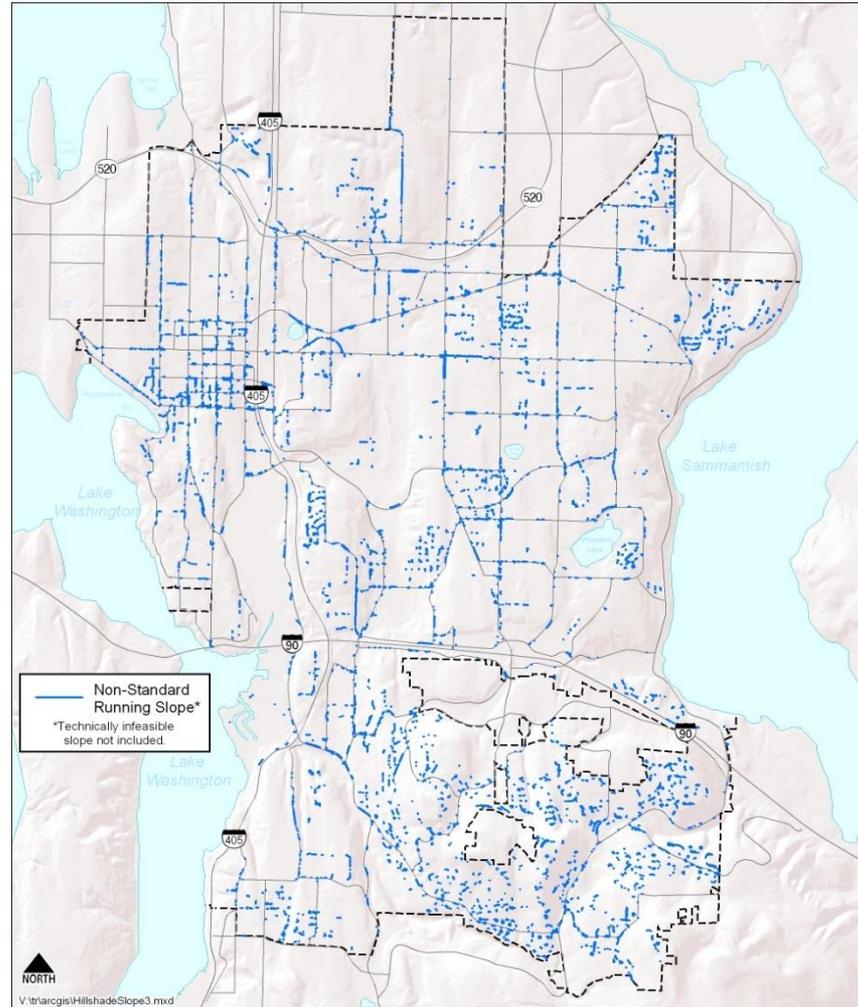


# Digital Elevation Model Calculation

**134 miles**

**— 95 miles**

**39 miles**



# NE 8<sup>th</sup> Street Example

The sidewalk slope does not conform to the roadway slope. The sidewalk is classified as a Ramp Type 30, which has a running slope between 5 and 8 percent over a distance of 30 feet or greater. The road adjacent to it, has a slope of 5 percent.



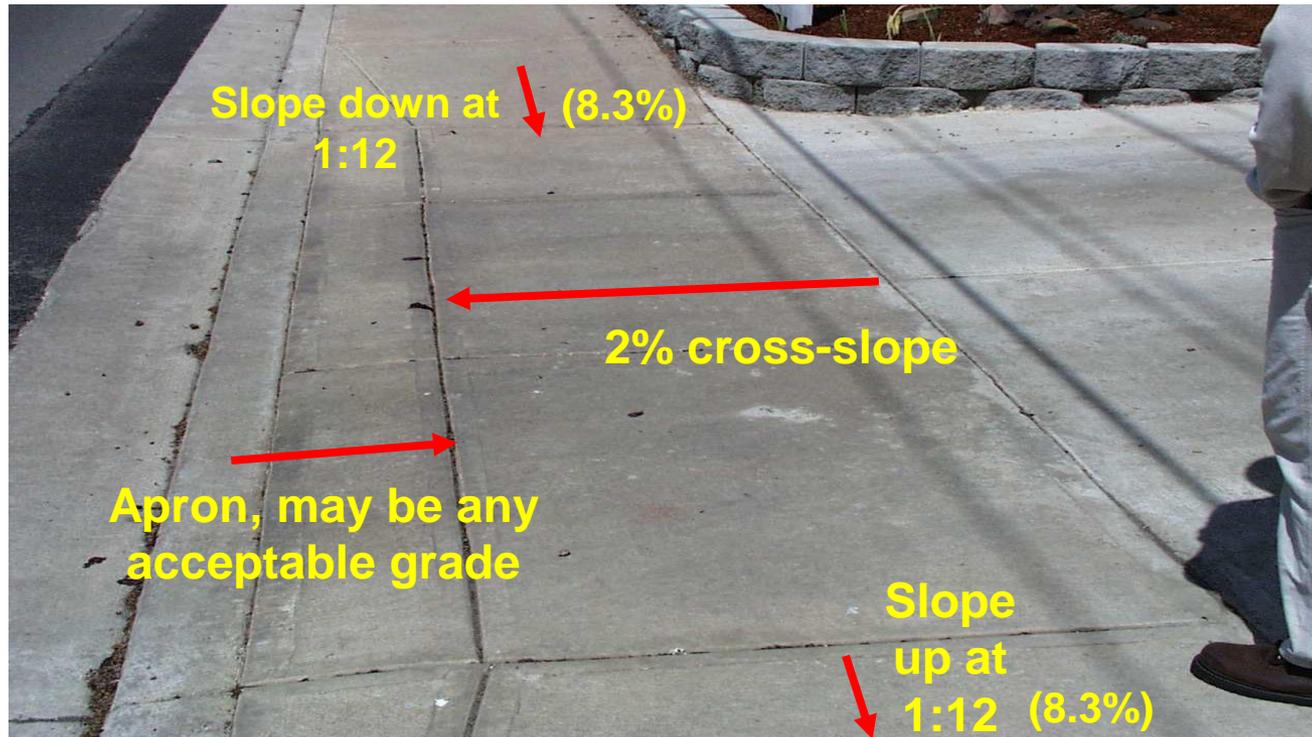
# NE 8<sup>th</sup> Street Example



The road slope where it is greater than 5 percent (red) is deemed technically infeasible according to ADDAG documentation. Sidewalks with adjacent road slopes that are less than 5 percent are identified as non-standard.

# **Driveway Cross Slope Analysis**

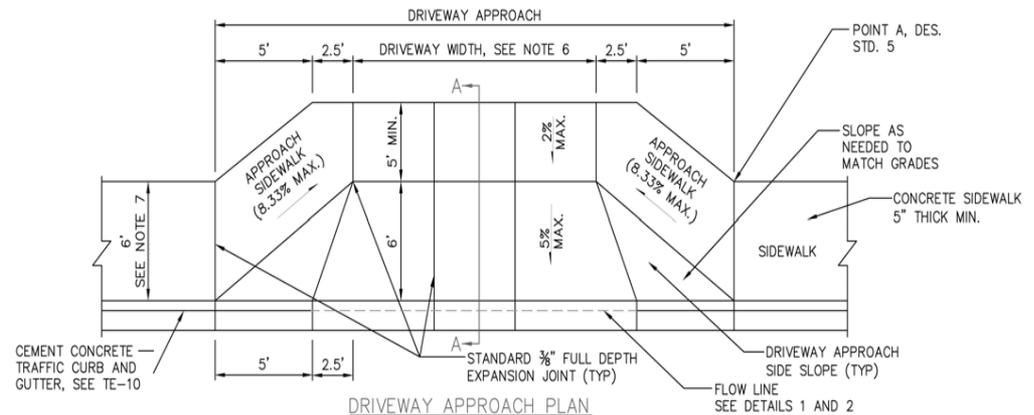
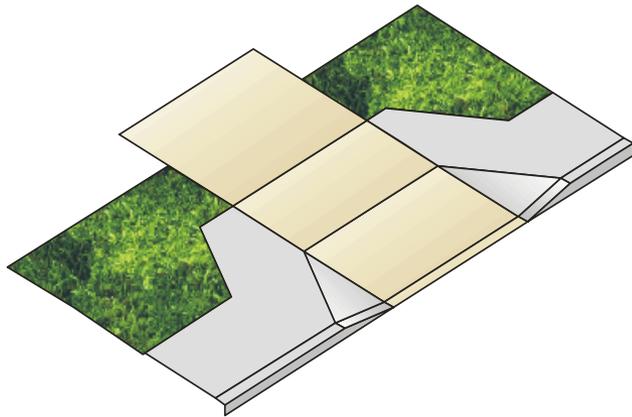
# Driveway Standards



- Certain grades and slopes must be maintained.
- 2% cross-slope,
- 8.33% max ramp slopes if used.

# Bellevue Design Manual

Bellevue employs a number of accessible driveway designs to maintain an acceptable cross slope and facilitate wheelchair movement at driveways.



As reflected in DEV-7D above, securing additional right-of-way from the adjacent property is a good strategy for improving pedestrian access on narrow sidewalks. This design allows pedestrians to maintain a level path as they cross the driveway.

# Project Approach

**Driveway crossings without landings confront wheelchair users with severe and rapidly changing slopes at the driveway flare.**



**A series of driveway apron flares with 11% cross slope measurements at 130th Avenue SE & SE 26th Street.**



**The driveway analysis is based on ULIP recordings taken by field staff at the center points of driveways. Using GIS, any non-standard cross slope values within buffer are attributed to the driveway aprons.**

# Cross Slope Findings

Cross Slope Category	Total Length (Miles)	Cross Slope within Driveway Buffer (Miles)	Cross Slope without Driveways (Difference)	% Attributable to Driveways
2-4%	134	18	116	13%
4-6%	49	9	41	17%
6-8%	15	5	10	31%
8-10%	7	4	3	54%
10%+	7	5	2	70%
Total	212	40	172	19%

1. Over 50% of Bellevue's 8+ percent cross slope measurements are attributable to driveway aprons.
2. Number increases as cross slope values increase, with 70% of 10+ percent cross slope measurements attributable to driveway aprons.
3. Overall, 19% of all non-standard cross slope measurements are attributable to driveway aprons constructed like ramps, with steep, short side flares.

