Designing for Older Road Users

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November 20, 2014

Today's Presentation

- **Introduction and housekeeping**
- **Audio issues?**
  Dial into the phone line instead of using "mic & speakers"
- **PBIC Trainings and Webinars**
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- **Questions at the end**

Thank You!

- **Archive at www.pedbikeinfo.org/webinars**
  - Downloadable/streaming recording and presentation slides
- **Questions?**
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  - **Gene Amparano | Gene.Amparano@dot.gov**
  - **Jesse Mintz-Roth | JMintz-Roth@dot.nyc.gov**
  - **General Inquiries | webinars@hsrc.unc.edu**

FHWA Older Road Users Program

- The Office of Safety is committed to providing a safe environment for older road users, including drivers, pedestrians, bicyclists and motorcyclists.

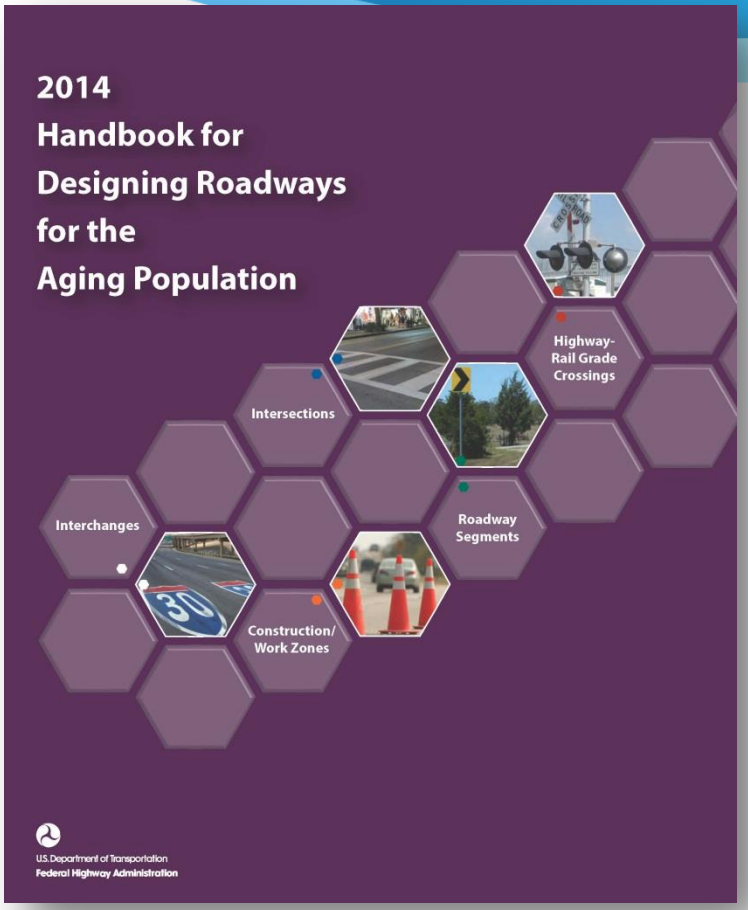
- The Office of Safety's Older Road User program addresses the engineering aspects of highway safety.

Engineering Guidance

Handbook for Designing Roadways for the Aging Population

This 2001 handbook was written for highway designers, engineers, and highway safety specialists. The handbook provides guidance on how to accommodate the declining functional capabilities of the older road users with effective road design practices and engineering enhancements.

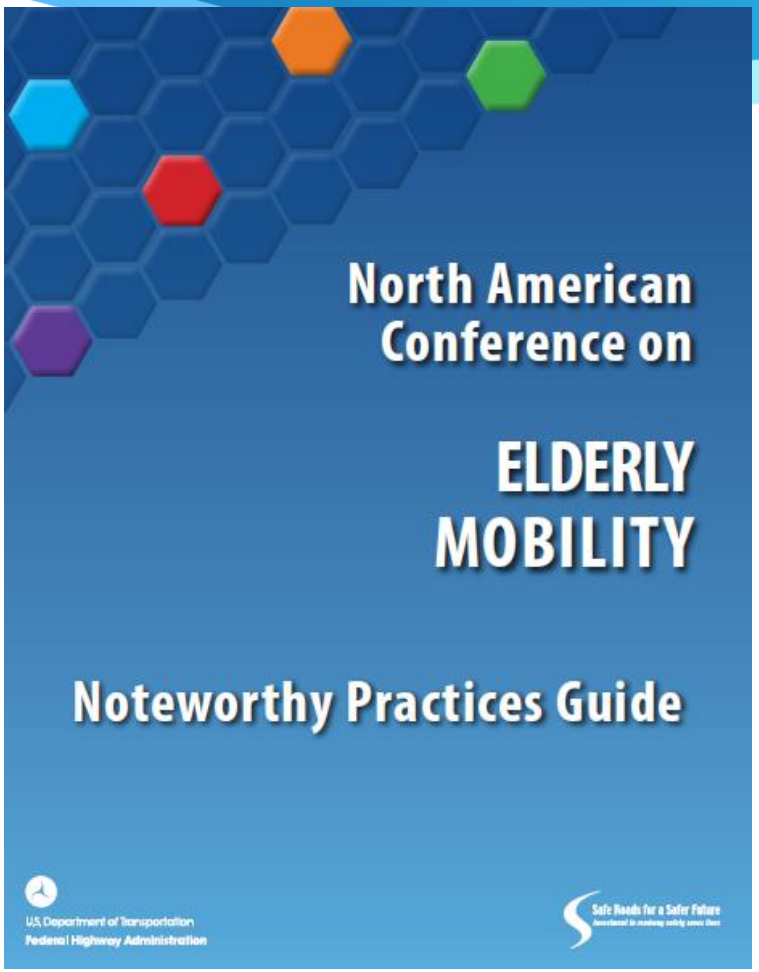
FHWA Pub. No. FHWA-SA-14-015



NACEM: Noteworthy Practices Guide

- North American Conference on Elderly Mobility (NACEM), May 11-14, 2014

- Showcases national and international practices presented at the NACEM.



Older Drivers and Pedestrians Special Rule

MAP-21 Section 1112(a):

23 U.S.C. 148 (g) “Special RULES.-(2) Older drivers.--If traffic fatalities and serious injuries per capita for drivers and pedestrians over the age of 65 in a State increases during the most recent 2-year period…State shall be required to include… strategies to address the increases...

Training

- FHWA offers a 1-day workshop to review the treatments contained in the Handbook for Designing Roadways for the Aging Population.

- The workshop is designed for engineers responsible for highway design and operations.

Aging Road User Clearinghouse

- Produce, collect, organize, and disseminate information related to aging road users.

- Provide research, case studies, best practices, and evaluation tools in the areas of public safety research and technology transfer activities.

Roadway Safety FOUNDATION

COMING SOON!!!!

Contact Information

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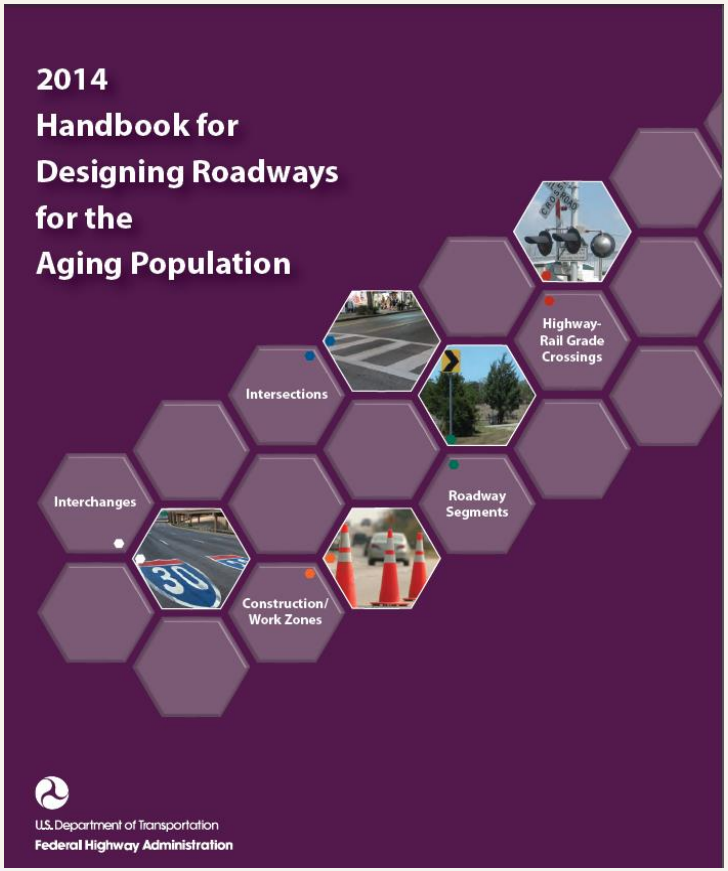
2014 FHWA Older Driver Handbook

Handbook for Designing Roadways for the Aging Population



Aging Road User Webinar

November 20, 2014

Primary Handbook Questions:

What is it?

Why is it needed?

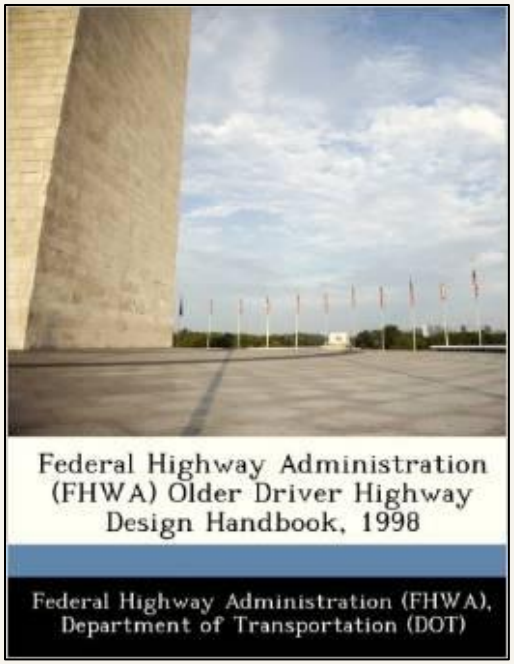
What is in it?

- **Brief Overview**

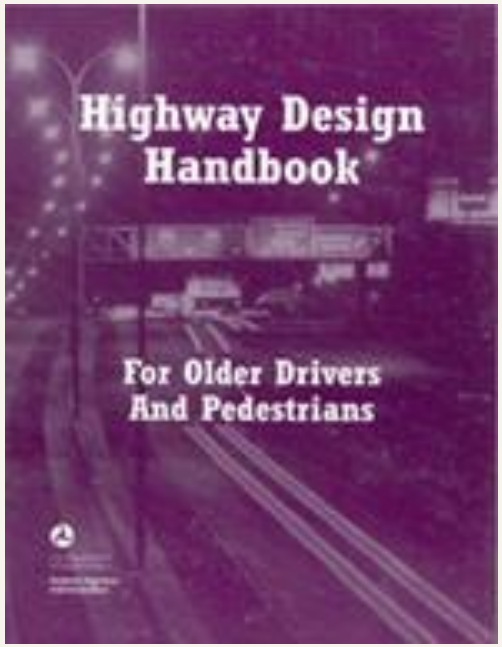
How and Where should it be used?

What is the Handbook?

