Dynamic Hard Shoulder Running

Lessons Learned from the US and UK Experience

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Overview

• What is Hard Shoulder Running?
• HSR in the US
• Washington State DOT Experience
• HSR in the UK
• Considerations for Implementation in Ohio
What is Hard Shoulder Running (HSR)?

1. Conversion of an existing hard shoulder as a running lane, to provide additional capacity.

2. An alternative to road widening that provides:
   - similar capacity and throughput
   - greater trip time reliability
     - no loss of safety
     - the ability to remotely close lane(s), when needed
     - construction and operational cost savings
     - environmental benefits (air quality; noise)
     - significantly faster deployment (no need for land take)
WSDOT and HSR
Why This Corridor?

**I-405 adds shoulder lane**

A new peak hours shoulder lane on northbound I-405, between Highway 527 and I-5, eases some of the congestion caused when the freeway narrows to three lanes in Bothell, but doesn't eliminate the bottleneck.

**New peak-hours shoulder lane**

- **Express toll lanes**
  - Single toll lane
  - Two toll lanes

- **Direct access ramps**

**Sources:** Esri, WSDOT

EMILY M. ENG / THE SEATTLE TIMES

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Components of WSDOT HSR

**Technology**
- Four (4) Installations at ½ mile spacing
- Over-Head Lane Control Sign
- Side Mounted VMS
- Static Signing
- CCTV Cameras
- Vehicle Detection
- UPS

**Civil Infrastructure**
- 11’ wide shoulder lane, with 2’ shy distance to barrier
- Narrowing of other lanes to 11’
- Re-striping
- Refuge/Pullout Areas
- Limited paving
• Based on existing Active Traffic Management software

*Photos Courtesy WSDOT Flickr Site*
Operations and Messaging

Shoulder Open

Shoulder Closed

LCS

SMS
I-405 Implemented System
Safety

- CCTV Coverage of entire shoulder
- Video sweep of shoulder prior to opening
- Queue warning, limited sight distance
- Refuge areas
## Travel Time SR522 to I-5

<table>
<thead>
<tr>
<th>Lane Type</th>
<th>Without HSR</th>
<th>With HSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Purpose</td>
<td>20 mins</td>
<td>12 mins</td>
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<tr>
<td>Express Toll Lanes</td>
<td>10 mins</td>
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**Without HSR:**
- **General Purpose:** 20 mins
- **Express Toll Lanes:** 10 mins

**With HSR:**
- **General Purpose:** 12 mins
- **Express Toll Lanes:** 8 mins
Experience In UK
**Evolution of the Design**

<table>
<thead>
<tr>
<th>Controlled Motorways</th>
<th>• Introduced in 1995, near London Heathrow airport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Traffic Management (Pilot)</td>
<td>• Opened in 2006 – used to prove the concept of hard shoulder use</td>
</tr>
<tr>
<td>Managed Motorways: Dynamic Hard Shoulder</td>
<td>• Rollout began in 2009: 7 locations now operational</td>
</tr>
<tr>
<td>Smart Motorways: All Lanes Running</td>
<td>• First scheme opened 2014. 10 locations now operational, +25 in design/construction</td>
</tr>
</tbody>
</table>

In total, 240 miles (480 lane miles) of extra capacity by 2020
England – Initial Dynamic Hard Shoulder Design

CCTV  AMS Signs  Motorway Lighting  Lightweight Gantries

SOS Phone  ERA  HSR  AMI signs with Enforcement  Sensors

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England - “All Lanes Running” design
The Dynamic Hard Shoulder design (2009 – 2012)

**Physical**
- Signal gantries every ~800 m
- ERA’s co-located with gantries
- No additional lighting to be installed

**Technological**
- Lane specific signalling + VMS for text
- Fixed cameras to check hard shoulder
- AID and full PTZ coverage

**Operational**
- Hard shoulder opened when flow trigger reached
- 60 mph speed limit when DHS open
- Hard shoulder check before opening
Key Results from the Pilot

- Peak hours journey times down 10 - 25%; variability down 22%
- Personal Injury Accidents down 58%
- Emissions down by 10%, fuel consumption down by 4%
- 94% compliance with variable speed limits
- Improved incident management
Considerations for HSR in Ohio

- Safety and Mobility Benefits
- System Start-Up
- Frequency of Signing
- HSR End Treatments
- Speed Limit Enforcement
- Incident Management
Questions?
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