# **ADA Viewer Interface**

# ADA Viewer Window

Identify/ Print  
Toggle Bar

Navigation

Extents  
Navigation

Locate by  
Address

Legend/  
Layers

The screenshot shows a web browser window titled "http://vcobinetdv17/ADA\_Tabs/ - Windows Internet Explorer". The address bar shows "http://vcobinetdv17/ADATabs/". The browser menu includes File, Edit, View, Favorites, Tools, and Help. The main content area displays the "ADA Viewer" application. At the top of the application is a toolbar with buttons: Identify, Print, Zoom In, Zoom Out, Pan, Previous Extent, Next Extent, Full Extent, and Locate. On the left side, there is a "Legend" panel with the following categories:

- Curb Ramps**
  - Existing (Yellow triangle)
  - Not Existing (Grey triangle)
  - Islands (Orange circle)
- Obstructions**
  - Fixed (Red square)
  - Movable (Black circle)
  - Vegetation (Green star)
- Changes in Level (inches)**
  - 0.25 - 0.50 (Light blue circle)
  - 0.51 - 0.75 (Blue circle)
  - 0.76 - 1.00 (Dark blue circle)
  - > 1.00 (Black circle)
- Sidewalk Grade (percent)**
  - 30 (5% - 8.33%) (Light blue line)
  - 6 (8.34% - 19%) (Blue line)
  - 3 (10.1% - 12.5%) (Dark blue line)
  - 96 (> 12.5%) (Black line)
  - Technically Infeasible (Dashed line)
- Sidewalk Cross Slope (percent)**
  - 2 - 4% (Yellow line)
  - 4 - 5% (Orange line)
  - 6 - 8% (Red line)
  - 8 - 10% (Purple line)
  - 10% or more (Dark blue line)
- Layers**

The main map area shows an aerial view of a street intersection. The street is labeled "NE 8TH ST". The map is overlaid with various colored lines and markers corresponding to the legend. Several "Curb ID #" labels are visible: 728, 726, 725, 674, 673, and 672. A scale bar at the bottom indicates 40 m and 100 ft. A "Location Map" inset in the bottom left corner shows a grid of streets with a red box highlighting the current view area. The browser status bar at the bottom shows "Local intranet" and "100%".

Location  
Map

# ADA Viewer

## ADA Viewer

Identify

Print

Zoom In

Zoom Out

Pan

Previous Extent

Next Extent

Full Extent

Locate

### Legend

#### Curb Ramps

- Existing
- Not Existing
- Islands

#### Obstructions

- Fixed
- Movable
- Vegetation

#### Changes in Level (inches)

- 0.25 - 0.50
- 0.51 - 0.75
- 0.76 - 1.00
- > 1.00

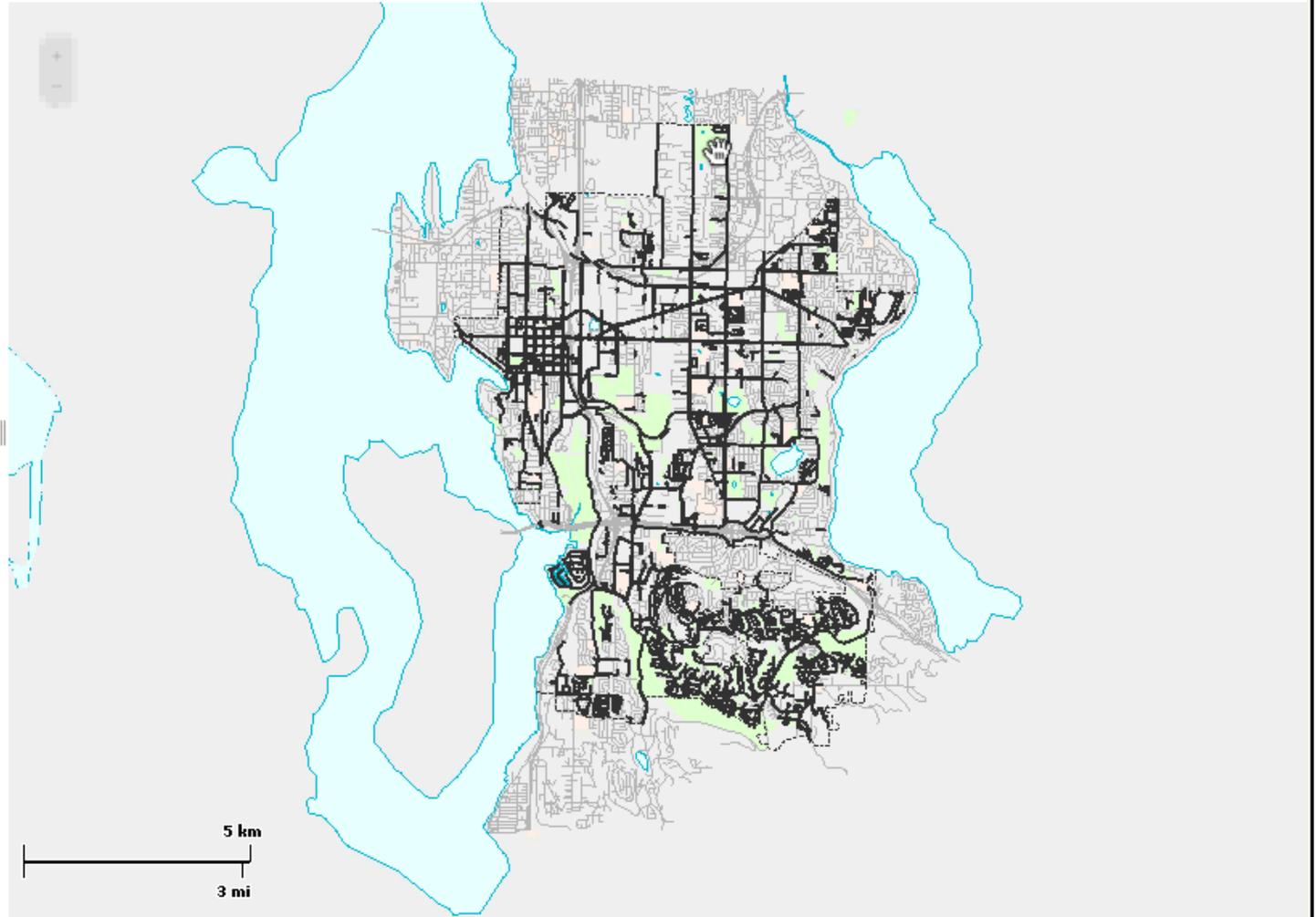
#### Sidewalk Grade (percent)

- 30 (5% - 8.33%)
- 0 (8.34% - 10%)
- 3 (10.1% - 12.5%)
- 55 (> 12.5%)
- Technically infeasible

#### Sidewalk Cross Slope (percent)

- 2 - 4%
- 4 - 5%
- 6 - 8%
- 8 - 10%
- 10% or more

#### Layers



**Legend**

- Curb Ramps
  - Existing
  - Not Existing
- Obstructions
  - Tree
  - Sign
  - Lightpole
- Changes in Level (inches)
  - 0.25 - 0.50
  - 0.51 - 0.75
  - 0.76 - 1.00
  - > 1.00
- Sidewalk Grade (percent)
  - 0 - 0.99%
  - 1 - 0.99%
  - 2 - 0.99%
  - 3 - 0.99%
  - 4 - 0.99%
  - 5 - 0.99%
  - 6 - 0.99%
  - 7 - 0.99%
  - 8 - 0.99%
  - 9 - 0.99%
  - 10 - 0.99%
  - 11 - 0.99%
  - 12 - 0.99%
  - 13 - 0.99%
  - 14 - 0.99%
  - 15 - 0.99%
  - 16 - 0.99%
  - 17 - 0.99%
  - 18 - 0.99%
  - 19 - 0.99%
  - 20 - 0.99%
  - 21 - 0.99%
  - 22 - 0.99%
  - 23 - 0.99%
  - 24 - 0.99%
  - 25 - 0.99%
  - 26 - 0.99%
  - 27 - 0.99%
  - 28 - 0.99%
  - 29 - 0.99%
  - 30 - 0.99%
  - 31 - 0.99%
  - 32 - 0.99%
  - 33 - 0.99%
  - 34 - 0.99%
  - 35 - 0.99%
  - 36 - 0.99%
  - 37 - 0.99%
  - 38 - 0.99%
  - 39 - 0.99%
  - 40 - 0.99%
  - 41 - 0.99%
  - 42 - 0.99%
  - 43 - 0.99%
  - 44 - 0.99%
  - 45 - 0.99%
  - 46 - 0.99%
  - 47 - 0.99%
  - 48 - 0.99%
  - 49 - 0.99%
  - 50 - 0.99%
  - 51 - 0.99%
  - 52 - 0.99%
  - 53 - 0.99%
  - 54 - 0.99%
  - 55 - 0.99%
  - 56 - 0.99%
  - 57 - 0.99%
  - 58 - 0.99%
  - 59 - 0.99%
  - 60 - 0.99%
  - 61 - 0.99%
  - 62 - 0.99%
  - 63 - 0.99%
  - 64 - 0.99%
  - 65 - 0.99%
  - 66 - 0.99%
  - 67 - 0.99%
  - 68 - 0.99%
  - 69 - 0.99%
  - 70 - 0.99%
  - 71 - 0.99%
  - 72 - 0.99%
  - 73 - 0.99%
  - 74 - 0.99%
  - 75 - 0.99%
  - 76 - 0.99%
  - 77 - 0.99%
  - 78 - 0.99%
  - 79 - 0.99%
  - 80 - 0.99%
  - 81 - 0.99%
  - 82 - 0.99%
  - 83 - 0.99%
  - 84 - 0.99%
  - 85 - 0.99%
  - 86 - 0.99%
  - 87 - 0.99%
  - 88 - 0.99%
  - 89 - 0.99%
  - 90 - 0.99%
  - 91 - 0.99%
  - 92 - 0.99%
  - 93 - 0.99%
  - 94 - 0.99%
  - 95 - 0.99%
  - 96 - 0.99%
  - 97 - 0.99%
  - 98 - 0.99%
  - 99 - 0.99%
- Sidewalk Cross Slope (percent)
  - 0 - 0%
  - 1 - 0%
  - 2 - 0%
  - 3 - 0%
  - 4 - 0%
  - 5 - 0%
  - 6 - 0%
  - 7 - 0%
  - 8 - 0%
  - 9 - 0%
  - 10 - 0%
  - 11 - 0%
  - 12 - 0%
  - 13 - 0%
  - 14 - 0%
  - 15 - 0%
  - 16 - 0%
  - 17 - 0%
  - 18 - 0%
  - 19 - 0%
  - 20 - 0%
  - 21 - 0%
  - 22 - 0%
  - 23 - 0%
  - 24 - 0%
  - 25 - 0%
  - 26 - 0%
  - 27 - 0%
  - 28 - 0%
  - 29 - 0%
  - 30 - 0%
  - 31 - 0%
  - 32 - 0%
  - 33 - 0%
  - 34 - 0%
  - 35 - 0%
  - 36 - 0%
  - 37 - 0%
  - 38 - 0%
  - 39 - 0%
  - 40 - 0%
  - 41 - 0%
  - 42 - 0%
  - 43 - 0%
  - 44 - 0%
  - 45 - 0%
  - 46 - 0%
  - 47 - 0%
  - 48 - 0%
  - 49 - 0%
  - 50 - 0%
  - 51 - 0%
  - 52 - 0%
  - 53 - 0%
  - 54 - 0%
  - 55 - 0%
  - 56 - 0%
  - 57 - 0%
  - 58 - 0%
  - 59 - 0%
  - 60 - 0%
  - 61 - 0%
  - 62 - 0%
  - 63 - 0%
  - 64 - 0%
  - 65 - 0%
  - 66 - 0%
  - 67 - 0%
  - 68 - 0%
  - 69 - 0%
  - 70 - 0%
  - 71 - 0%
  - 72 - 0%
  - 73 - 0%
  - 74 - 0%
  - 75 - 0%
  - 76 - 0%
  - 77 - 0%
  - 78 - 0%
  - 79 - 0%
  - 80 - 0%
  - 81 - 0%
  - 82 - 0%
  - 83 - 0%
  - 84 - 0%
  - 85 - 0%
  - 86 - 0%
  - 87 - 0%
  - 88 - 0%
  - 89 - 0%
  - 90 - 0%
  - 91 - 0%
  - 92 - 0%
  - 93 - 0%
  - 94 - 0%
  - 95 - 0%
  - 96 - 0%
  - 97 - 0%
  - 98 - 0%
  - 99 - 0%