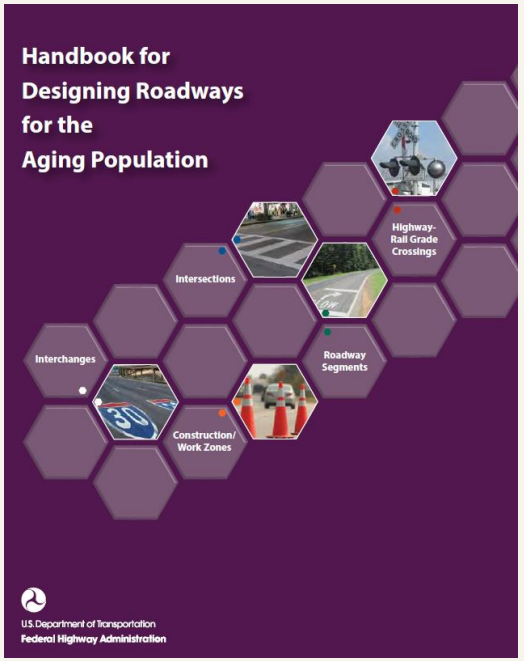
1998
1st Edition



2001
2nd Edition



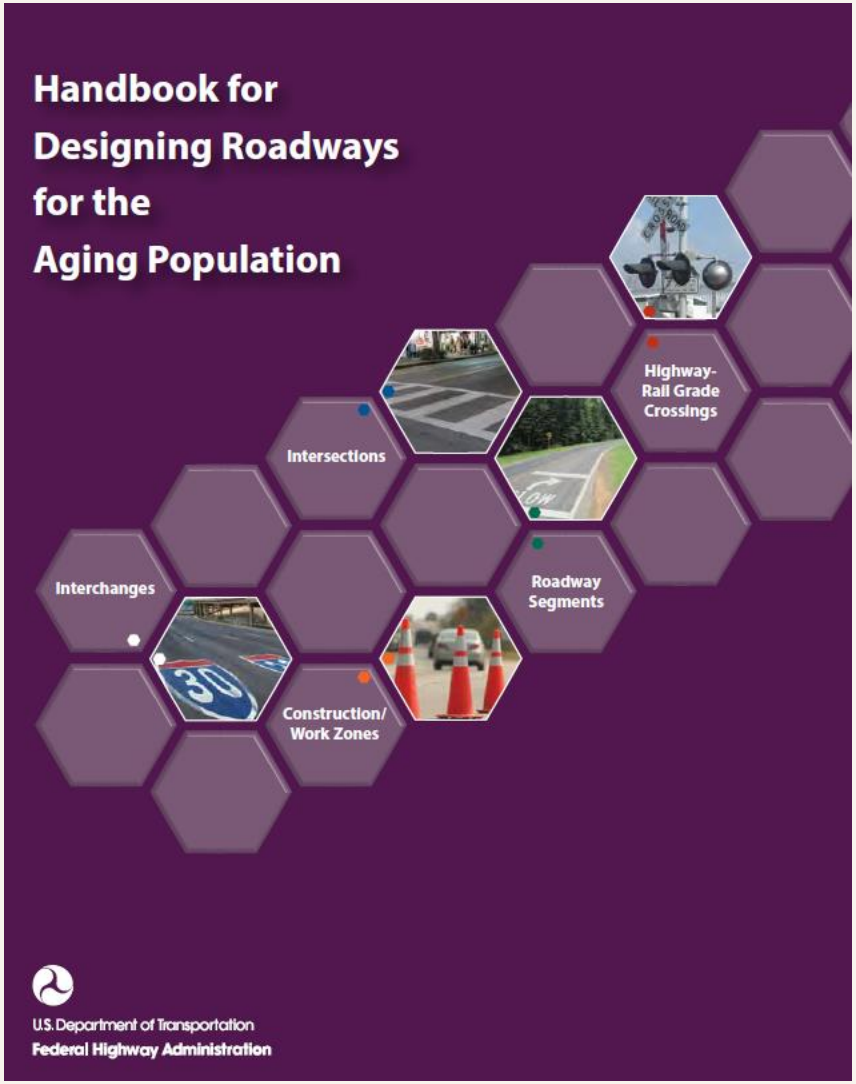
2014
3rd Edition



Note: There is a title change for the new 3rd edition

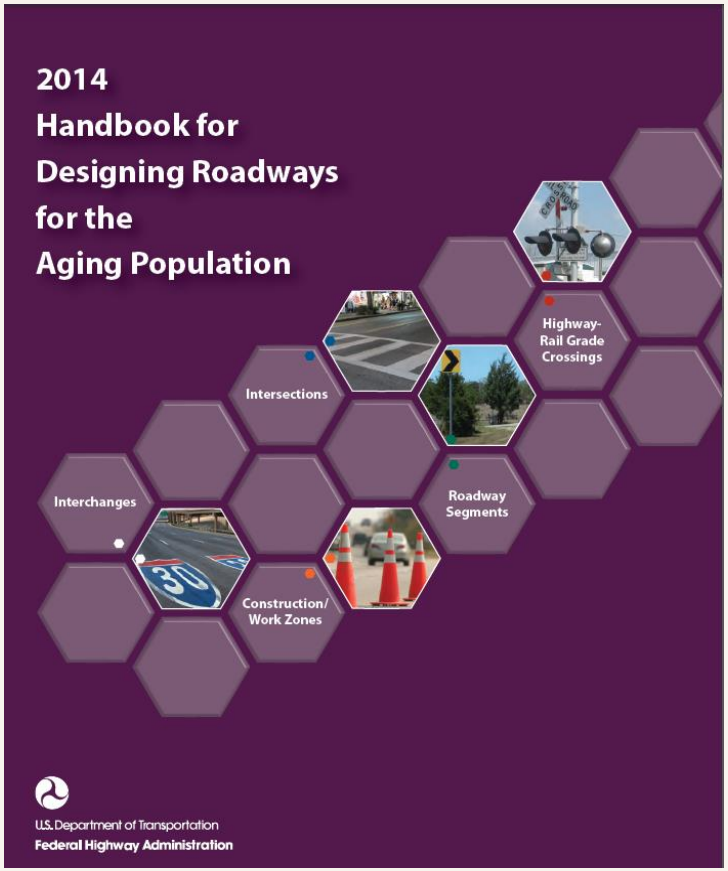
http://safety.fhwa.dot.gov/older_users/

What is the Handbook?



- Provides information linking aging road user performance to highway design, operations, and traffic engineering
- Inclusion of newer research
- Two Parts I & II
- Supplements existing guidelines

What is the Handbook?



Changes?

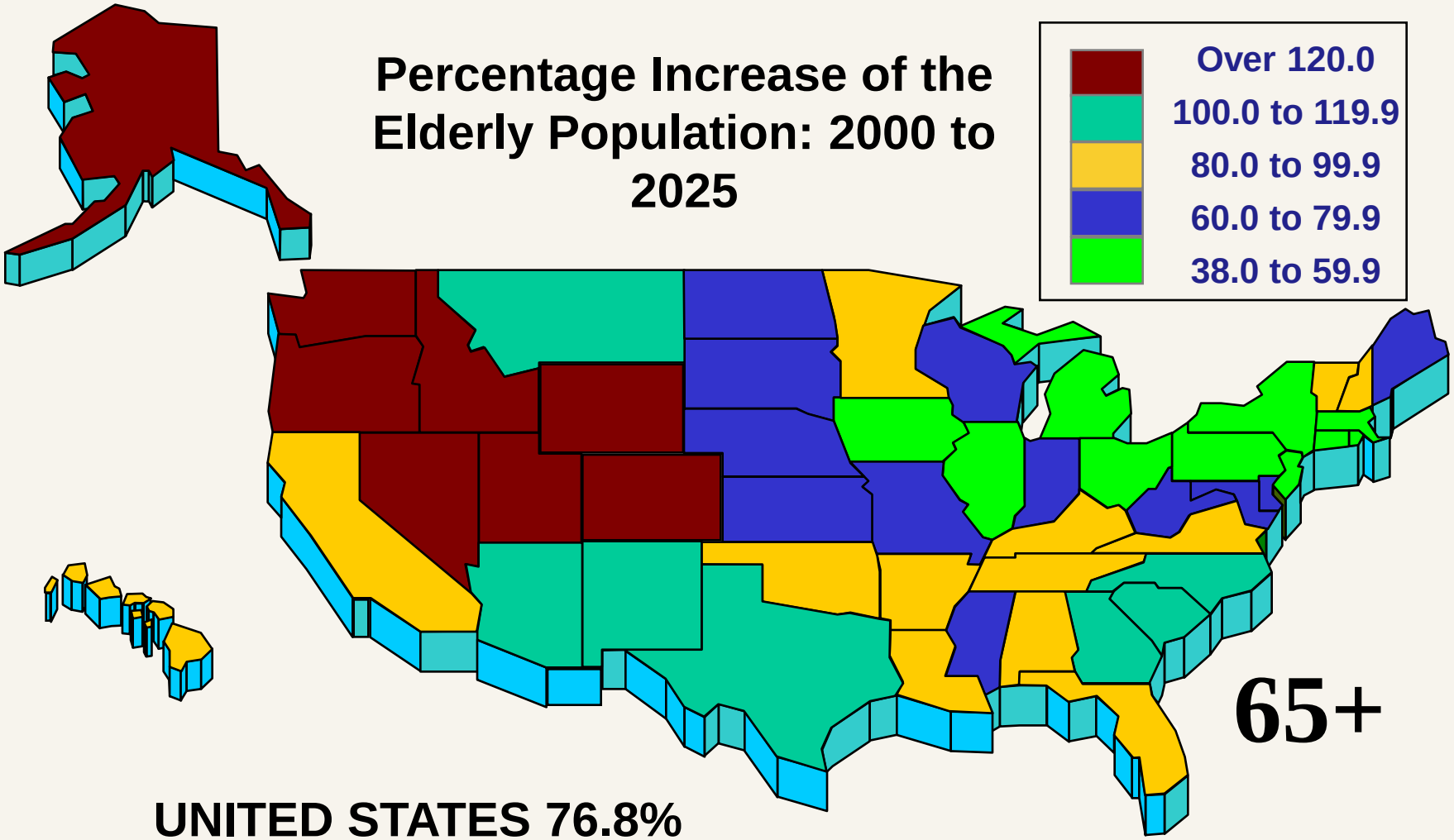
- New Title
- Incorporates new research
- Promising Practices added*
- Format changes (HTML)
- Electronic version

(http://safety.fhwa.dot.gov/older_users/)

- Omits recommendations that have been adopted into the MUTCD or AASHTO Greenbook

*Promising Practices - treatments being used by one or more agencies, though not fully evaluated, are believed to benefit aging roadway users.

Why is the Handbook needed?



Why is the Handbook needed?

Increase in Older Drivers

Older drivers made up 16 percent of all licensed drivers in 2011*

Increasing proportion of drivers will experience:

- **Declining Vision**
- **Slower decision making and reaction times**
- **Increased difficulty in driver attention sharing**
- **Reductions in physical strength and flexibility**

**Source: NHTSA 2012 Older Driver Traffic Safety Facts*

Why is the Handbook needed?

Primary reasons for the need of highway design and operations strategies for older drivers and pedestrians?

- Our older population has increased significantly over the previous decades
- Increasing % of 65+ people remaining in the workforce (delaying retirement)
- Data shows that fatalities and injuries for older drivers and pedestrians are over representative
- Older road users should be accommodated by the design and operational characteristics of a highway to the extent practical.

Changing Demographics = Change in "Design Driver"

What is in the Handbook?

Part I – Treatments: 144 Recommendations

Category	Proven Practices	*Promising Practices	Total Treatments
Chapter 2: Intersections	16	8	24
Chapter 3: Interchanges	6	2	8
Chapter 4: Roadway Segments	4	6	10
Chapter 5: Work Zones	5	2	7
Chapter 6: Highway-Rail Grade Crossings	2	0	2
Total	33	18	51

*Promising Practices: Treatments being used by one or more agencies, though not fully evaluated, are believed to benefit aging roadway users.

