

# 2021 ACTIVE TRANSPORTATION SYMPOSIUM

CONNECT. VISUALIZE. TRANSFORM.

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Active Transportation Resource Center

**CT**  
Caltrans

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## *Exploring Bicycle Highways to Transform Mobility*

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# Background



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## What are Bike Highways?\*

- High-quality, direct or dedicated, and long-distance bikeways
- Support higher speed travel
- Support large volumes of people bicycling
- Connect regional destinations



*Bike Highway in Denmark. Photo: Maurits Lopez Cardozo*

\* Based on review of worldwide best practices



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## Intended Users

- Bicycle Commuters
- Recreational riders
- Powered micromobility
- E-bikes



Bike Highway in the Netherlands. Photo: Maurits Lopez Cardozo



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# Elements



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## Design Principles

- Higher speed
- Dedicated
- Low Effort
- Direct



Photo: Alta Planning + Design;  
Maurits Lopez Cardozo;  
Sergio Ruiz



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## Design Elements

- Alignment
- Intersections
- Materials and Amenities



Photos: Alta Planning + Design;  
Maurits Lopez Cardozo;  
Sergio Ruiz



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## Alignment

- Levels of Separation
- Design Speeds
- Width
- Slope
- Vehicles Permitted



*Photo: Alta Planning + Design*





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## Intersections

- Access Points and Connections to Local Bikeways
- Intersection/Crossing Treatments
- Intelligent Transportation System Features



*Photos: Alta Planning + Design  
Maurits Lopez Cardozo*





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## Materials and Amenities

- Surface Materials
- Branding/Wayfinding
- Lighting
- Support Facilities



Photos: Alta Planning + Design  
Maurits Lopez Cardozo



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# Design Considerations



## Bike Highway Design Guiding Principle

In the Bay Area and California, Bike Highways may best be thought as a route “overlay” intended for a specific type of user (i.e., higher speed, longer distance cycling), rather than a single specific facility type.










## User Speed and Needs\*

- People Bicycling
- People Walking
- Other Rolling Users

\*Based on HDM Guidance



User Type	Average Speed of Travel	Dimensional Needs
 <b>WALKERS</b>	1 to 3 mph	<ul style="list-style-type: none"> <li>• Physical Width 1'-10"</li> <li>• Preferred Operating Space 5'-0"</li> <li>• Eye Level 4'-6" - 5'-10"</li> <li>• Min. Eye Level 2'-6"</li> </ul>
 <b>RUNNERS</b>	5 to 9 mph	
 <b>WHEELCHAIR USERS</b>	1 to 3 mph (non-motorized) 3-5 mph (motorized)	<ul style="list-style-type: none"> <li>• Physical Width 2'-6"</li> <li>• Minimum Operating Space 3'-0"</li> <li>• Space Needed for 180° Turn 4'-0"</li> <li>• Eye Level 3'-8"</li> <li>• Arm Rest 2'-5"</li> </ul>
 <b>CASUAL AND NEW CYCLISTS</b>	6 to 12 mph	
 <b>EXPERIENCED CYCLISTS</b>	12 to 25 mph	<ul style="list-style-type: none"> <li>• Physical Width 2'-6"</li> <li>• Minimum Operating Space 3'-6"</li> <li>• Preferred Operating Space 5'-0"</li> <li>• Handle Bar 3'-8"</li> <li>• Eye Level 5'-0" - 5'-10"</li> </ul>
 <b>E-BIKE USERS*</b>	16 to 28 mph	<p><small>* Class 1, 2 and 3 (use, access and equipment restrictions apply to Class 3; electric tricycles; electric cargo bikes; and pedal-less e-bikes. Class 1 and 2 e-bikes are throttle-limited to 20 mph.</small></p>
 <b>E-SCOOTER USERS</b>	Up to 20 mph	<ul style="list-style-type: none"> <li>• Physical Width 2'-6"</li> <li>• Minimum Operating Space 3'-6"</li> <li>• Preferred Operating Space 5'-0"</li> <li>• Handlebar 3'-8"</li> <li>• Eye Level 4'-6" - 5'-10"</li> </ul>

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### Facility Design | Design Speed

Selected speed used to determine the geometric features of the facility

- Increase in e-bikes = increase in design speed
- International average: 18-25 mph

#### Recommended Design Speed for BHs

- Separated facility: 25 mph
- Shared facility: 20 mph



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### Facility Design | Width

Based on user demand, separations of users and modes, and physical constraints

- International minimums: 10 ft (bidirectional) and 6.5-8.5 ft (unidirectional)

#### Recommended Widths for Bidirectional BHs

- Preferred for Bike/Rolling/Fast path: 14 ft.
- Preferred for Ped/Slow path: 14 ft.
- Minimum for shared path: 8 ft.
- Preferred for shared path: 16 ft.





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**Facility Design | Grade**  
Slope - affects safety and comfort

- Maximum of 5% if pedestrian route
- International maximum: 6%

**Recommended Grade for BHs**

- Maximum: 5%
- Sustained grades: Limited to 2%



*Bike Highway in Bogota, Photo: Maurits Lopez Cardozo*



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**Facility Design |**  
Route Identification  
and Wayfinding

Provides sense of safety,  
security and comfort, and  
improves coherency of network



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**Facility Design | Lighting**

Increases actual and perceived safety

- Particularly important at crossings

**Recommended Illumination for BHs**

- Minimum: 7 lux\*



*Bike Highway in the Netherlands. Photo: Maurits Lopez Cardozo*

\* HDM 1000.18



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**Facility Design | Materials and Surface**

Important for user comfort and safety

- International guidance: smooth, well-drained surfaces free of inconsistencies (often concrete/asphalt)

**Recommended Surfaces for BHs**

- Stable, firm, slip resistant
- Well-drained



*Bike Highway in Amsterdam utilizes different surfaces to delineate user areas. Photo: Maurits Lopez Cardozo*



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**Facility Design | Intersections and Crossings**

Important for efficient, low-effort BHs

International guidance:

- Advance bicycle detection
- Green wave signal timing
- Protected intersections
- Grade separated crossings



*Bike Highway crossing in Rotterdam. Photo: Maurits Lopez Cardozo*



BIKE HIGHWAYS DESIGN CONSIDERATION  
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**Facility Design | Transitions**

Moving from a BH to another facility

- Must be intuitive for users

**Recommended Transition Principles**

- Minimize conflict exposure
- Reduce speeds at conflict points
- Communicate ROW priority
- Provide adequate sight distances



*Bike Highway in Denmark. Photo: Maurits Lopez Cardozo*



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### Facility Design | Amenities

Increase attractiveness, comfort and enjoyment

International examples:

- Bicycle tools and lockers
- Seating and water fountains
- Trash and recycling receptacles
- Shared mobility resources
- Landscaping



Bike parking along a Bike Highway in the Netherlands. Photo: Maurits Lopez Cardozo



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