**Layers**

**1 Features Selected**

**Sidewalk Block Face 1**

**field**

Chg in Lvl (num): 0.75 - 0.9	
Chg in Lvl (num): 1 in. or m	
Cross Slope (ft): 10% or mo	
Cross Slope (ft): 2 - 4%	214
Cross Slope (ft): 4 - 6%	165
Cross Slope (ft): 6 - 8%	54
Cross Slope (ft): 8 - 10%	86
Fixed Obstructions (num)	1
Length	614.79

Close ADAAG Help

**Help**

ADAAG PROWAG

**ADA Accessibility Guidelines for Buildings and Facilities (2002)**  
<http://www.access-board.gov/adaag/html/adaag.htm>

4.3.3:  
Minimum clear width of 36 inches.

4.3.7:  
Maximum cross slope of 2 % (1V:48H).

4.4:  
Prohibits protrusions along circulation paths from projecting more than 4 inches, if the leading edge is above 27 inches and below 80 inches. Also requires a minimum head clearance of 80 inches.

4.5.2:  
Changes in level up to ¼ inch vertical and without edge treatment. Changes in

Print Close

**ADA Viewer**

Identify Print Zoom In Zoom Out Pan Previous Extent Next Extent Full Extent Locate

**Legend**

**Curb Ramps**

- Ending
- No Ending
- Intersect

**Obstructions**

- Tree
- Structure
- Signpost

**Changes in Level (inches)**

- 0.25 - 0.50
- 0.51 - 0.75
- 0.76 - 1.00
- > 1.00

**Sidewalk Grade (percent)**

- 0 - 0.99
- 1 - 0.99
- 1 - 0.99
- 10 - 0.99
- Generally Inaccessible

**Sidewalk Cross Slope (percent)**

- 0 - 0.99
- 1 - 0.99
- 1 - 0.99
- 1 - 0.99
- 10% or more

**Layers**

**1 Features Selected**

Sidewalk Block Face 1

field	value
Chg in Lvl (num): 0.75 - 0.99 in	1
Chg in Lvl (num): 1 in. or more	
Cross Slope (ft): 10% or more	43
Cross Slope (ft): 2 - 4%	

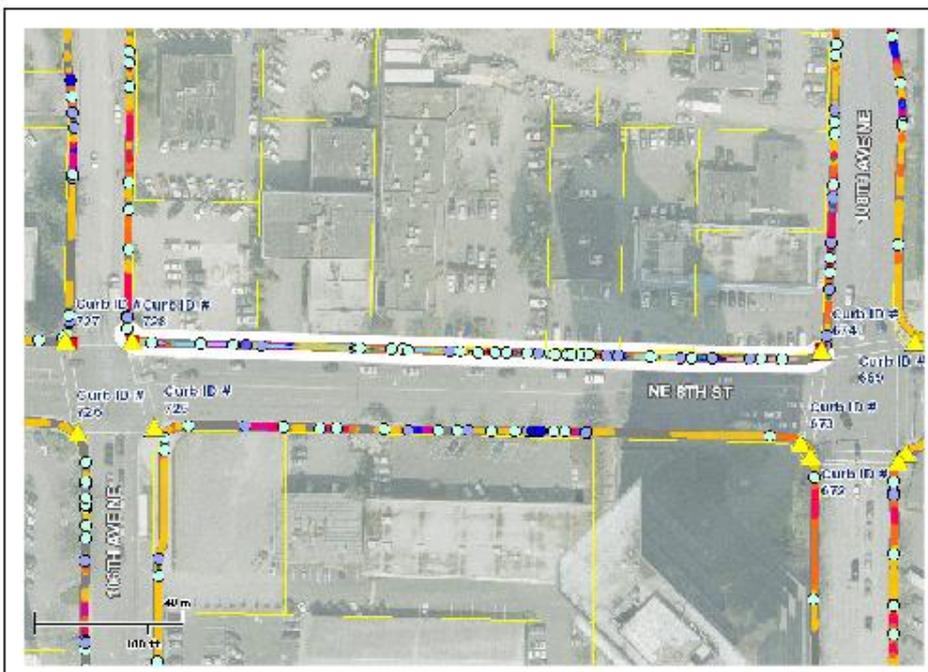
Double click for more help

**Changes in Level**

Changes in level are defined as vertical height transitions between adjacent surfaces or along the surface of a path. The Federal accessibility standards (ADAAG 4.5.2) permit changes in level less than 0.25 in high to be vertical but require changes in level between 0.25 in and 0.50 in to have a maximum bevel of 50 percent. A ramp is required for changes in level that exceed 0.50 in.



*Change in sidewalk level (2 inch) at 148th Avenue NE & NE 35th Street.*



**Block ID: 1035**

Priority Score: 170 : High

Length = 615 ft.

Cross Slope *Length (ft.)*

2-4%	214
4-6%	185
6-8%	54
8-10%	66
>=10%	43

Running Slope *Length (ft.)*

3 - 8.33%	364
8.34 - 10%	102
10.1 - 12.5%	20
>12.5%	12
Technically Infeasible	113

Changes in Level *number of*

0.25-0.50'	23
0.51-0.75'	12
0.76-1.00'	1
>1.00'	0

Obstructions *number of*

Fixed	1
Movable	0
Vegetation	0



**City of Bellevue: ADA Inventory**

**Block Face Report**

Print Date: 08/24/2010

This information on this map is a graphic representation derived from the City of Bellevue's geographic information system. The City of Bellevue does not guarantee the information on this map is accurate or complete. This map is provided as a "best effort" and should not be used for any legal or financial purposes. The City of Bellevue is not responsible for any errors or omissions on this map. Use of this map is at your own risk. Contact us with feedback or for a print order.

Print Close

### ADA Viewer

Identify Print Zoom In Zoom Out Pan Previous Extent Next Extent Full Extent Locate

**Legend**

**Curb Ramps**

- Existing (Yellow triangle)
- Not Existing (Grey triangle)

**Obstructions**

- Fixed (Red square)
- Movable (Orange circle)
- Vegetation (Green star)

**Changes in Level (inches)**

- 0.25 - 0.50 (Light blue circle)
- 0.51 - 0.75 (Medium blue circle)
- 0.76 - 1.00 (Dark blue circle)
- > 1.00 (Dark purple circle)

**Sidewalk Grade (percent)**

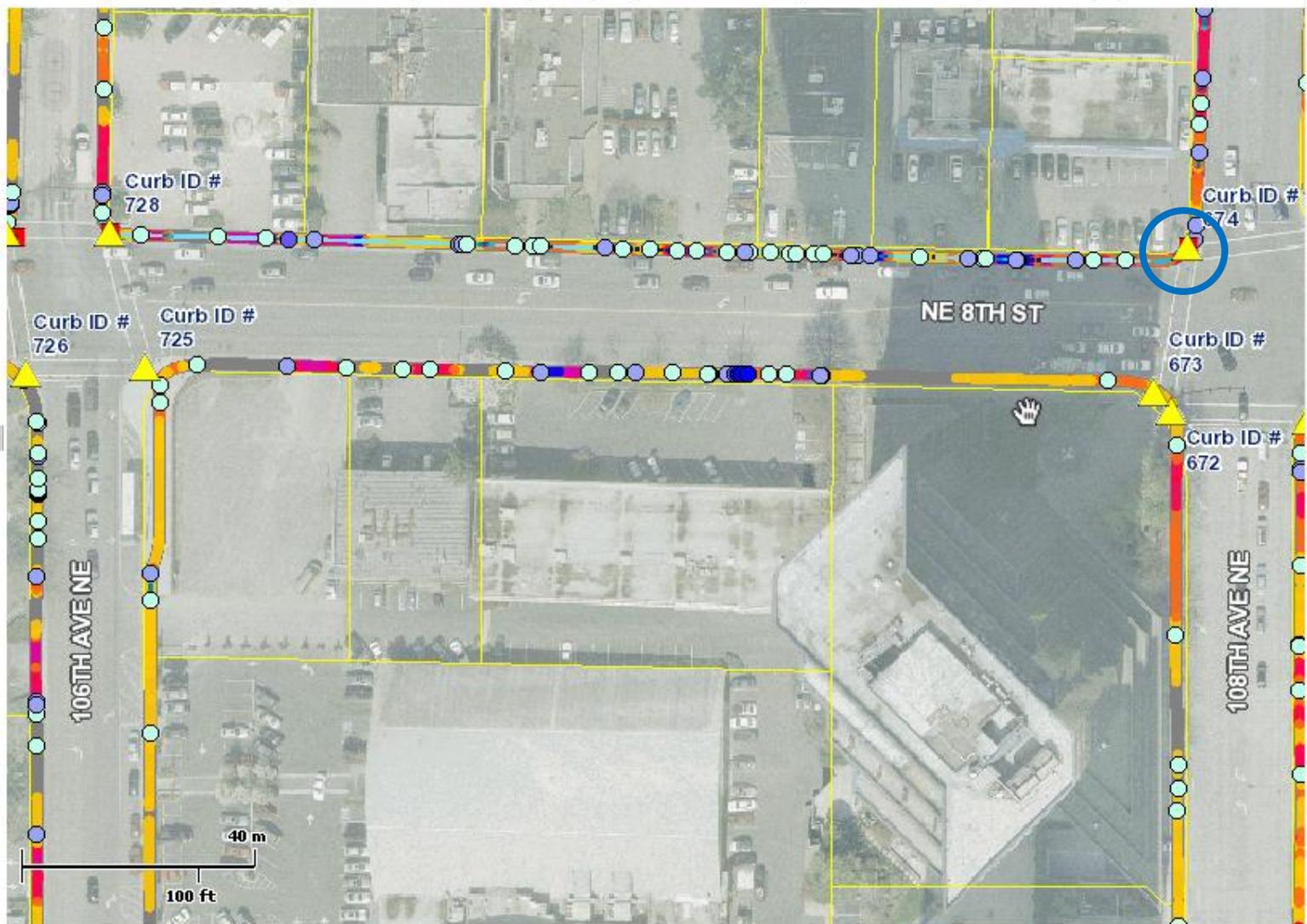
- 30 (5% - 8.33%) (Light blue line)
- 6 (9.34% - 10%) (Medium blue line)
- 3 (10.1% - 12.5%) (Dark blue line)
- 50 (> 12.5%) (Dark purple line)