Information provided for each Treatment and/or Recommendation:

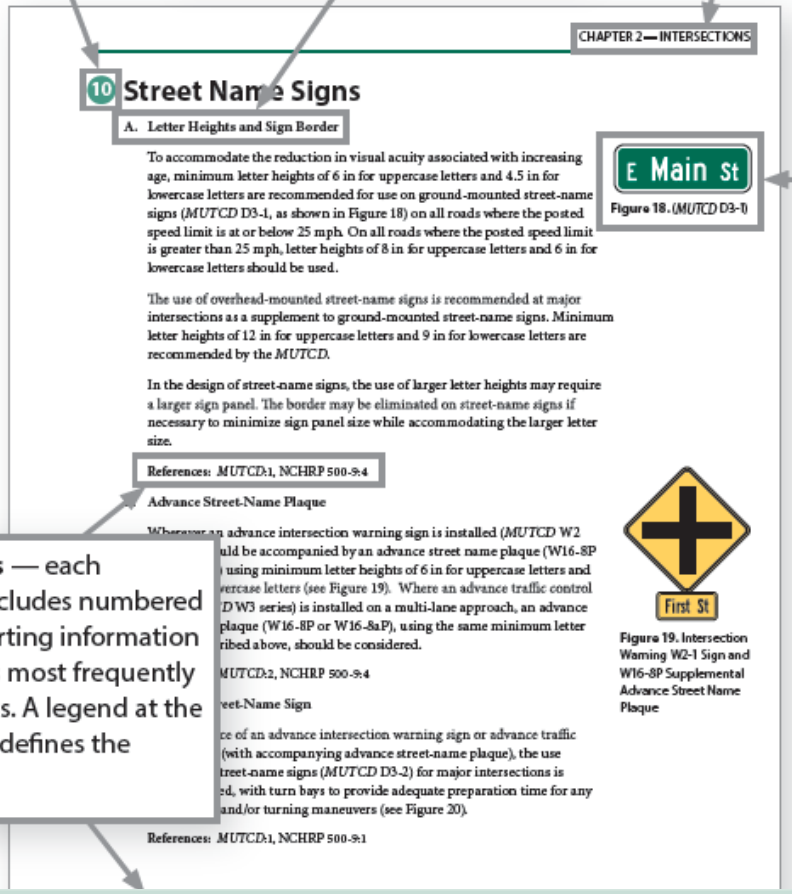
Design Element — each design element is numbered to allow for quick reference.

Category — identifies the current section of the guide.

Recommendations — each recommendation is identified with a letter for quick reference.

Figures — figures are used throughout the guide to illustrate the recommendations. They are numbered for easy reference.

Relationship Codes — each recommendation includes numbered references to supporting information in the design guides most frequently used by practitioners. A legend at the bottom of the page defines the relationship codes.



CHAPTER 2 — INTERSECTIONS

10 Street Name Signs

A. Letter Heights and Sign Border

To accommodate the reduction in visual acuity associated with increasing age, minimum letter heights of 6 in for uppercase letters and 4.5 in for lowercase letters are recommended for use on ground-mounted street-name signs (*MUTCD* D3-1, as shown in Figure 18) on all roads where the posted speed limit is at or below 25 mph. On all roads where the posted speed limit is greater than 25 mph, letter heights of 8 in for uppercase letters and 6 in for lowercase letters should be used.

The use of overhead-mounted street-name signs is recommended at major intersections as a supplement to ground-mounted street-name signs. Minimum letter heights of 12 in for uppercase letters and 9 in for lowercase letters are recommended by the *MUTCD*.

In the design of street-name signs, the use of larger letter heights may require a larger sign panel. The border may be eliminated on street-name signs if necessary to minimize sign panel size while accommodating the larger letter size.

References: *MUTCD*:1, NCHRP 500-9:4

E Main St

Figure 18. (*MUTCD* D3-1)

Advance Street-Name Plaque

Wherever an advance intersection warning sign is installed (*MUTCD* W2 uld be accompanied by an advance street name plaque (W16-8P using minimum letter heights of 6 in for uppercase letters and ercase letters (see Figure 19). Where an advance traffic control D W3 series) is installed on a multi-lane approach, an advance plaque (W16-8P or W16-8aP), using the same minimum letter ribed above, should be considered.

MUTCD:2, NCHRP 500-9:4

eet-Name Sign

ce of an advance intersection warning sign or advance traffic (with accompanying advance street-name plaque), the use treet-name signs (*MUTCD* D3-2) for major intersections is d, with turn bays to provide adequate preparation time for any and/or turning maneuvers (see Figure 20).

References: *MUTCD*:1, NCHRP 500-9:1

First St

Figure 19. Intersection Warning W2-1 Sign and W16-8P Supplemental Advance Street Name Plaque

REFERENCES LEGEND

See pages 3 and 4 for full description of codes and acronyms of cited design guides.

1: most conservative
2: preferred among differing guides
3: new application of current practice
4: more specific, detailed or stringent
5: permissible only in accordance with MUTCD section 1A.10, Interpretations, Experimentations, and Changes

What is in the Handbook?

Part II – Rationale and Supporting Evidence

One treatment category per chapter:

- Chapter 7: Intersections
- Chapter 8: Interchanges
- Chapter 9: Roadway Segments
- Chapter 10: Construction/Work Zones
- Chapter 11: Highway-Rail Grade Crossings

Appendices:

- Supplemental Technical Notes
- Photograph and Image Credits
- Glossary
- References

What is in the Handbook?

Chapter 2 – Intersections

16 Proven Practices

67 Recommendations

8 Promising Practices

10 Recommendations

No.	Treatment/Design Element
Chapter 2: INTERSECTIONS (16) Proven Practices	
1	Intersection Angle (Skew)
2	Receiving Lane (Throat) Width
3	Channelization
4	Intersections Sight-Distance
5	Offset Left-Turn Lanes
6	Delineation of Edgelines and Curbs
7	Curb Radius
8	Left-Turn Traffic Control for Signalized Intersections
9	Right-Turn Traffic Control for Signalized Intersections
10	Street Name Signs
11	Stop and Yield Signs
12	Lane Assignment on Intersection Approach
13	Traffic Signals
14	Intersection Lighting
15	Pedestrian Crossings
16	Roundabouts
Promising Practices for Intersections (8)	
17	Right-Turn Channelization Design
18	Combination Lane-Use/Destination Overhead Guide Signs
19	Signal Head Visibility
20	High Visibility Crosswalks
21	Supplemental Pavement Markings for Stop and Yield Signs
22	Reduced Left-Turn Conflict Intersections
23	Accessible Pedestrian Signal (APS) Treatments
24	Flashing Yellow Arrow

Chapter 2 – Intersections: Additions to Proven Practices

(5) Offset Left-Turn Lanes

NEW

- Provide a pedestrian refuge area where pedestrians have to cross in two stages (3.0 ft/s)

(13) Traffic Signals

- Install 12-inch Signal Heads

NEW

- Provide yellow retroreflective borders on backplates

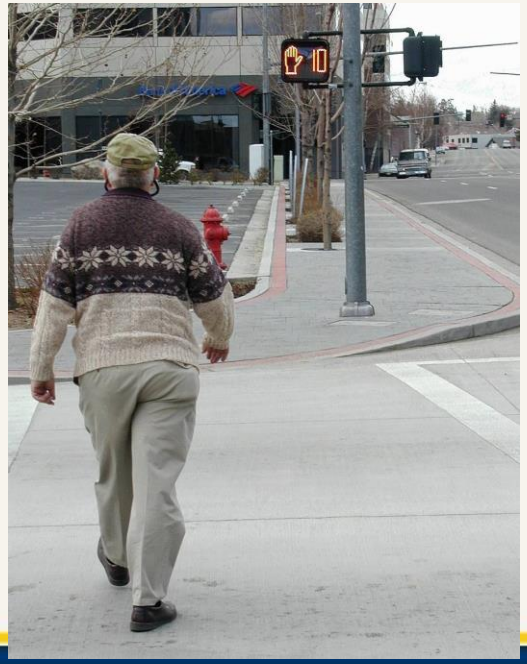
Chapter 2 – Intersections: Additions to Proven Practices

(15) Pedestrian Crossings:

- Walking Speed revised from 2.8 ft/s to 3.0 ft/s
- Crossing distance measured 6 ft back from the curb or edge of travel lane
- Leading Pedestrian Interval (LPI) equation adjusted for the above

$$LPI = (ML + PL + 6.0)/3.0$$

NEW • Install Countdown Pedestrian Signals at all signalized intersections



Chapter 2 – Intersections: Additions to Proven Practices

(16) Roundabouts:

- Enhanced information and figures on Roundabouts
- 3 NEW RECOMMENDATIONS:
  - Provide Advance Warning Signs (W2-6)
  - Provide Directional Arrow Signs (R6-4)
  - Install Roundabout Circulation Plaque (R6-5P)

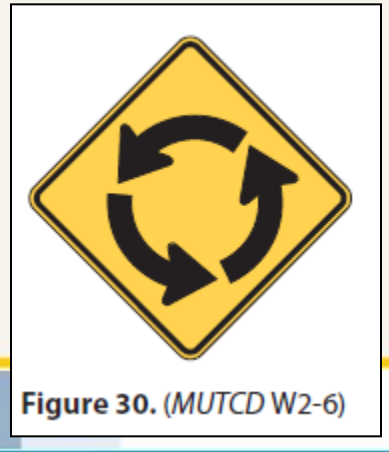
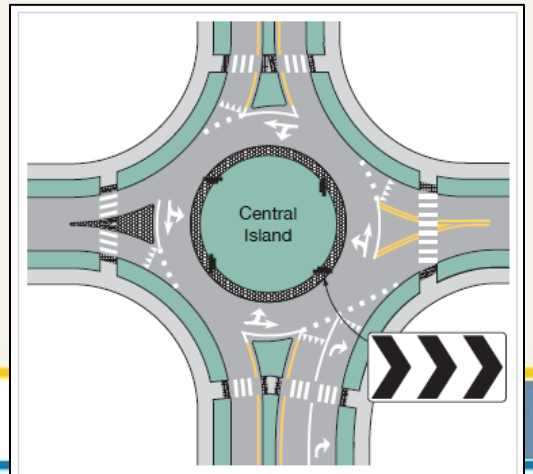
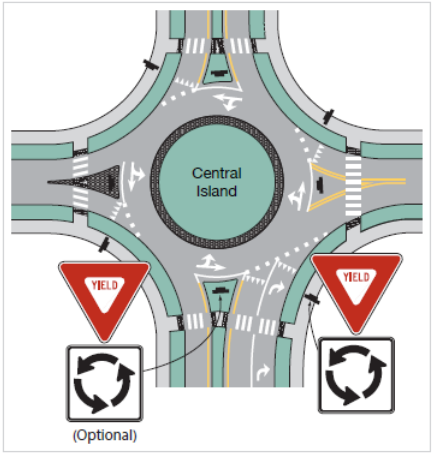


Figure 30. (*MUTCD* W2-6)

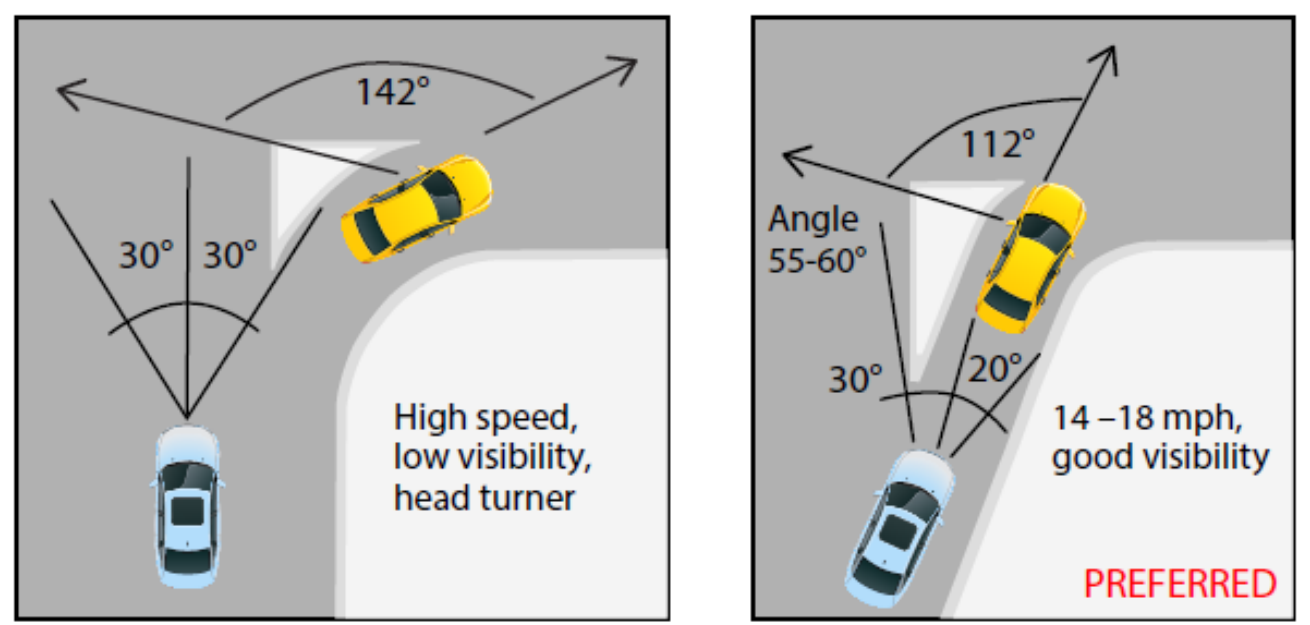




Chapter 2 – Promising Practices

(17) Right-Turn Channelization Design

- Use tighter radii (25 – 40 ft)
- Reduces turning speeds to 14 - 18 mph
- Optimizes line of sight for turning drivers



Chapter 2 – Promising Practices

(19) Signal Head Visibility

- One signal head per lane, centered over each lane

Chapter 2 – Promising Practices

(20) High-Visibility Crosswalks

- Use marking patterns that are move visible than standard markings
  - Ladder
  - Diagonal

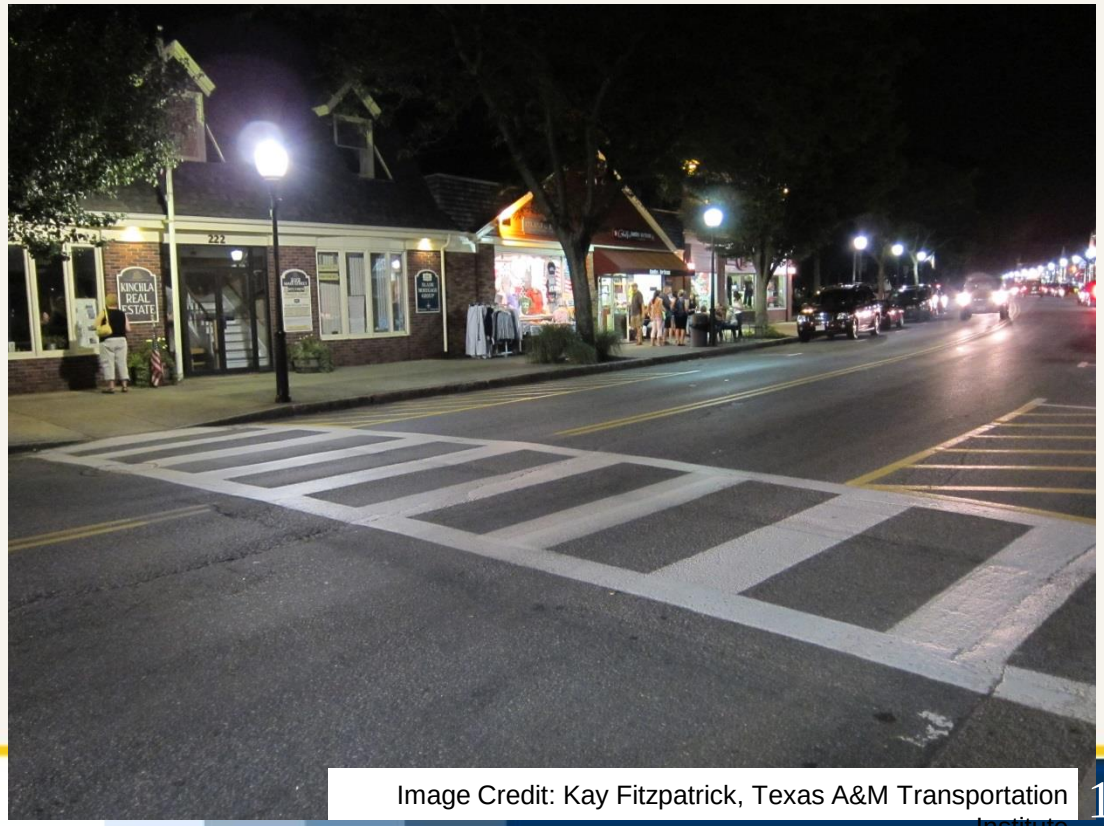
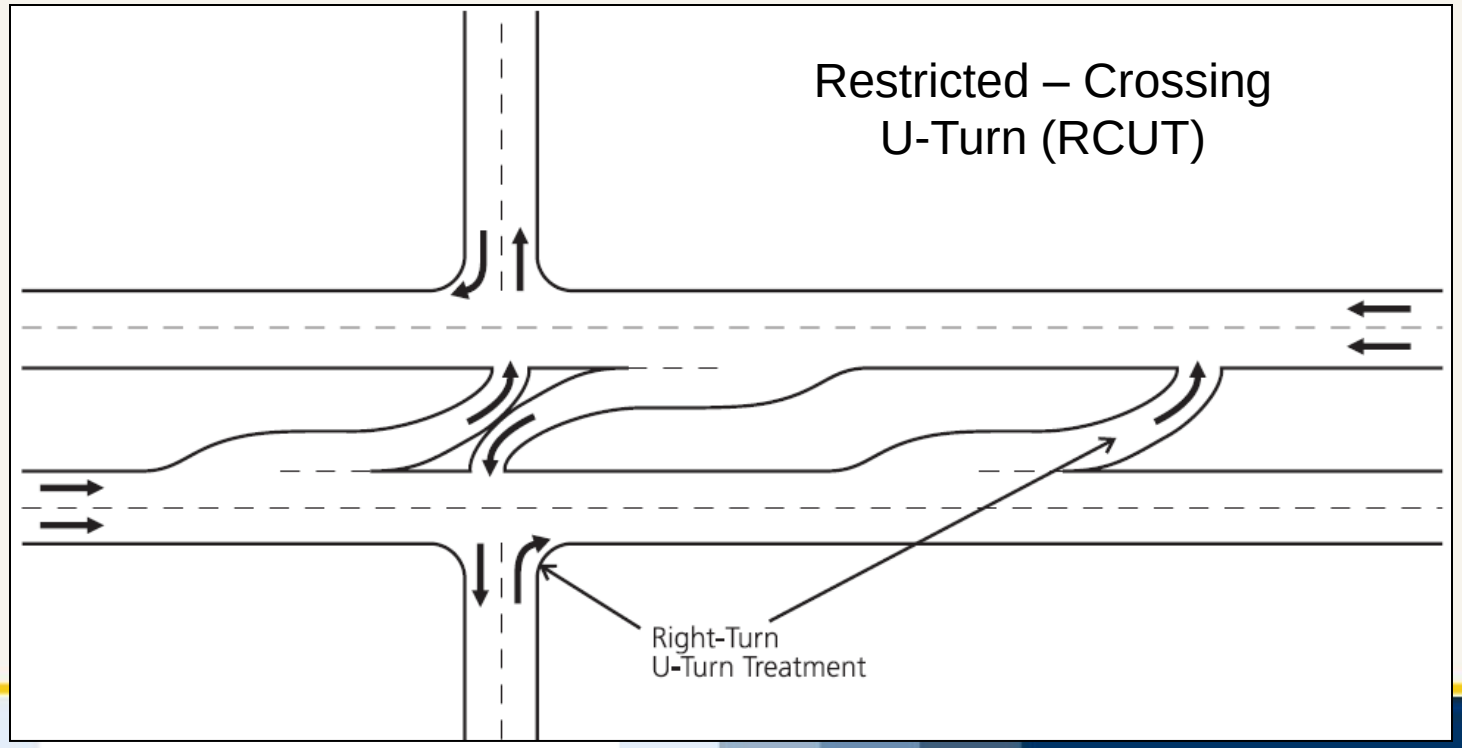


Image Credit: Kay Fitzpatrick, Texas A&M Transportation Institute

Chapter 2 – Promising Practices

(22) Reduced Left-Turn-Conflict Intersections

- Consider innovative designs that reduce or eliminate unprotected left turns

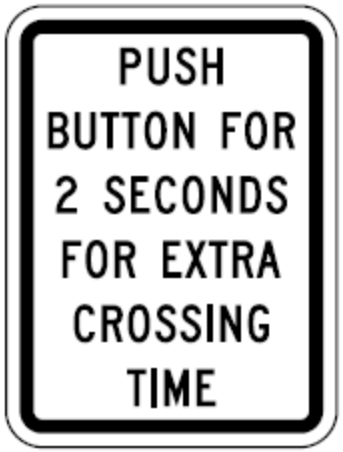


23 Accessible Pedestrian Signal Treatments

A. Pushbutton-Activated Extended Pedestrian Crossing Phase

Consider inclusion of pushbutton-activated extension of the pedestrian crossing phase

- Press and hold for 2 sec for additional preset crossing time
- Described in MUTCD Section 4E.08



R10-32P

B. Passive Pedestrian Detection

Uses sensors to detect the presence of pedestrians and register a pedestrian call with the signal system

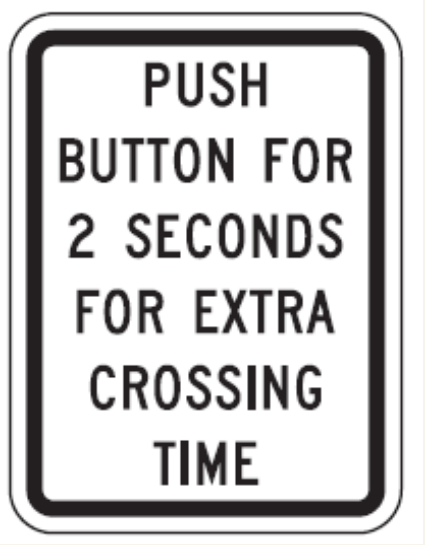
- Pedestrian does not have to push a button to request a WALK signal or extended crossing time

Chapter 2 – Promising Practices

(23) Accessible Pedestrian Treatments

A. Pushbutton-activated extension of crossing phase

- Activated by the pedestrian
- Press and hold for 2 sec for additional preset crossing time



B. Passive pedestrian detection (sensors detect presence of pedestrians within crosswalk)

Chapter 2 – Promising Practices

(24) Flashing Yellow Arrow

- Recommended signal indication for permissive left-turn movements

What is in the Handbook?

Chapter 3 – Interchanges

6 Proven Practices: 20 Recommendations

Chapter 3: INTERCHANGES (6) Proven Practices	
25	Exit Signs and Markings
26	Freeway Entrance Traffic Control Devices
27	Delineation
28	Acceleration/Deceleration Lane Design
29	Interchange Lighting
30	Restricted or Prohibited Movements

2 Promising Practices: 2 Recommendations

Promising Practices for Interchanges (2)	
31	Route Shield Markings at Major Freeway Junctions
32	Wrong-Way Driving Countermeasures (RSA)

Chapter 3 – Promising Practices

(32) Wrong-Way Driving Countermeasures

- Consider additional treatments to counter wrong-way driving
  - improved lighting, signs, and markings

What is in the Handbook?

Chapter 4 – Roadway Segments

4 Proven Practices: 11 Recommendations

Chapter 4: ROADWAY SEGMENTS (4) Proven Practices	
33	Horizontal Curves
34	Vertical Curves
35	Passing Zones
36	Lane Control Devices

6 Promising Practices: 6 Recommendations

Promising Practices for Roadway Segments (6)	
37	Lane Drop Markings
38	Contrast Markings on Concrete Pavement
39	Utilize Most Retroreflective Marking Material Available
40	Curve Warning Markings
41	Road Diets
42	High Friction Surface Treatments

Chapter 4 – Roadway Segments: Additions to Proven Practices

(33) Horizontal Curves

- Use RPMs where nighttime wet pavement visibility is problematic, regardless of curve radius

(34) Vertical Curves

- Employ strict adherence to 2.5s PRT for vertical curve design

Chapter 4 – Promising Practices

(41) Road Diets

- Reduction of lanes allocates space for other road users (bikes, peds, parking)

(42) High Friction Surface Treatments (HFSTs)

- Amplifies braking and expedites the reduction in vehicle speeds, helping drivers retain control

What is in the Handbook?