--- Technically infeasible

**Sidewalk Cross Slope (percent)**

- 2 - 4% (Yellow line)
- 4 - 5% (Orange line)
- 6 - 8% (Red line)
- 8 - 10% (Dark red line)
- 10% or more (Purple line)

**Layers**



### ADA Viewer

**Legend**

**Curb Ramps**

- Curb Ramp
- Not Curb Ramp
- Islands

**Obstructions**

- Flare
- Staircase
- Vegetation

**Changes in Level (inches)**

- 0.25 - 0.50
- 0.51 - 0.75
- 0.76 - 1.00
- > 1.00

**Sidewalk Grade (percent)**

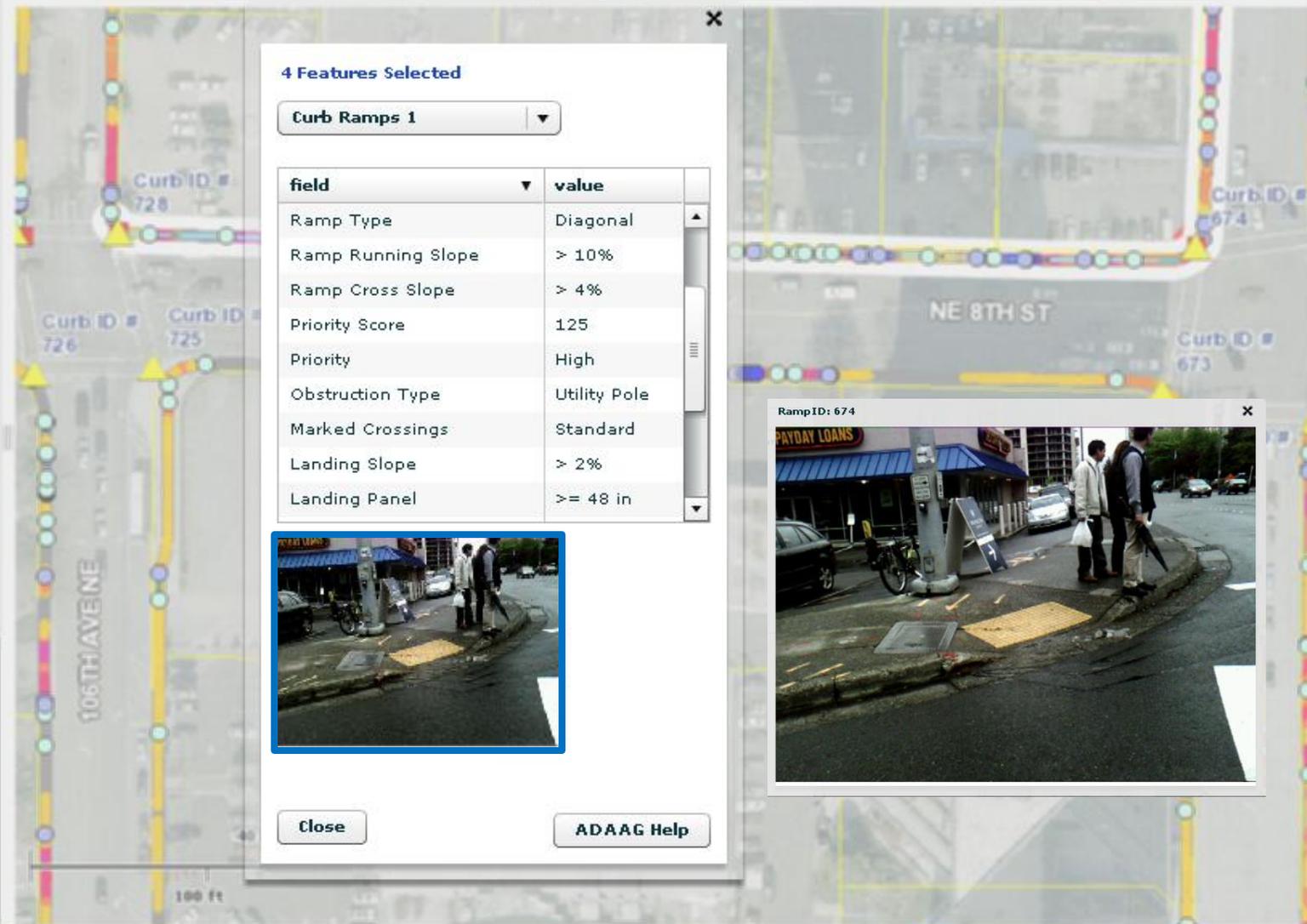
- 3% (0% - 6.49%)
- 6% (6.50% - 9.9%)
- 9% (9.91% - 13.3%)
- 12% (13.31% - 16.7%)
- 15% (16.71% - 20.1%)
- > 15%

**Sidewalk Cross Slope (percent)**

- 2 - 4%
- 4 - 6%
- 6 - 8%
- 8 - 12%
- 10% or more

**Layers**

Identify Print Zoom In Zoom Out Pan Previous Extent Next Extent Full Extent Locate



**4 Features Selected**

Curb Ramps 1

field	value
Ramp Type	Diagonal
Ramp Running Slope	> 10%
Ramp Cross Slope	> 4%
Priority Score	125
Priority	High
Obstruction Type	Utility Pole
Marked Crossings	Standard
Landing Slope	> 2%
Landing Panel	>= 48 in

Close ADAAG Help



**ADA Viewer**

Identify Print Zoom In Zoom Out Pan Previous Extent Next Extent Full Extent Locate