Chapter 5 – Construction/Work Zones

5 Proven Practices: 24 Recommendations

Chapter 5: CONSTRUCTION/WORKZONES: (5) Proven Practices	
43	Signing and Advance Warning
44	Portable Changeable (Variable) Message Signs
45	Channelization Practices (Path Guidance)
46	Delineation of Crossovers/Alternate Travel Paths
47	Temporary Pavement Markings

2 Promising Practices: 2 Recommendations

Promising Practices for Roadway Segments (2)	
48	Increased Letter Height for Temporary Work Zone Signs
49	Work Zone Road Safety Audit (WZRSA)

Chapter 5 – Construction/Work Zones: Additions to Proven Practices

(43) Signing and Advance Warning:

- Legibility Distance

NEW

  - Use 1 inch letter height per 30 feet of legibility distance

(44) Portable Changeable Message Signs

- Sign Height

NEW

  - Elevated to a height sufficient to be seen across multiple lanes of traffic

What is in the Handbook?

Chapter 6 – Highway-Rail Grade Crossings

2 Proven Practices: 2 Recommendations

Chapter 6: HIGHWAY-RAIL GRADE CROSSINGS (PASSIVE): (2) Proven Practices	
50	Passive Traffic Control Devices
51	Lighting

0 Promising Practices:

Reorganized Proven Practices into 2 treatment categories rather than 1 (No Major Additions)

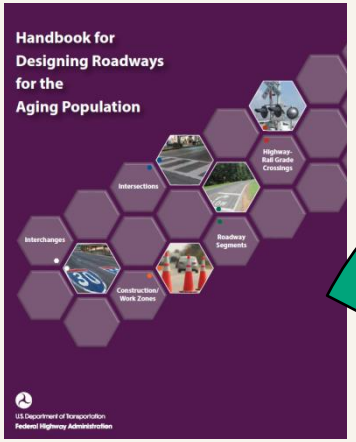
Where and How to use the Handbook?

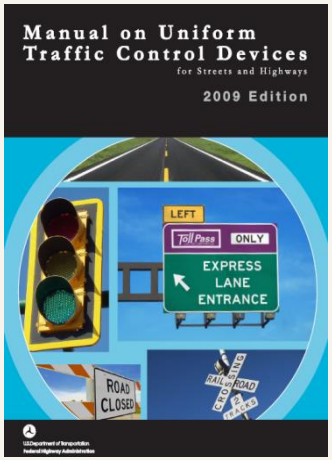
What is the Relationship Between the *Handbook* & Existing Design Manuals?

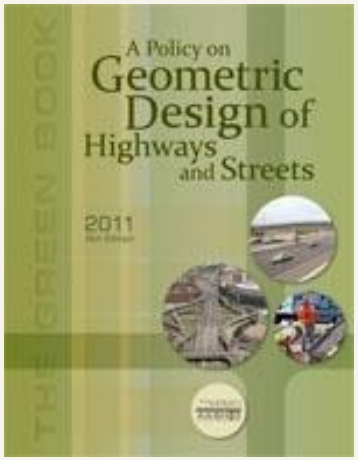
The *Handbook* supplements existing standards and guidelines

The Recommendations do not constitute a new *standard* of required practice

The *Handbook* provides guidance to enhance the safety & ease of use for older drivers and pedestrians







Where and How to use the Handbook?

Problem Identification/Project Review Questions:

1. Demonstrated crash problem with aging road users?

2. Any complaints from aging road users or potential safety concern for aging road users either through observation, agency documentation, or engineering judgment?

3. Project located on a direct link to a travel origin or destination for which aging persons constitute a significant proportion of current users?

4. Project located in a census tract that has experienced an increase in the proportion of residents age 65 and older?"

Where and How to use the Handbook?

Implementation is a 3-Step Process:

1. **Problem Identification/Project Review**
   - **Answer the four basic Problem ID questions**
     - ✓ **Front of Handbook (Chapter 1, Pages 6 & 7)**
2. **Identification of Candidate *Handbook* Applications**
   - **List Relevant Design Elements**
   - **Identify Handbook Recommendations**
   - **Assess Differences in Design Practices**
3. **Implementation Decision**

If you design for the Old

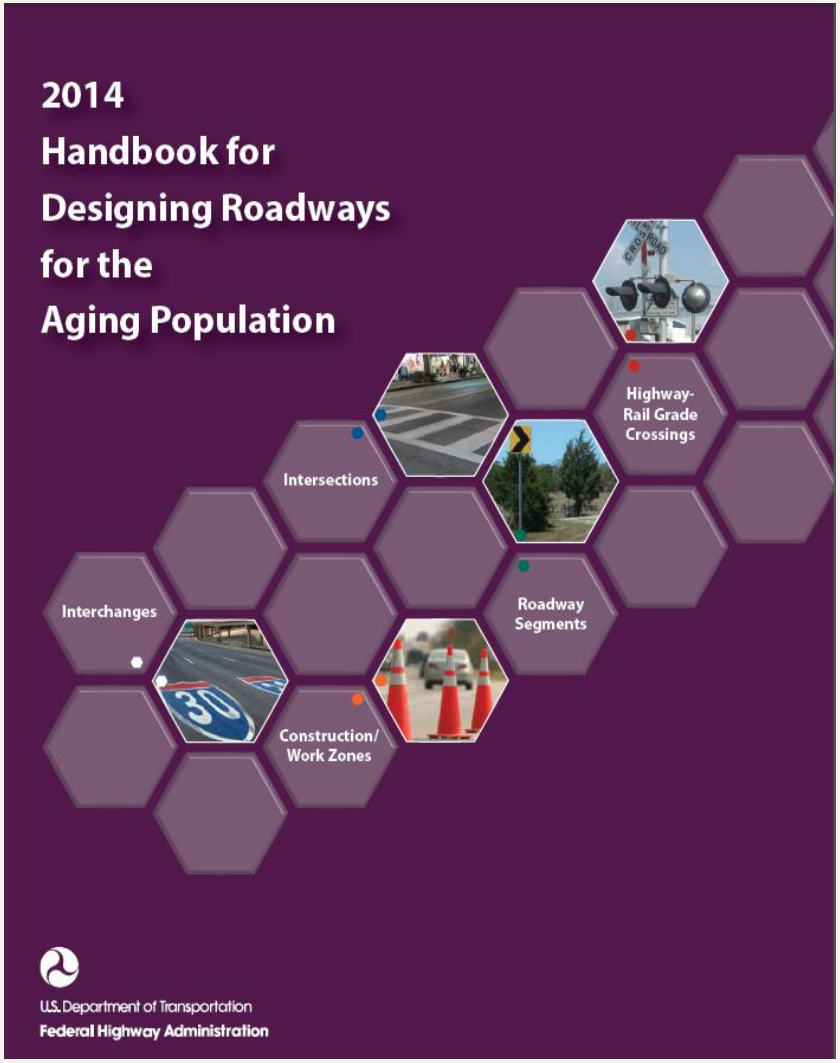
You include the young

If you design for the Young

You exclude the Old

Dr. Bernard Isaacs, Renowned Geriatric Physician and Author

2014 FHWA Older Driver Handbook



Aging Road User Webinar

Thank You!

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FHWA, Resource Center
Kansas City, MO

Safe Streets for Seniors
New York City

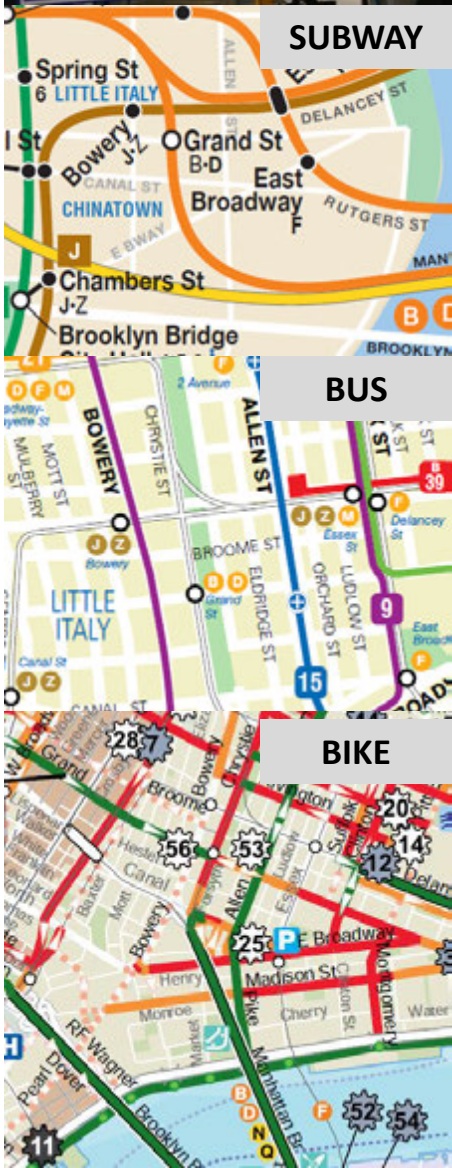
PBIC
FHWA
2014

Jesse Mintz-Roth - Senior Project Manager, Research Implementation and Safety
New York City Department of Transportation - November 20, 2014

NEW YORK CITY DOT

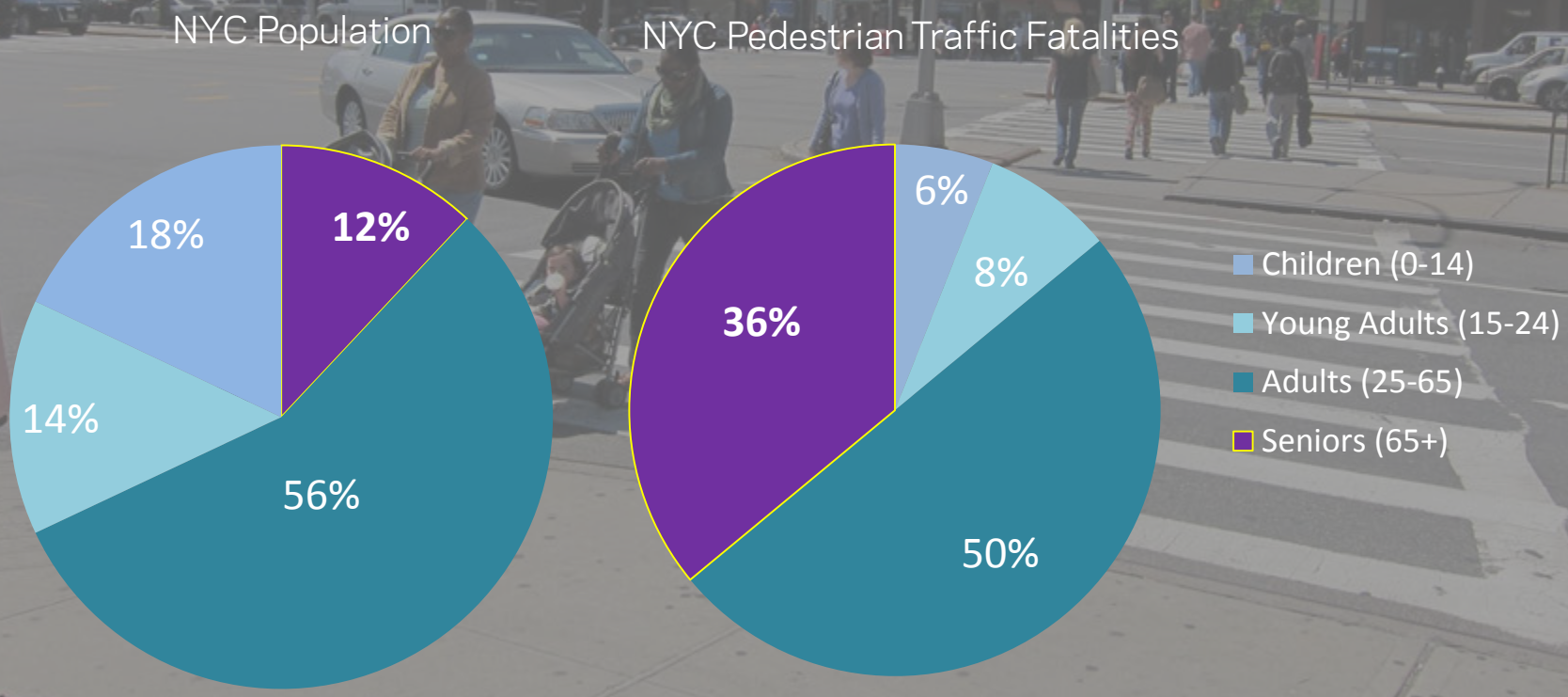
New York City: By the numbers

- NYC population: 8.4 million (MSA 22.2 million)
- Extensive 24/7 subway and bus networks
- NYC traffic fatality rate: 3.1 per 100,000: Low among large US cities
  - Over 50% are pedestrians: High among large US cities
- Low car ownership; Everyone is a pedestrian; No Right Turn on Red
- VISION ZERO multi-agency street safety initiative (2014-):
  - New 25 mph speed limit (11/7/14)
  - 50 Street Safety Projects per year
  - NYCDOT working with Police Dept, Taxi Cmn

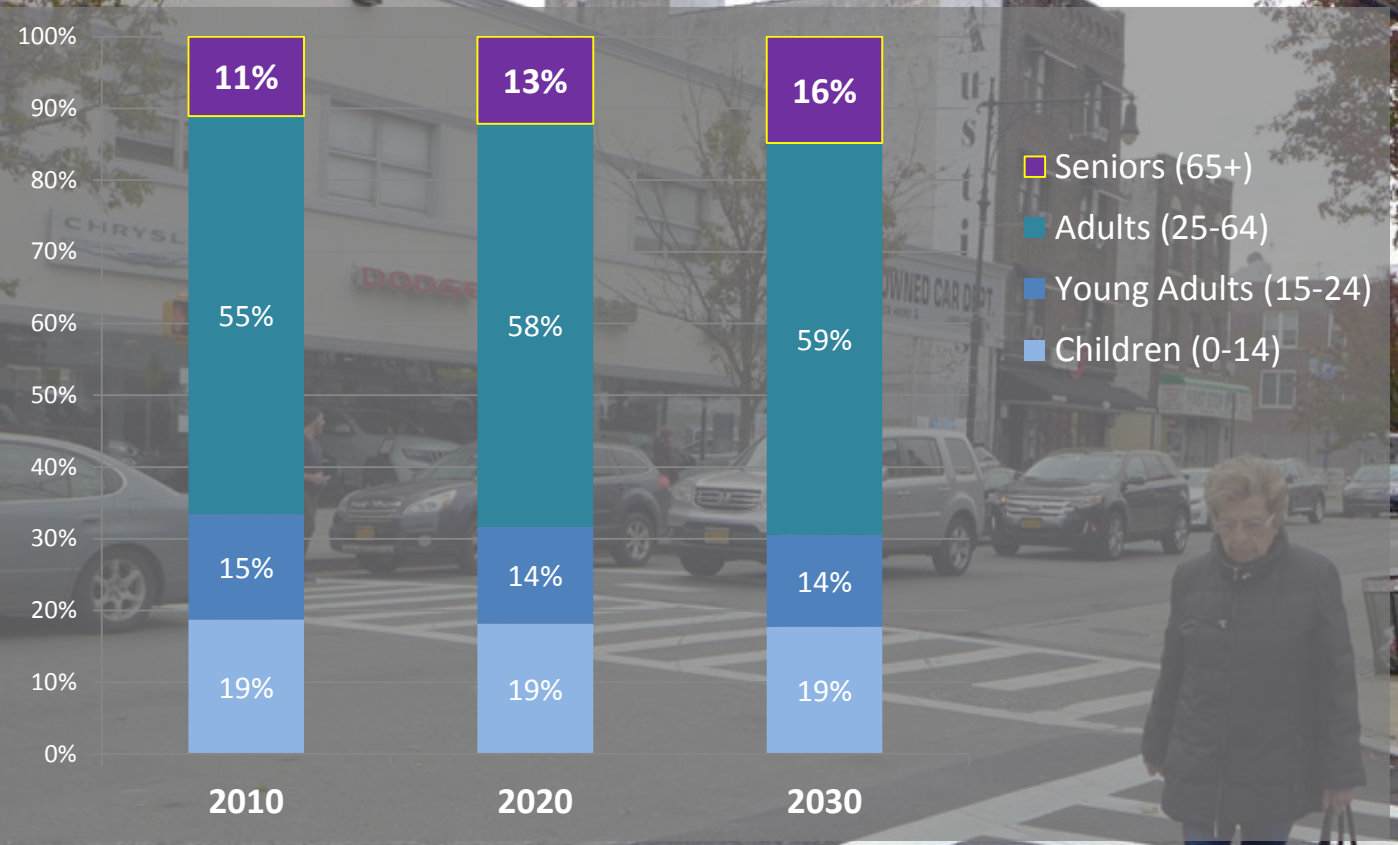


NYC Senior Pedestrians

- 12% of the NYC population are seniors
- 36% of NYC traffic fatalities are senior pedestrians



NYC Senior Population Increasing



Source: New York City Population Projections by Age/Sex & Borough 2000–2030 – NYC Department of City Planning: 2006

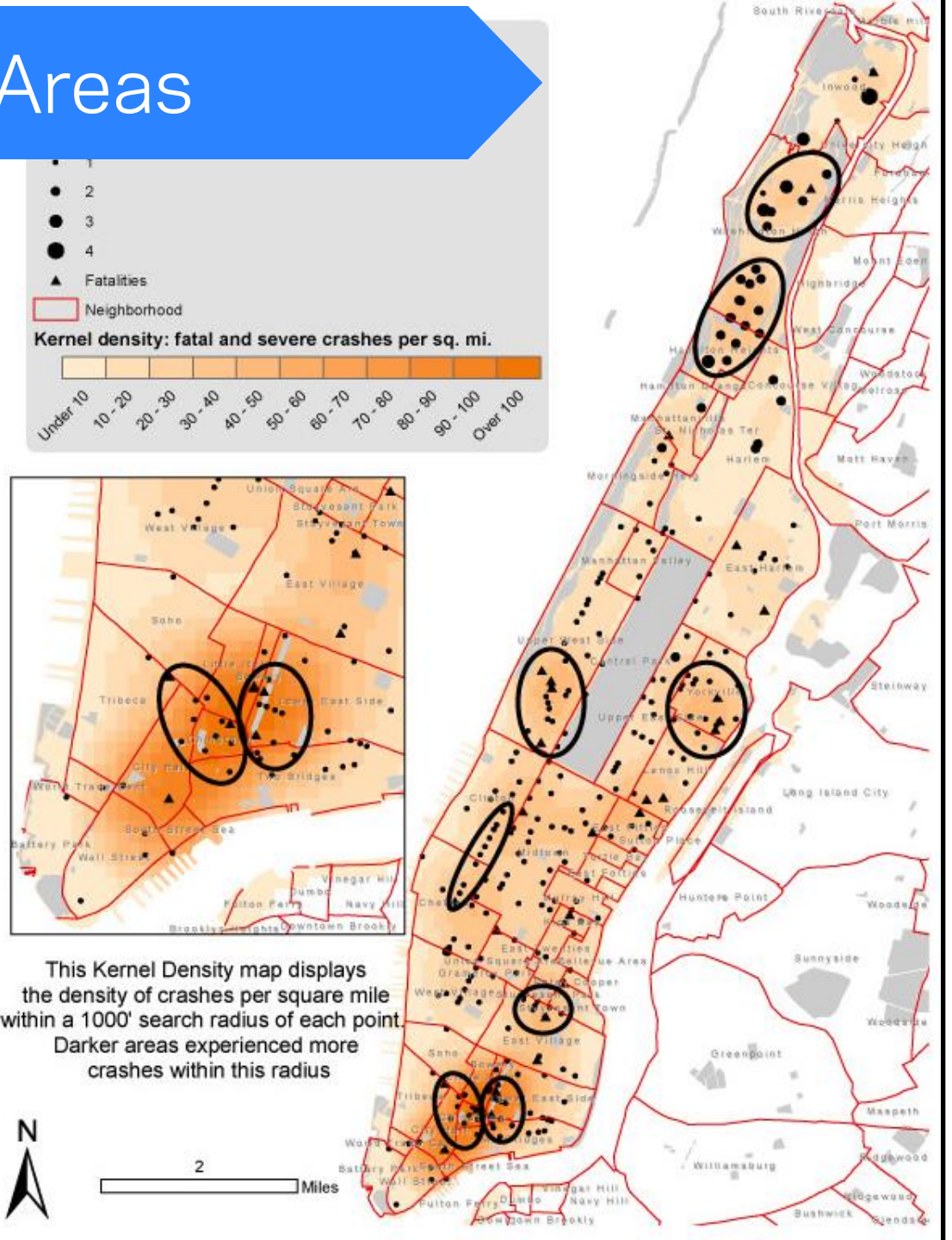
Identifying Focus Areas

First 25 areas (2008)

- Mapped pedestrians age 65+ killed and severely injured (KSI)
- Circled clustering on heat map to identify first focus areas

12 new areas (2012)

- Also studied and included senior centers, housing, other spatial variables



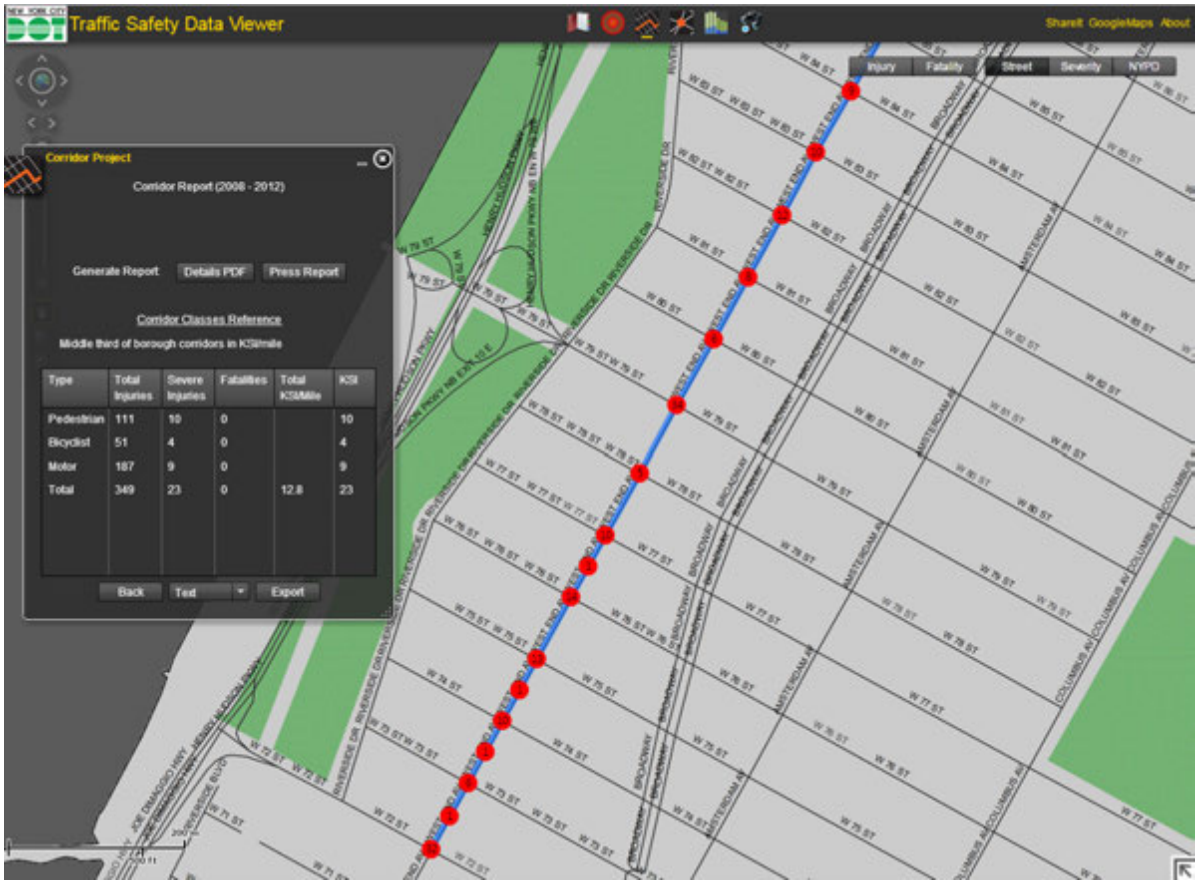
Senior Pedestrian Issues

- Not enough time to cross the street
- Broken or missing pedestrian ramps
- Faded and hard-to-see markings
- Poor drainage or ponding in crosswalks
- Turning vehicles failing to yield