**Legend**

**Curb Ramps**

- Curb Ramp
- Flare
- Returned Curbs
- Path of Travel

**Obstructions**

- Flare
- Returned Curbs
- Path of Travel

**Changes in Level (inches)**

- 0.25 - 0.50
- 0.51 - 0.75
- 0.76 - 1.00
- > 1.00

**Sidewalk Grade (percent)**

- 2% (0% - 4.99%)
- 3% (5.00% - 9.99%)
- 4% (10.00% - 14.99%)
- 5% (15.00% - 19.99%)
- 6% (20.00% - 24.99%)
- 7% (25.00% - 29.99%)
- 8% (30.00% - 34.99%)
- 9% (35.00% - 39.99%)
- 10% (40.00% - 44.99%)
- 11% (45.00% - 49.99%)
- 12% (50.00% - 54.99%)
- 13% (55.00% - 59.99%)
- 14% (60.00% - 64.99%)
- 15% (65.00% - 69.99%)
- 16% (70.00% - 74.99%)
- 17% (75.00% - 79.99%)
- 18% (80.00% - 84.99%)
- 19% (85.00% - 89.99%)
- 20% (90.00% - 94.99%)
- 21% (95.00% - 99.99%)
- 22% (100.00% - 104.99%)
- 23% (105.00% - 109.99%)
- 24% (110.00% - 114.99%)
- 25% (115.00% - 119.99%)
- 26% (120.00% - 124.99%)
- 27% (125.00% - 129.99%)
- 28% (130.00% - 134.99%)
- 29% (135.00% - 139.99%)
- 30% (140.00% - 144.99%)
- 31% (145.00% - 149.99%)
- 32% (150.00% - 154.99%)
- 33% (155.00% - 159.99%)
- 34% (160.00% - 164.99%)
- 35% (165.00% - 169.99%)
- 36% (170.00% - 174.99%)
- 37% (175.00% - 179.99%)
- 38% (180.00% - 184.99%)
- 39% (185.00% - 189.99%)
- 40% (190.00% - 194.99%)
- 41% (195.00% - 199.99%)
- 42% (200.00% - 204.99%)
- 43% (205.00% - 209.99%)
- 44% (210.00% - 214.99%)
- 45% (215.00% - 219.99%)
- 46% (220.00% - 224.99%)
- 47% (225.00% - 229.99%)
- 48% (230.00% - 234.99%)
- 49% (235.00% - 239.99%)
- 50% (240.00% - 244.99%)
- 51% (245.00% - 249.99%)
- 52% (250.00% - 254.99%)
- 53% (255.00% - 259.99%)
- 54% (260.00% - 264.99%)
- 55% (265.00% - 269.99%)
- 56% (270.00% - 274.99%)
- 57% (275.00% - 279.99%)
- 58% (280.00% - 284.99%)
- 59% (285.00% - 289.99%)
- 60% (290.00% - 294.99%)
- 61% (295.00% - 299.99%)
- 62% (300.00% - 304.99%)
- 63% (305.00% - 309.99%)
- 64% (310.00% - 314.99%)
- 65% (315.00% - 319.99%)
- 66% (320.00% - 324.99%)
- 67% (325.00% - 329.99%)
- 68% (330.00% - 334.99%)
- 69% (335.00% - 339.99%)
- 70% (340.00% - 344.99%)
- 71% (345.00% - 349.99%)
- 72% (350.00% - 354.99%)
- 73% (355.00% - 359.99%)
- 74% (360.00% - 364.99%)
- 75% (365.00% - 369.99%)
- 76% (370.00% - 374.99%)
- 77% (375.00% - 379.99%)
- 78% (380.00% - 384.99%)
- 79% (385.00% - 389.99%)
- 80% (390.00% - 394.99%)
- 81% (395.00% - 399.99%)
- 82% (400.00% - 404.99%)
- 83% (405.00% - 409.99%)
- 84% (410.00% - 414.99%)
- 85% (415.00% - 419.99%)
- 86% (420.00% - 424.99%)
- 87% (425.00% - 429.99%)
- 88% (430.00% - 434.99%)
- 89% (435.00% - 439.99%)
- 90% (440.00% - 444.99%)
- 91% (445.00% - 449.99%)
- 92% (450.00% - 454.99%)
- 93% (455.00% - 459.99%)
- 94% (460.00% - 464.99%)
- 95% (465.00% - 469.99%)
- 96% (470.00% - 474.99%)
- 97% (475.00% - 479.99%)
- 98% (480.00% - 484.99%)
- 99% (485.00% - 489.99%)
- 100% (490.00% - 494.99%)
- 101% (495.00% - 499.99%)
- 102% (500.00% - 504.99%)
- 103% (505.00% - 509.99%)
- 104% (510.00% - 514.99%)
- 105% (515.00% - 519.99%)
- 106% (520.00% - 524.99%)
- 107% (525.00% - 529.99%)
- 108% (530.00% - 534.99%)
- 109% (535.00% - 539.99%)
- 110% (540.00% - 544.99%)
- 111% (545.00% - 549.99%)
- 112% (550.00% - 554.99%)
- 113% (555.00% - 559.99%)
- 114% (560.00% - 564.99%)
- 115% (565.00% - 569.99%)
- 116% (570.00% - 574.99%)
- 117% (575.00% - 579.99%)
- 118% (580.00% - 584.99%)
- 119% (585.00% - 589.99%)
- 120% (590.00% - 594.99%)
- 121% (595.00% - 599.99%)
- 122% (600.00% - 604.99%)
- 123% (605.00% - 609.99%)
- 124% (610.00% - 614.99%)
- 125% (615.00% - 619.99%)
- 126% (620.00% - 624.99%)
- 127% (625.00% - 629.99%)
- 128% (630.00% - 634.99%)
- 129% (635.00% - 639.99%)
- 130% (640.00% - 644.99%)
- 131% (645.00% - 649.99%)
- 132% (650.00% - 654.99%)
- 133% (655.00% - 659.99%)
- 134% (660.00% - 664.99%)
- 135% (665.00% - 669.99%)
- 136% (670.00% - 674.99%)
- 137% (675.00% - 679.99%)
- 138% (680.00% - 684.99%)
- 139% (685.00% - 689.99%)
- 140% (690.00% - 694.99%)
- 141% (695.00% - 699.99%)
- 142% (700.00% - 704.99%)
- 143% (705.00% - 709.99%)
- 144% (710.00% - 714.99%)
- 145% (715.00% - 719.99%)
- 146% (720.00% - 724.99%)
- 147% (725.00% - 729.99%)
- 148% (730.00% - 734.99%)
- 149% (735.00% - 739.99%)
- 150% (740.00% - 744.99%)
- 151% (745.00% - 749.99%)
- 152% (750.00% - 754.99%)
- 153% (755.00% - 759.99%)
- 154% (760.00% - 764.99%)
- 155% (765.00% - 769.99%)
- 156% (770.00% - 774.99%)
- 157% (775.00% - 779.99%)
- 158% (780.00% - 784.99%)
- 159% (785.00% - 789.99%)
- 160% (790.00% - 794.99%)
- 161% (795.00% - 799.99%)
- 162% (800.00% - 804.99%)
- 163% (805.00% - 809.99%)
- 164% (810.00% - 814.99%)
- 165% (815.00% - 819.99%)
- 166% (820.00% - 824.99%)
- 167% (825.00% - 829.99%)
- 168% (830.00% - 834.99%)
- 169% (835.00% - 839.99%)
- 170% (840.00% - 844.99%)
- 171% (845.00% - 849.99%)
- 172% (850.00% - 854.99%)
- 173% (855.00% - 859.99%)
- 174% (860.00% - 864.99%)
- 175% (865.00% - 869.99%)
- 176% (870.00% - 874.99%)
- 177% (875.00% - 879.99%)
- 178% (880.00% - 884.99%)
- 179% (885.00% - 889.99%)
- 180% (890.00% - 894.99%)
- 181% (895.00% - 899.99%)
- 182% (900.00% - 904.99%)
- 183% (905.00% - 909.99%)
- 184% (910.00% - 914.99%)
- 185% (915.00% - 919.99%)
- 186% (920.00% - 924.99%)
- 187% (925.00% - 929.99%)
- 188% (930.00% - 934.99%)
- 189% (935.00% - 939.99%)
- 190% (940.00% - 944.99%)
- 191% (945.00% - 949.99%)
- 192% (950.00% - 954.99%)
- 193% (955.00% - 959.99%)
- 194% (960.00% - 964.99%)
- 195% (965.00% - 969.99%)
- 196% (970.00% - 974.99%)
- 197% (975.00% - 979.99%)
- 198% (980.00% - 984.99%)
- 199% (985.00% - 989.99%)
- 200% (990.00% - 994.99%)
- 201% (995.00% - 999.99%)

**Sidewalk Cross Slope (percent)**

- 2 - 4%
- 4 - 5%
- 5 - 6%
- 6 - 7%
- 7 - 8%
- 8 - 9%
- 9 - 10%
- 10% or more

**Layers**

106TH AVE NE

Curb ID # 728

Curb ID # 726

Curb ID # 725

100 ft

**4 Features Selected**

Curb Ramps 1

field	value
Ramp Type	Diagonal
Ramp Running Slope	> 10%
Ramp Cross Slope	> 4%
Priority Score	125
Priority	High
Obstruction Type	Utility Pole
Marked Crossings	Standard
Landing Slope	> 2%
Landing Panel	>= 48 in

Double Click for images

Close ADAAG Help

**Diagonal Ramps**

- Ramp
- Landing Panel
- Flare
- Curb
- Gutter
- Crosswalk
- Detectable Warning
- Path of Travel

Location: NE 24th and 164th NE

**Directional Ramps**

- Ramp
- Landing Panel
- Returned Curbs
- Curb
- Gutter
- Crosswalk
- Detectable Warning
- Path of Travel

Location: NE 24th and 167th NE

**Island / Median Ramps**

- Ramp
- Landing Panel
- Returned Curbs
- Curb
- Gutter
- Crosswalk
- Detectable Warning
- Path of Travel

Location: NE 164th and 24th NE

**Parallel Ramps**

- Ramp
- Landing Panel
- Returned Curbs
- Curb
- Gutter
- Crosswalk
- Detectable Warning
- Path of Travel

Location: 164th NE and NE 24th

**Perpendicular Ramps**

- Ramp
- Landing Panel
- Flare
- Curb
- Gutter
- Crosswalk
- Detectable Warning
- Path of Travel

Location: NE 24th and 164th NE

Done Local intranet 100%

### ADA Viewer

**Legend**

**Curb Ramps**

- Cycling
- Not Cycling
- Islands

**Obstructions**

- Fixed
- Slippable
- Vegetation

**Changes in Level (inches)**

- 0.25 - 0.50
- 0.51 - 0.75
- 0.76 - 1.00
- > 1.00

**Sidewalk Grade (percent)**

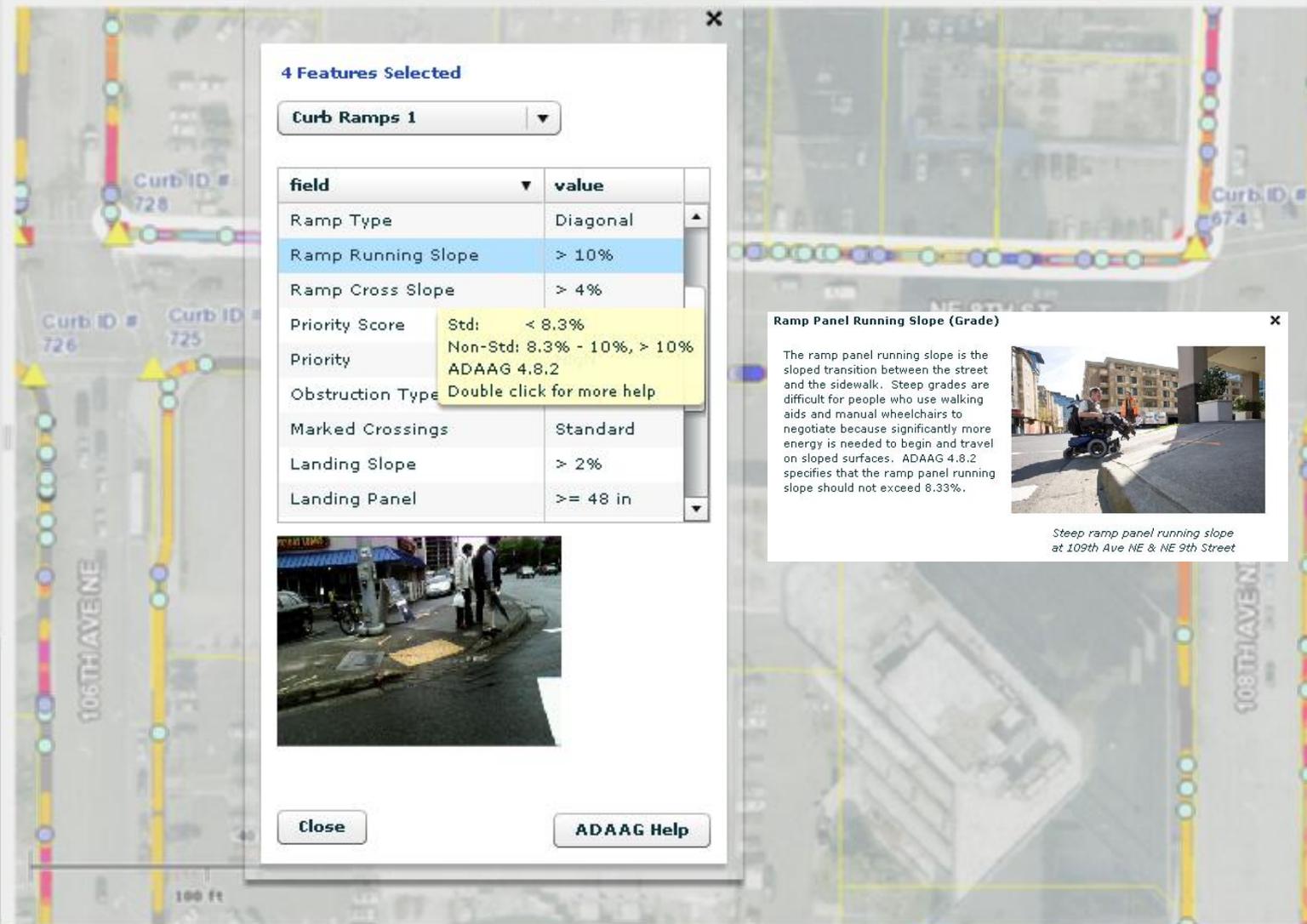
- 36 (0% - 4.24%)
- 6 (4.24% - 8.33%)
- 3 (> 8.33% - 12.5%)
- 50 (> 12.5%)
- Generally Inaccessible

**Sidewalk Cross Slope (percent)**

- 2 - 4%
- 4 - 5%
- 6 - 8%
- 8 - 12%
- 10% or more

**Layers**

Identify Print Zoom In Zoom Out Pan Previous Extent Next Extent Full Extent Locate



**4 Features Selected**

Curb Ramps 1

field	value
Ramp Type	Diagonal
Ramp Running Slope	> 10%
Ramp Cross Slope	> 4%
Priority Score	Std: < 8.33% Non-Std: 8.33% - 10%, > 10% ADAAG 4.8.2
Obstruction Type	Double click for more help
Marked Crossings	Standard
Landing Slope	> 2%
Landing Panel	>= 48 in

Close ADAAG Help

**Ramp Panel Running Slope (Grade)**

The ramp panel running slope is the sloped transition between the street and the sidewalk. Steep grades are difficult for people who use walking aids and manual wheelchairs to negotiate because significantly more energy is needed to begin and travel on sloped surfaces. ADAAG 4.8.2 specifies that the ramp panel running slope should not exceed 8.33%.