Identifying/Evaluating Project Locations

Priority: Top 10% or 33% Pedestrian KSI/mi in each Borough

Ranked by KSI per mile (KSI = Killed or Severely Injured)

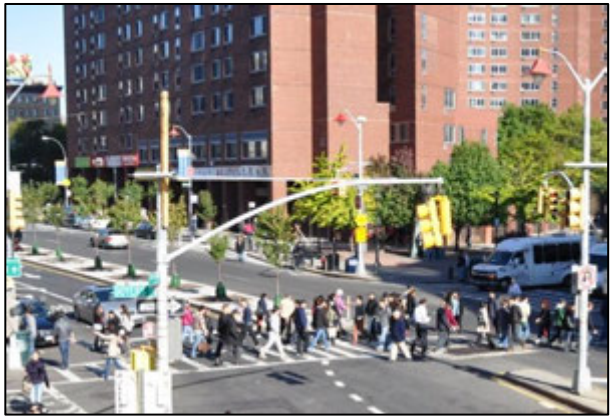


- NYCDOT developed intranet site to let project managers compare and rank safety projects using the most recent 5 years of cleaned crash data
- Before/After Analysis: average of 3 previous years vs 1/2/3 year(s) since, excluding build

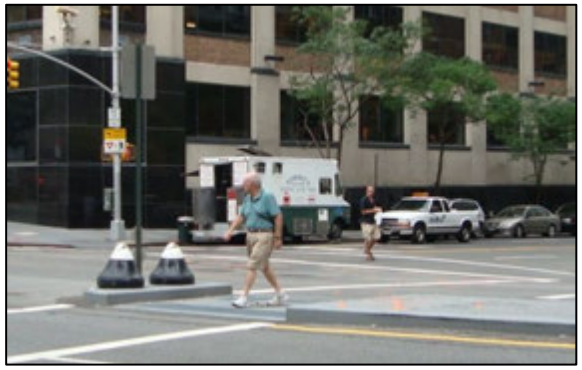
Toolbox of Typical Safety Improvements

Daylighting:
Better driver-pedestrian visibility

Countdown Signals:
Tell pedestrians how much more time they have to cross



Signal Timing:
Can add more time to cross where possible, LPIs, split phases



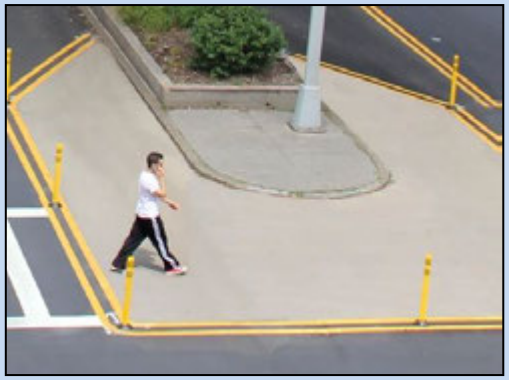
Pedestrian Safety Islands:
Shortens crossings on wide streets, provides safer crossing

Road Diet:
Organizes traffic, less speeding

Sidewalk Extensions:
Shortens crossing distance, slows turning cars

Street Design: 3 construction options

	Capital Concrete	In-House Concrete	Temporary Materials
Build Time	5+ years	1-2 years	1-2 years
Cost	High	Low	Very Low



Optional follow-up: Concrete Build Out

For safety projects, quicker build time saves lives

Temporary Materials: Input from Visually-Impaired

- Partnership with advocates for the visually and hearing impaired has led to better informed policy and design decisions for using truffle paint and gravel curb extensions
- In 2013, NYC DOT installed over 400 Detectable Warning Strips in 14 of street improvement projects
- Testing new materials for durability and to achieve safety goals

W 70th St & West End, Manhattan

Reservoir Oval, The Bronx

Funding: Public Interest Finding

- Federal funding from FHWA, FTA for Livability, Air Quality, Mobility
- PIF lets NYCDOT use FHWA, FTA funds for in-house construction
- Faster implementation and lower cost than capital construction
- Allows NYCDOT to respond to street safety needs faster
- Transforming dangerous streets into safe desirable places to walk

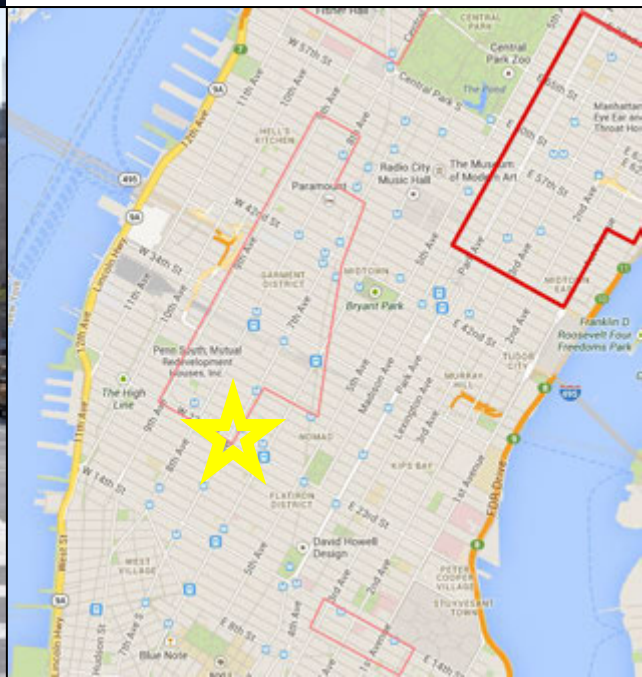
2013 Construction Items	In-House Cost/Item	Capital Cost/Item	Percentage Savings In-House
Pedestrian Island	$24,153	$80,000	-70%
Curb Extension (Single Neckdown)	$25,488	$80,000	-68%
Large Curb Extension (Double Neckdown)	$33,557	$140,000	-76%
Median Tip Extension	$23,910	$60,000	-20%
Planted Full Median	$83,271	$100,000	-60%

Safety Improvements at Key Intersections

W 23rd St/7th Ave (2010)

Location:

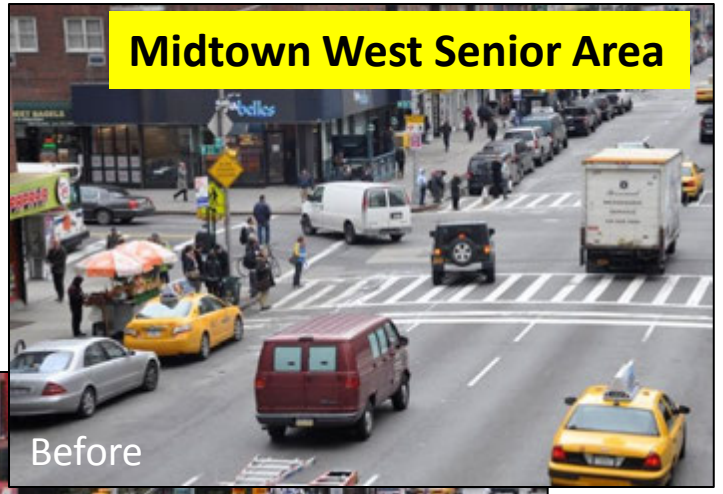
- **Chelsea, Manhattan**
- Truck Routes
- Subway: 1-train
- High pedestrian volumes
- Near American Foundation for the Blind
- Near Penn South NORC



Safety Improvements at Key Intersections

7th Ave and W 23rd St, Manhattan

- Pedestrian injuries down by **68%**



Modified signal timing to add protected pedestrian crossing

Installed two pedestrian safety islands

Created separated left turns

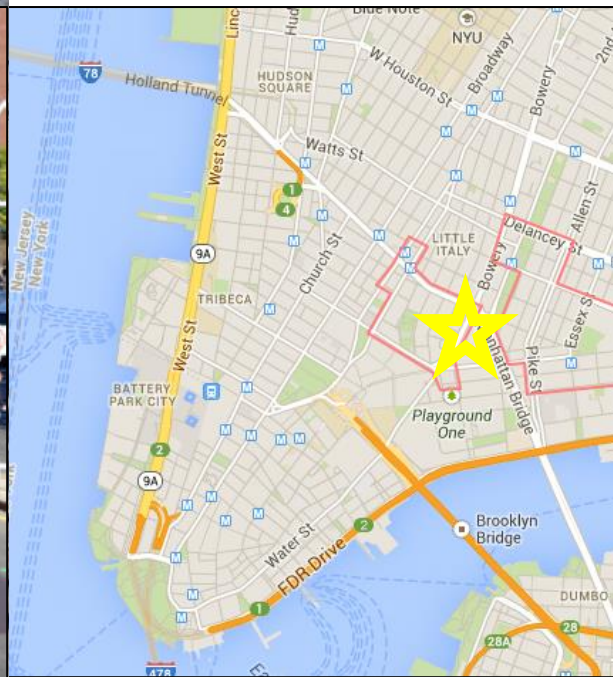
Accessible Pedestrian Signal (APS) installed

Safety Improvements Near Housing

Bowery (2010)

Location:

- **Chinatown, Manhattan**
- Truck Routes
- Heavy traffic on Canal between Holland Tunnel and Manhattan Bridge
- Very high pedestrian volumes