*Steep ramp panel running slope at 109th Ave NE & NE 9th Street*

**ADA Viewer**

Identify Print Zoom In Zoom Out Pan Previous Extent Next Extent Full Extent Locate

**Legend**

**Curb Ramps**

- Cycling
- Not Cycling
- Islands

**Obstructions**

- Fixed
- Removable
- Vegetation

**Changes in Level (inches)**

- 0.25 - 0.50
- 0.51 - 0.75
- 0.76 - 1.00
- > 1.00

**Sidewalk Grade (percent)**

- 36 (0% - 4.47%)
- 6 (0.24% - 0.2%)
- 3 (1.1% - 0.15%)
- 00 (> 0.1%)
- Notoriously Inaccessible

**Sidewalk Cross Slope (percent)**

- 2 - 4%
- 4 - 2%
- 1 - 0%
- 0 - 12%
- 10% or more

**Layers**

**4 Features Selected**

Curb Ramps 1

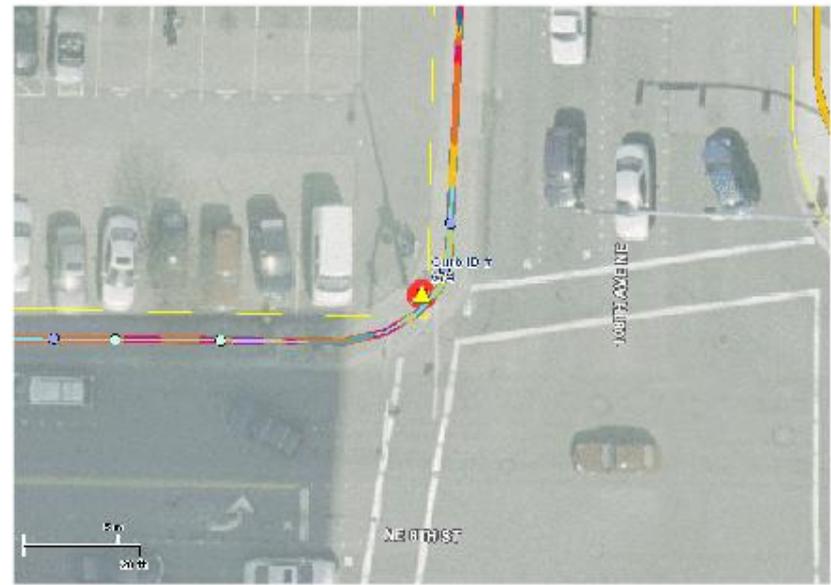
field	value
Ramp Type	Diagonal
Ramp Running Slope	> 10%
Ramp Cross Slope	> 4%
Priority Score	125
Priority	Std: < 2% Non-Std: 2%-4%, > 4%
Obstruction Type	ADAAG 4.8.6
Marked Crossing	Double click for more help
Landing Slope	> 2%
Landing Panel	>= 48 in

Close ADAAG Help

**Ramp Panel Cross Slope**

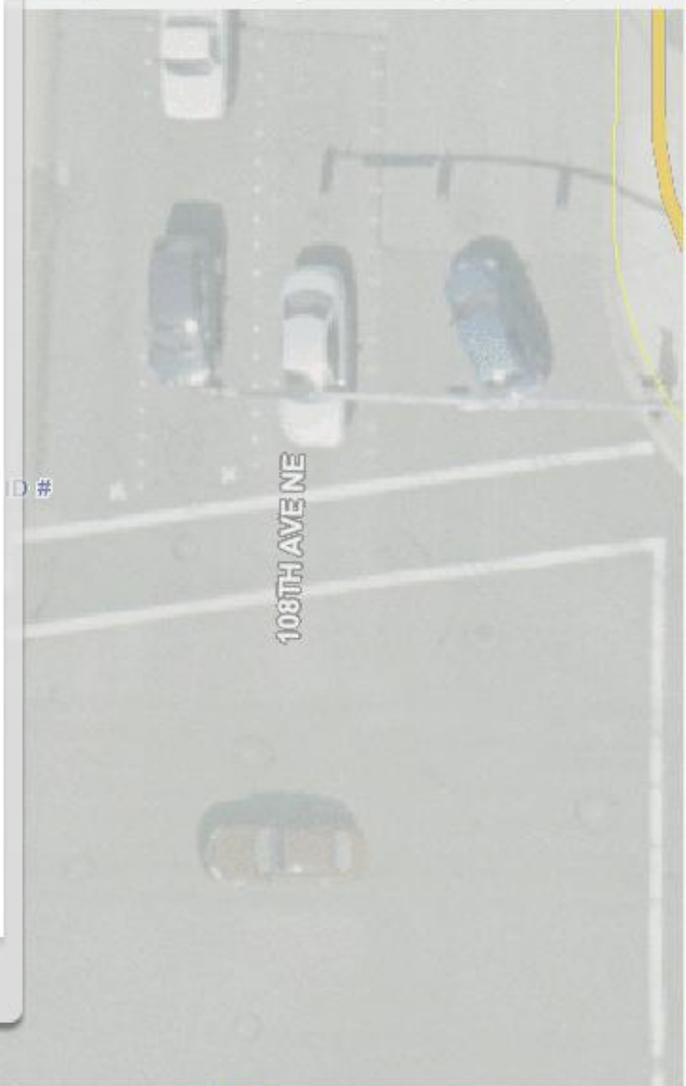
A curb ramp allows people who use wheelchairs and other wheeled devices to negotiate the elevation change between the roadway and the sidewalk without having to negotiate the curb. People with mobility impairments often have difficulty negotiating a grade and cross slope simultaneously. Since the grade of the ramp will be significant, the cross slope should be minimized. ADAAG 4.8.6 specifies that ramp panel cross slopes should not exceed 2%.

*Steep ramp panel cross-slope at 128th Ave SE & SE 32nd Street.*



**Ramp ID: 674**  
Priority Score: 125 : High

Field	Value
Clear Space	Non-Standard
Comments	
Rares	> 12%
Gutter Cross Slope	> 2%
Gutter Running Slope	> 5%
Landing Panel	>= 48 in
Landing Slope	> 2%
Marked Crossings	Standard
Obstruction Type	Utility Pole
Ramp Cross Slope	> 4%
Ramp Running Slope	> 10%
Ramp Type	Diagonal
Ramp Width	36-47 in
Return Curbs	None
Transition	Non-Standard
Warnings	Standard



**ADA Inventory**

**Curb Ramp Report**

Print Date: 08/24/2009

The information on this map is a geographic information system (GIS) database of information regarding the location and condition of curb ramps in the City of Vancouver. This information is derived from a variety of sources, including but not limited to: street view imagery, aerial photography, and field observations. The information is provided as a service to the public and is not intended to be used for legal purposes. The City of Vancouver is not responsible for any damages resulting from the use of this information. For additional information, please contact the City of Vancouver at 604-273-8888.

Print Close

# **Barrier Ranking Analysis**

# Compliance vs. Accessibility

ADA tells us which features are non-standard ...



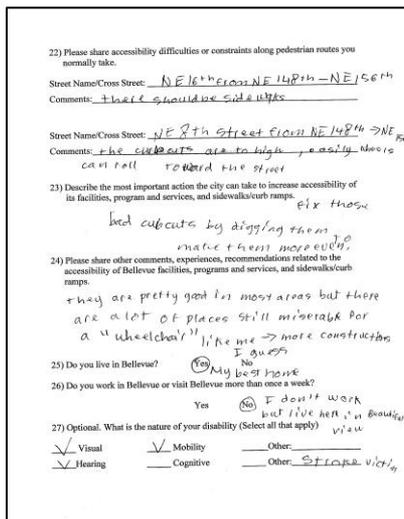
... But it doesn't tell us which of these non-standard features should be replaced first.

# Community Outreach Requirements

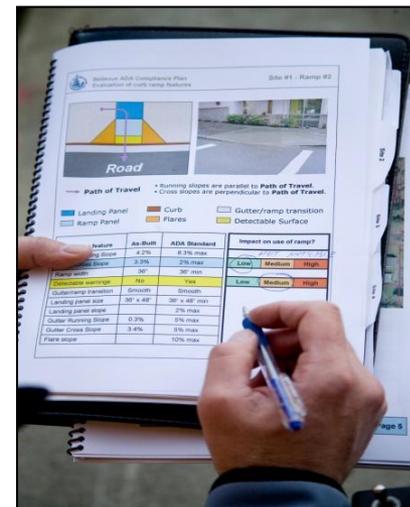
- Provide opportunity to interested persons and groups to participate in self-evaluation leading to transition plan. 28 C.F.R. 35.105(b).
- Make self-evaluation and plan available for public inspection. Specific time frames and information required. 28 C.F.R. 35.105(c).



Poster at Open House



Mail-Back Survey



Curb Ramp Assessments

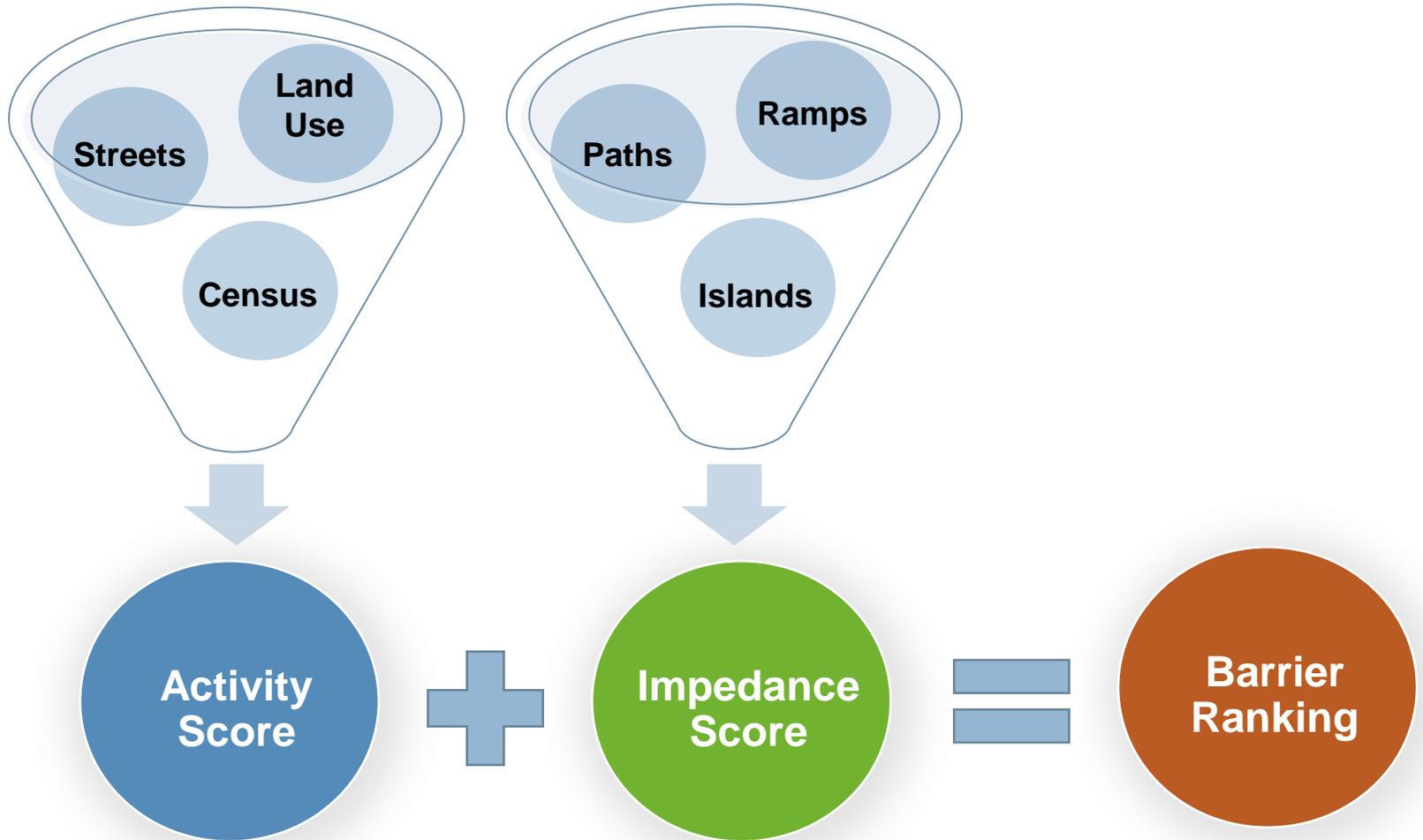
# Accessibility Evaluations

## Bellevue Approach:

- Accessibility evaluations in the field with Bellevue residents who are Access para-transit customers.
- For each ramp, participants filled out an evaluation form.
- Assessed in a general fashion the impact of each curb ramp feature (panel size, ramp cross slope, etc) on accessibility.



# Barrier Ranking Analysis



# GIS-Based Prioritization Tool

Allows users to adjust the weights for each criteria and run the analysis iteratively for validation purposes.

Criteria	Weight
Ratings Values Factor	1
Fixed Obstruction Weight	20
Heaving: .25" - .5"	1
Heaving: .5" - .75"	2
Heaving: .75" - 1"	3
Heaving: 1" or greater	6
Grade: GE 5% and LE 8.33%	2
Grade: GT 8.33% and LE 10%	4
Grade: GT 10% and LE 12.5%	7
Grade: GT 12.5%	14
X Slope: GT 2% and LE 4%	2
X Slope: GT 4% and LE 6%	4
X Slope: GT 6% and LE 8%	8

**ADA Sidewalk Barriers Assessment**

This tool is designed to allow users to run sidewalk prioritization analysis using different weighting criteria, and thus iteratively validating the model. Any weight can be adjusted, however, the sum of all weights must equal 100%. Also, users can adjust the maximum points allocated for all criteria.