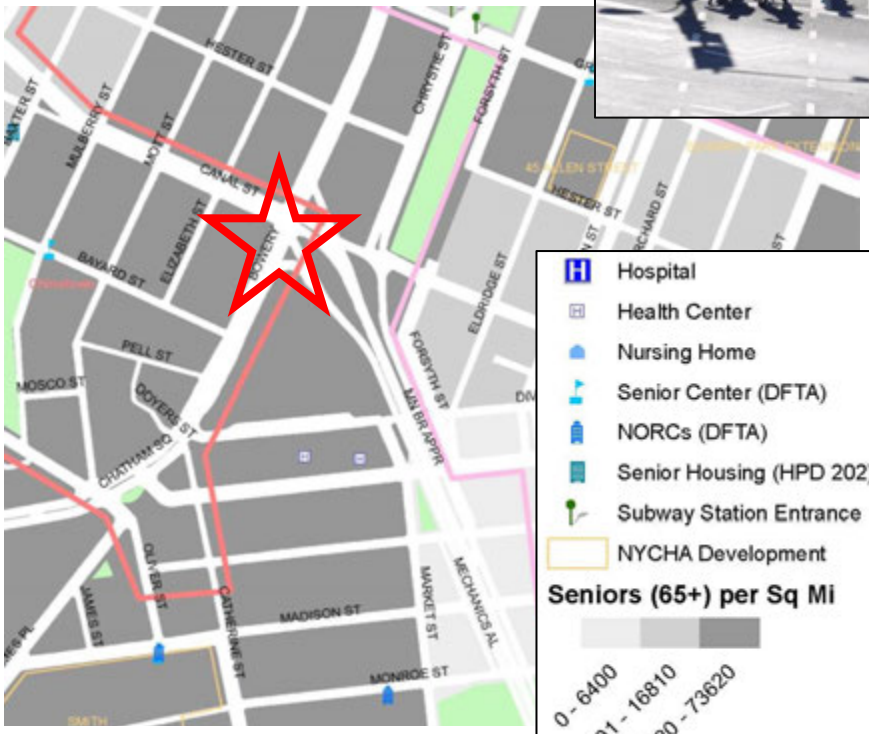
Safety Improvements Near Housing

Bowery, Manhattan

- Pedestrian injuries reduced by **39%**

Better organized and calmed Bowery traffic

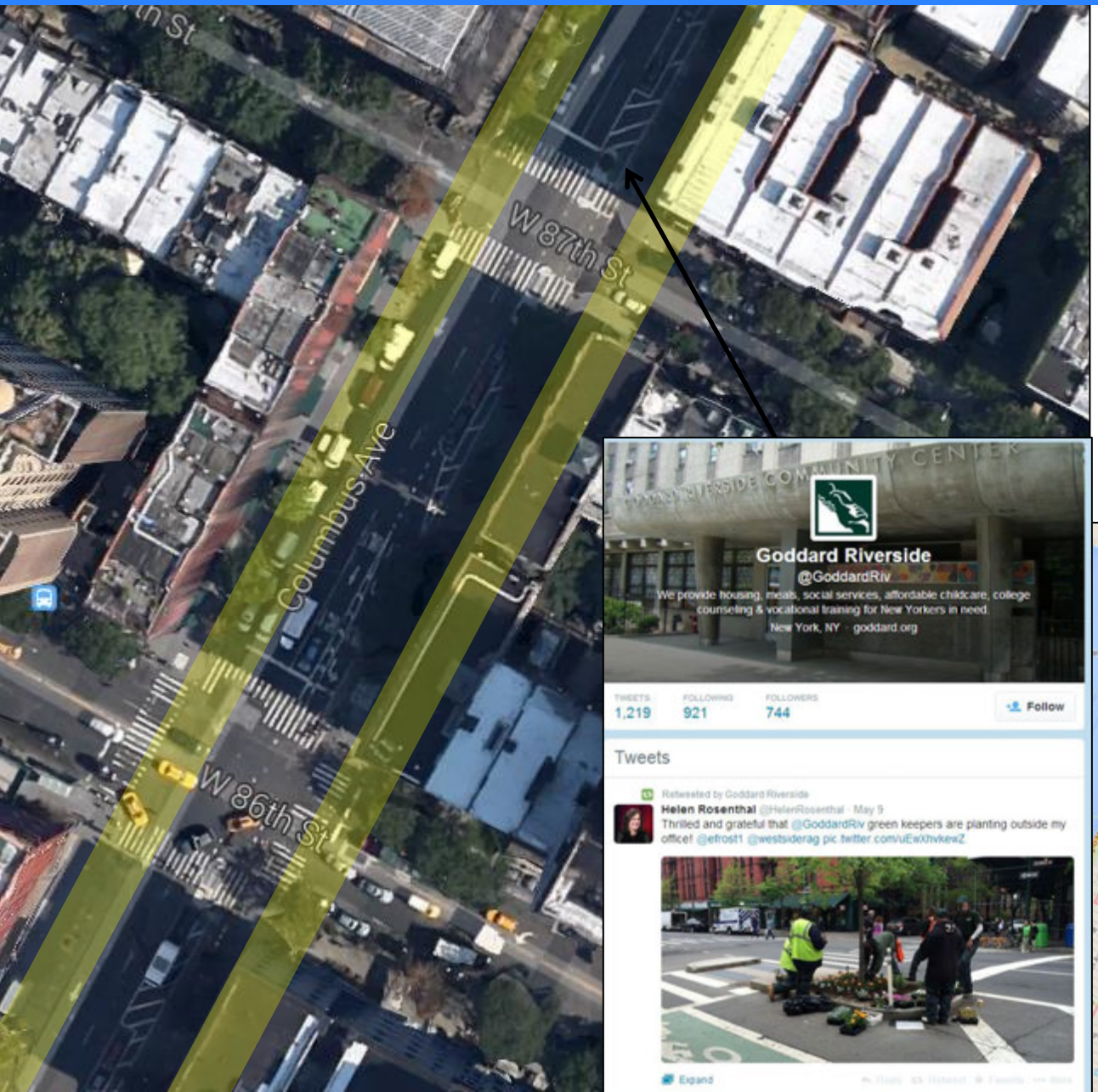
Added planted median between Canal and Division



Chinatown/Lower East Side, Manhattan

Bowery at Canal St (Manhattan Bridge entrance), looking south

Safety Improvements on Arterials



Context: Columbus Ave

Location:

- **Upper West Side, Manhattan**
- Truck Route, Bus Route
- Near Subway: B/C trains
- High pedestrian volumes
- Goddard Riverside NORC and Senior Center, Park West Village NORC

Safety Improvements on Arterials

Upper West Side Senior Area

Columbus Ave, Manhattan
Phase 1 (W 77th to W 97th St)

- Pedestrian injuries down by **39%**

Created separated left turn bays and protected bike lanes

Installed pedestrian safety islands

After: Phase 2

CityBench Program

- Working with DOT's City Bench program
- Placing benches at strategic locations, such as:
  - Senior centers
  - Bus stops without shelters
  - Public libraries
  - Municipal facilities

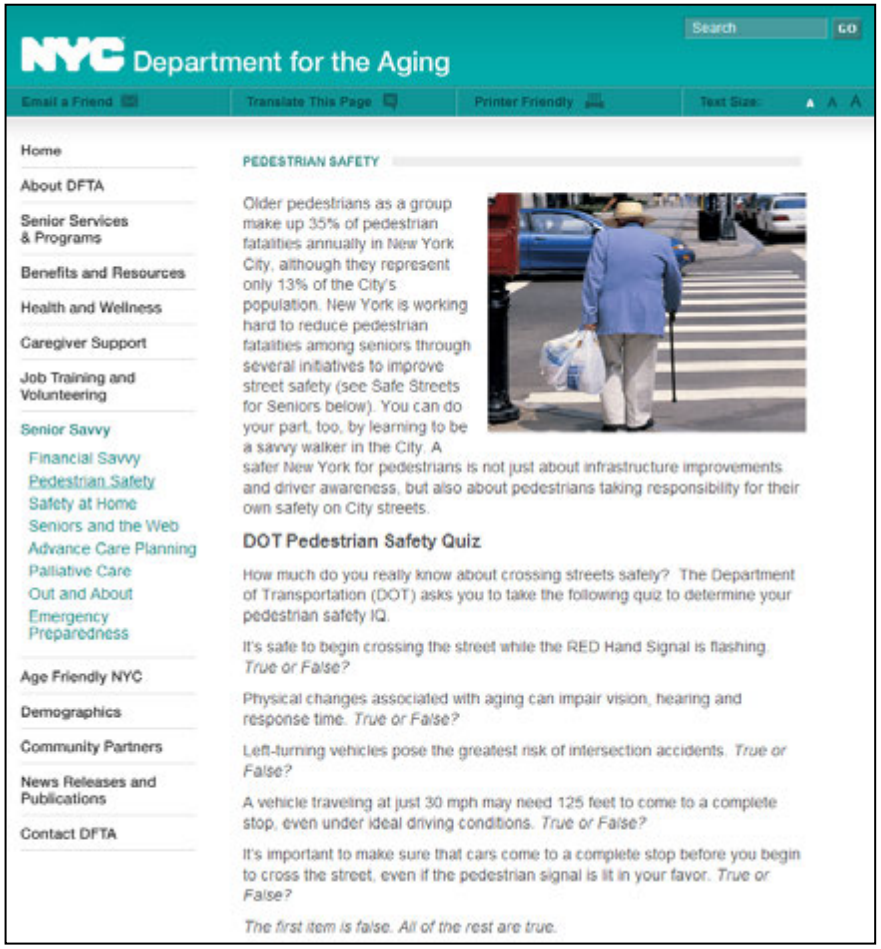
2nd Avenue bus stop, Manhattan

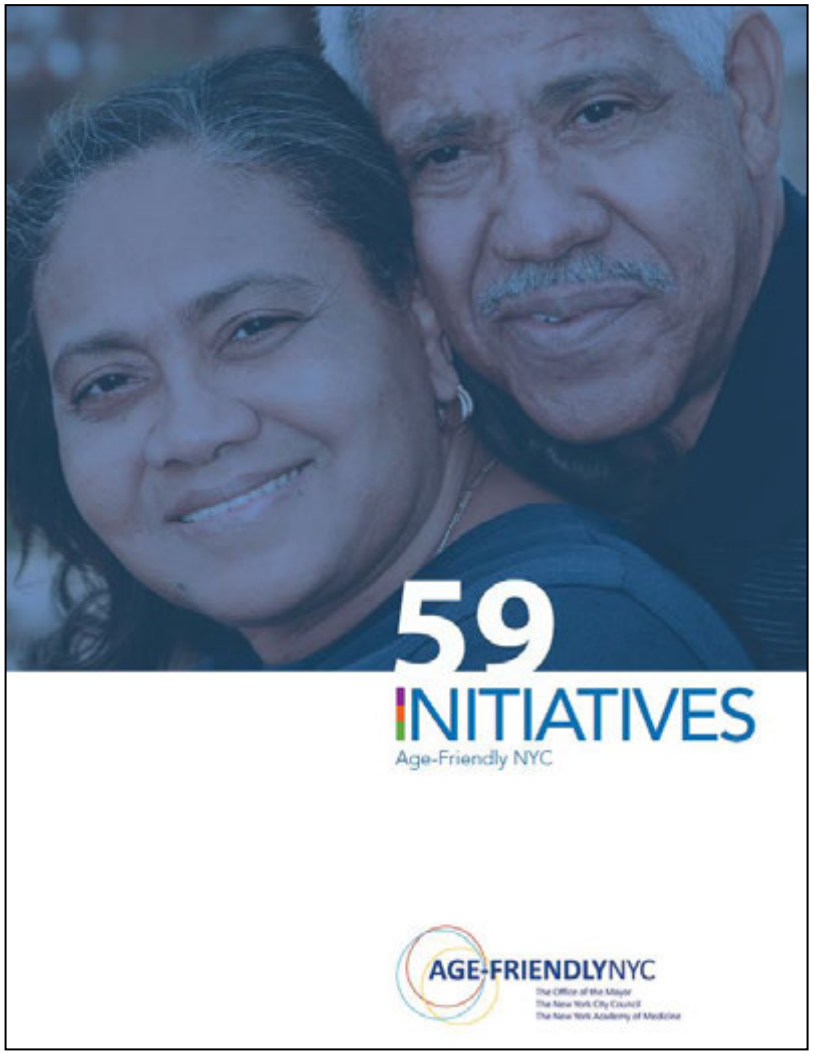
Self Help Austin St Senior Center in Forest Hills, Queens

Outreach with NYC Seniors

- Working with the NYC Department for the Aging
- Coordinating with NYCDOT's Safety Education Team
- Going into Senior Centers to get feedback
- Approaching Aging Committees on Community Boards for project ideas

Partner Agencies and Initiatives





Guidelines for other cities

Focus on Safety

- Age-friendly NYC initiative unites senior population growth with DOT safety goals
- Know your crash data:
  - Create agency priorities
  - Data anomalies determine study areas
- Public Interest Finding, Temporary Materials: Faster implementation saves lives

Grants

- Think Big: Link to sustainability, livability, mobility, and resilience
  - Improving link between housing and fixed route transportation
  - Mode shift to pedestrian/public transit creates attractive walkable corridors

Outreach

- Know your issues, know your local audience, work with partner organizations

More at nyc.gov/dot

Thank You