OK Cancel Environments... << Hide Help Tool Help

NE 10 ST

NE  
9 ST

NE 8 ST

104 AVE NE

NE 6 ST

106 AVE NE

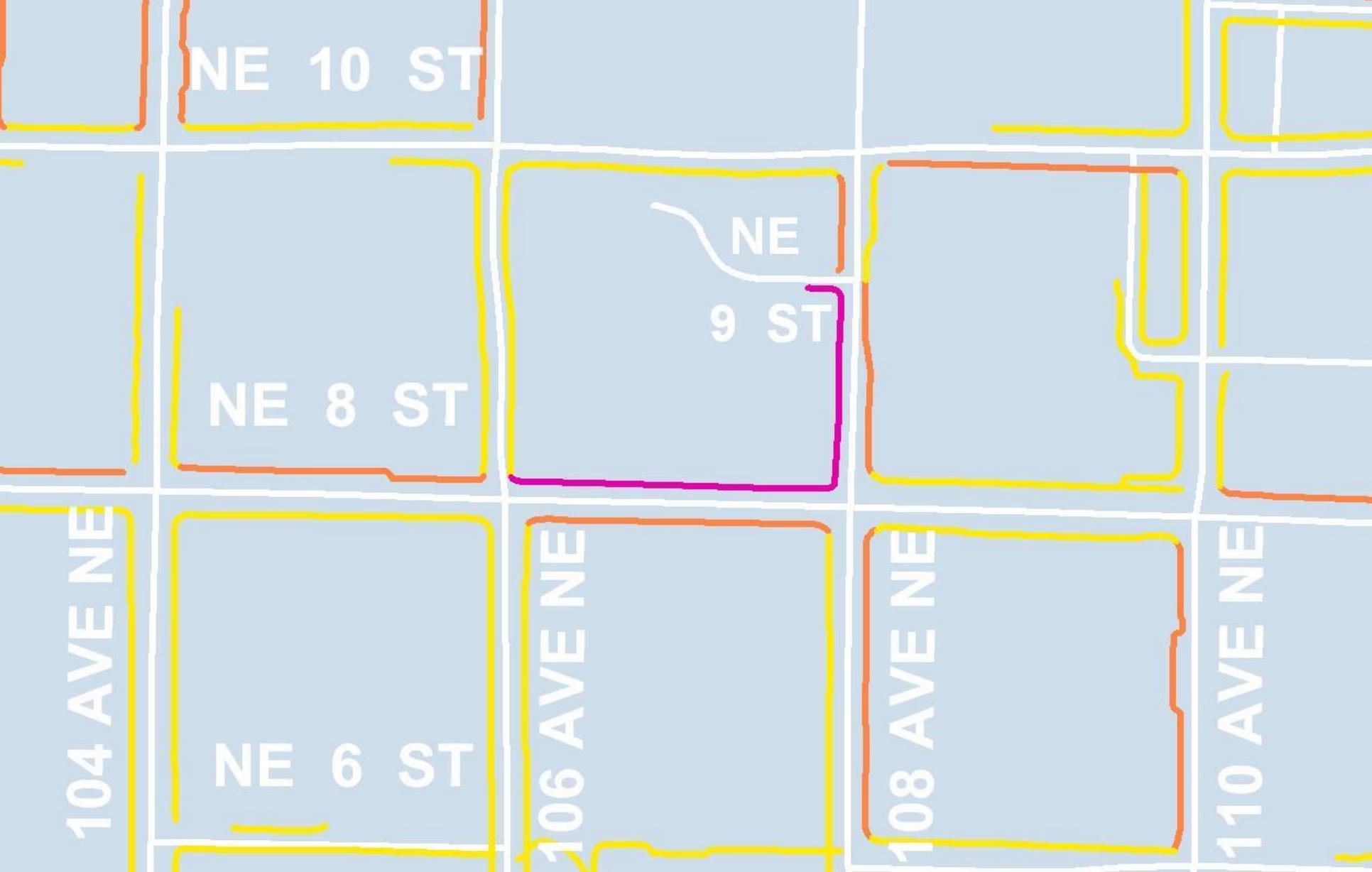
108 AVE NE

110 AVE NE

# *Activity Score*

## Legend

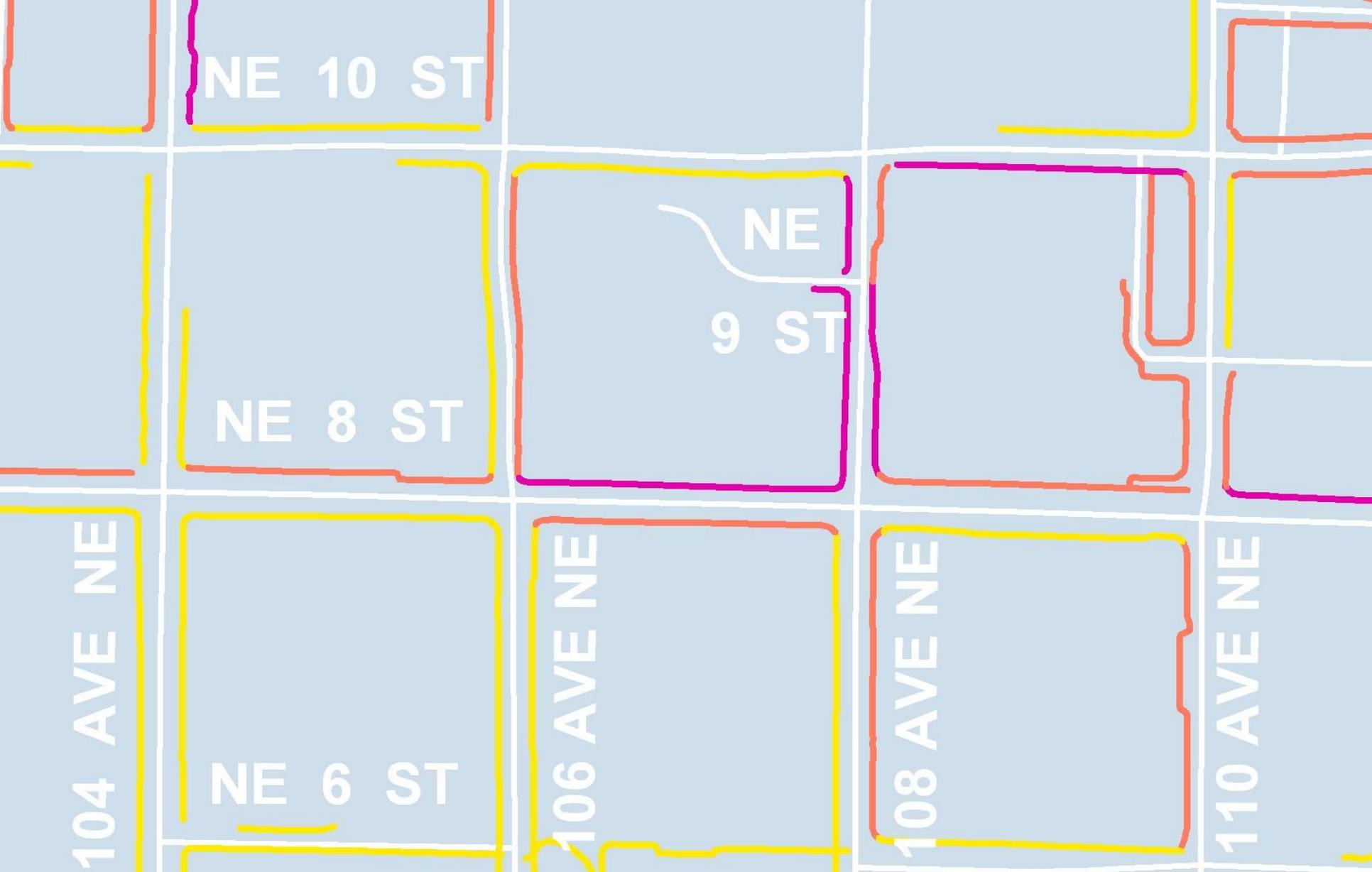




# ***Impedance Score***

## Legend

- High Priority
- Medium Priority
- Low Priority



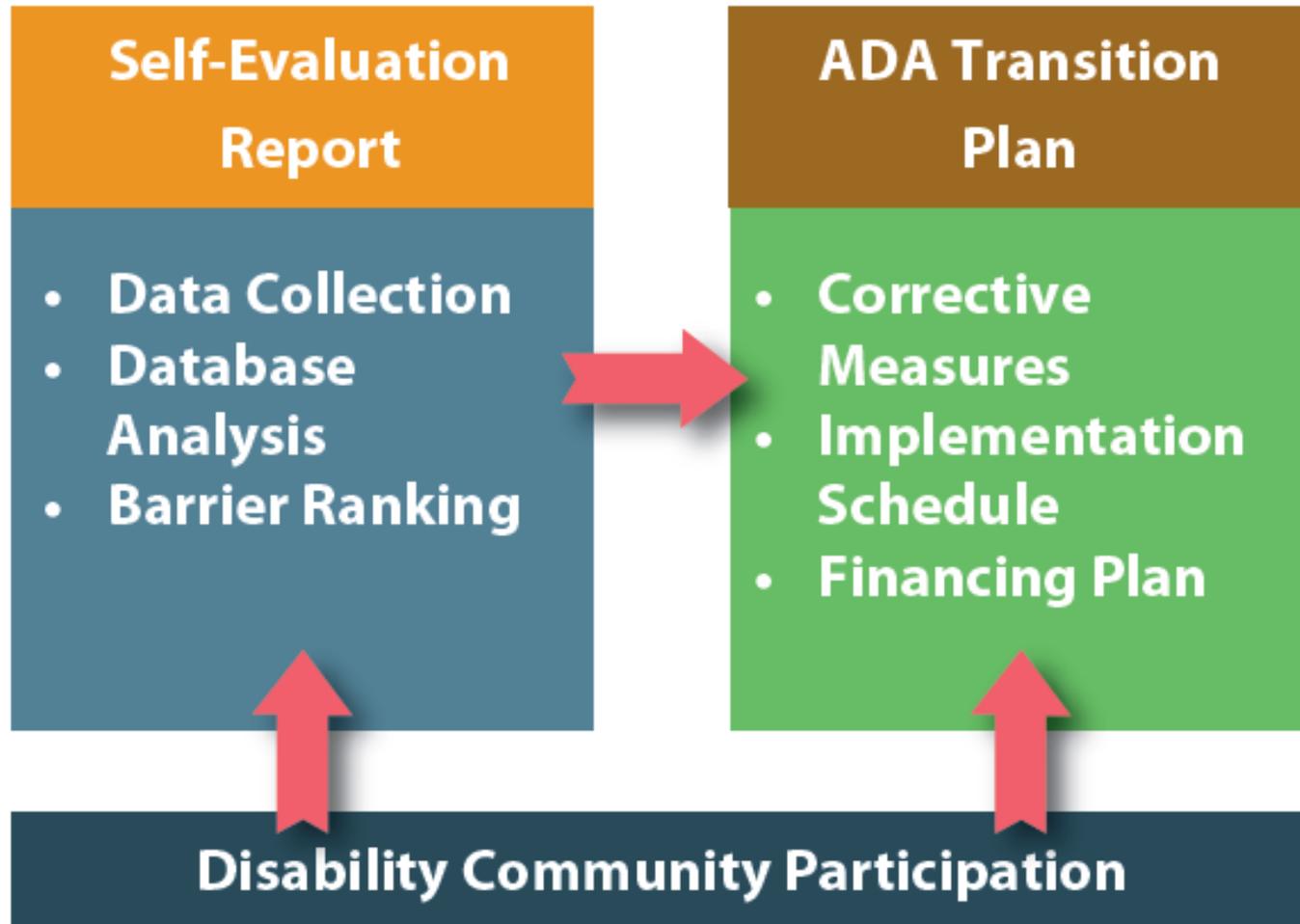
# ***Final Score***

## Legend

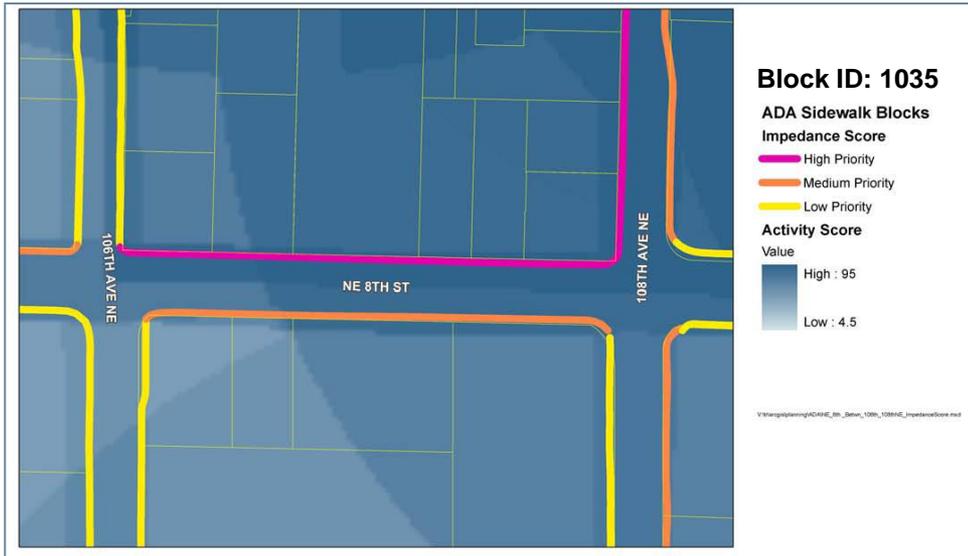
- High Priority
- Medium Priority
- Low Priority

# **Programming of Asset Improvements**

# Implementation Schedule



# NE 8<sup>th</sup> Street Widening Project



- Summer 2009 - A new sidewalk and curb ramps were built next to the new westbound lane.
- Project enhanced pedestrian facilities by removing fixed obstructions and improving sidewalk surface conditions (both changes in level and slope variations).
- Addressed barriers to accessibility in a downtown Bellevue location that has high volumes of pedestrian usage.



# Corrective Measures



With proper pruning, two persons can comfortably and safely use the whole sidewalk.

**Keep it Neighborly  
CLEAR THE WALKWAY!**

In our northwest climate, trees and shrubs grow quickly. Overgrown plants and low hanging branches can lead to head and eye injuries, or can force pedestrians to sidestep into oncoming traffic. To improve the safety of your sidewalk, be sure to:

- ◆ Prune trees to a seven foot vertical clearance.
- ◆ Prune one foot back from the edge of the sidewalk. The extra space allows your neighbors to use all of the sidewalk space more effectively and safely.
- ◆ Sweep away fallen leaves and other debris.
- ◆ Trim vegetation obstructing driveways or intersections to increase visibility of pedestrians and street signs.

Be neighborly - keep your sidewalk clear (BCC 14.06.010).

For more information, call the City of Bellevue Transportation Department at (425) 452-6856.

For technical information on how to properly prune, contact Bellevue's Parks and Community Services Department, Resource Management Division at (425) 452-6855.

12/2010/00101



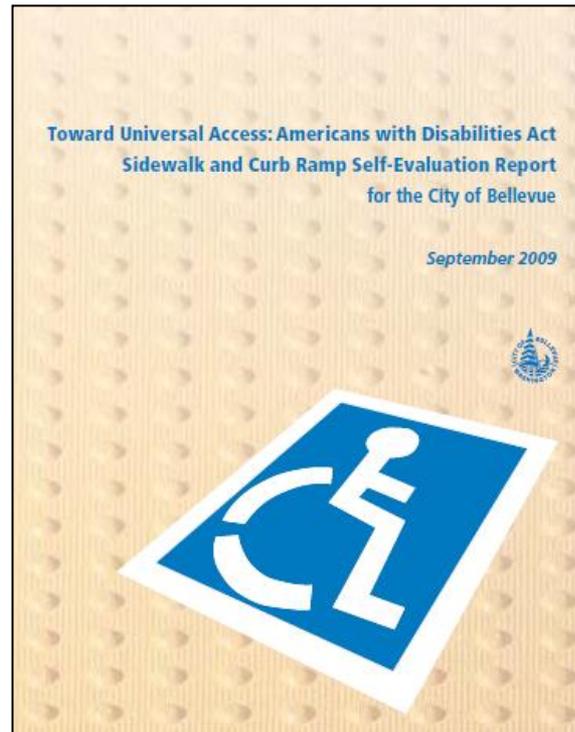
# Curb Ramp Improvements



**From 2007 through 2009, Bellevue will have spent more than \$2 million to upgrade nearly 300 curb ramps citywide.**

# For More Information

The ADA Sidewalk and Curb Ramp Self-Evaluation Report is located at: <http://www.bellevuewa.gov/accessibility-reports.htm>



The project manager, Franz Loewenherz, can be reached at 425-452-4077 or [FLoewenherz@bellevuewa.gov](mailto:FLoewenherz@bellevuewa.gov)