

Excerpts from:

Preliminary Investigation

Caltrans Division of Research and Innovation

Produced by CTC & Associates LLC

Effects of Outdoor Advertising Displays on Driver Safety

Requested by

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The Caltrans Division of Research and Innovation (DRI) receives and evaluates numerous research problem statements for funding every year. DRI conducts Preliminary Investigations on these problem statements to better scope and prioritize the proposed research in light of existing credible work on the topics nationally and internationally. Online and print sources for Preliminary Investigations include the National Cooperative Highway Research Program (NCHRP) and other Transportation Research Board (TRB) programs, the American Association of State Highway and Transportation Officials (AASHTO), the research and practices of other transportation agencies, and related academic and industry research. The views and conclusions in cited works, while generally peer reviewed or published by authoritative sources, may not be accepted without qualification by all experts in the field.

- The message change interval should not exceed 2 s.
- The displayed image should remain static from the moment it first appears until the moment it is changed.
- No animation, flashing or moving lights should be allowed.
- No message or image that could be mistaken for a traffic control signal should be displayed.
- Messages should be simple and concise.

United States

New York State

Regulations proposed in 2008 include:

- Minimum message duration of 62 seconds, so that no motorist would be able to see more than one message change as he or she approached any particular changeable electronic variable message sign.
- Message transition time should be instantaneous to minimize distraction.
- Minimum spacing between changeable electronic variable message sign is 5,000 feet.
- Maximum changeable electronic variable message sign brightness of 5,000 cd/m² in daylight and 280 cd/m² at night.
- Prohibited locations:
 - On interstate and controlled access highways: Within 1,100 feet of an interchange, at-grade intersection, toll plaza, signed curve or lane merge/weave area; within 5,000 feet of another changeable electronic variable message sign or official traffic device that has changeable messages.
 - On primary highways: Within 1,100 feet of an entrance or exit from a controlled access highway, a signed curve or a lane/merge area; within 5,000 feet of another changeable electronic variable message sign or official traffic control device with changeable messages.

Revised criteria made these requirements less restrictive, reducing message duration from 62 to 6 seconds and changing spacing requirements and prohibited locations. The requirements for instantaneous message transition and maximum brightness did not change.

San Antonio, TX

Regulations for a trial evaluation of 15 off-premise digital signs included a message duration time of 10 seconds; change intervals of one second or less; brightness less than or equal to 7,000 nits during the day and 2,500 nits at night; and various other regulations. (One nit = one candela per square meter.)

Flowery Branch, GA

Regulations in this community begin on page 138 of the report and include:

- Minimum message duration: to the amount of time that would result in one message per mile at the highest speed limit posted within the 5000 feet approaching the sign for the road from which the sign is to be viewed.
- Transition time: less than one-tenth of a second, with no animated transitions.
- Illumination and brightness: not greater than 12 foot-candles from the nearest point of the road.
- Freezing of the display on malfunction.
- Prohibition of message sequencing.

Oakdale, MN

Brightness is limited to 2,500 nits during the day and 500 nits at night, with adjustments for ambient light conditions and a minimum display duration of 60 seconds.

State Regulations

State and Local Regulation Summaries

State Changeable Message Chart, Outdoor Advertising Association of America, undated.
http://www.superliciousdesign.com/ledmedia/State_Changeable_Message.pdf (or see [Appendix A](#)).

This chart summarizes changeable message advertising sign regulations for 46 states:

- Three states (New Hampshire, North Dakota and Wyoming) do not allow these signs.
- Five states (Maryland, Massachusetts, Oregon, Texas and Washington) allow tri-action signs only.
- Thirty-eight states allow changeable message signs. Of these, 19 states (California, Colorado, Connecticut, Delaware, Florida, Georgia, Indiana, Kansas, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oklahoma, Tennessee, Utah, Virginia and Wisconsin) have statutes; 10 states (Arkansas, Idaho, Illinois, Iowa, Louisiana, Nebraska, Nevada, North Carolina, South Carolina and West Virginia) have regulations; seven states (Alaska, Arizona, Kentucky, Montana, New Mexico, Rhode Island and South Dakota) have interpretations of the federal/state agreement; and two states (Mississippi and Pennsylvania) have policy memoranda.

The document categorizes each of these states by regulations for minimum message duration (“dwell time”—generally from 4 to 10 seconds, with 6 or 8 seconds most common); maximum interval between messages (typically from 1 to 4 seconds), and spacing (500 feet is most common). It is unclear how up-to-date these regulations are; we were unable to determine the date for this chart or obtain the latest information from the OAAA, which requires paid registration for access.

The Regulation of Signage: Guidelines for Local Regulation of Digital On-Premise Signs, Menelaos Triantafyllou, Alan C. Weinstein, National Signage Research and Education Conference, 2010.

<http://www.thesignagefoundation.org/LinkClick.aspx?fileticket=3inv%2fFyrpFk%3d&tabid=59&mid=468>

From the report: Based on a recent survey of numerous jurisdictions by one of the authors, the most common regulatory provisions applicable to digital on-premise signs appear below:

- Require that the sign display remain static for a minimum of 5-8 seconds and require “instantaneous” change of the display; i.e., no “fading” in/out of the message.
- Prohibit scrolling and animation outside of unique—and mostly pedestrian-oriented—locations.
- Limit brightness to 5,000 nits during daylight and 500 nits at night.
- Require automatic brightness control keyed to ambient light levels.
- Require display to go dark if there is a malfunction.
- Specify distancing requirements from areas zoned for residential use and/or prohibit orientation of sign face towards an area zoned for residential use.

See also Appendices B and C in Research Review of Potential Safety Effects of Electronic Billboards on Driver Attention and Distraction in **Related Research** for an overview of state regulations and practices as of 2001.

Survey of Current State Regulations

We found digital display regulations for 12 states. These regulations are summarized in the following table and then detailed by state.

| State | Duration ≥ | Inter- val ≤ | Brightness/ Illumination | Font Size | Visual Effects | Sequencing | Spacing | Locations | Billboard Size |
|-----------|---------------|-----------------|--|---|--|----------------|--|---|-------------------|
| DE | 10s | 1s | Must appropriately adjust display brightness as ambient light levels change. | Size not specified. A sign that attempts or appears to attempt to direct the movement of traffic or which contains wording, color, shapes, or likenesses of official traffic control devices is prohibited. | May not contain or display any lights, effects, or messages that flash, move, appear to be animated or to move, scroll, or change in intensity during the fixed display period | Prohibited. | >2,500ft from another VMS >500ft from a static sign | Permitted within 660ft of the edge of the right-of-way of any interstate or federal-aid primary highway. > 1,000ft from an interchange, interstate junction of merging or diverging traffic, or an at-grade intersection. May not be placed along designated Delaware byways. | Not specified. |
| FL | 6s | 2s | Lighting which causes glare or impairs the vision of the driver of any motor vehicle, or which otherwise interferes with any driver's operation of a motor vehicle is prohibited. A sign may not be illuminated so that it interferes with the effectiveness of, or obscures, an official traffic sign, signal or device. Lighting may not be added to or increased on a nonconforming sign. | Not specified. | Flashing, intermittent, rotating, or moving lights are prohibited. Instantaneous transition for entire sign face required. | Not specified. | Not specified. | Not specified. | Not specified. |

| State | Duration ≥ | Inter- val ≤ | Brightness/ Illumination | Font Size | Visual Effects | Sequencing | Spacing | Locations | Billboard Size |
|-------|---------------|-----------------|--|----------------|--|--------------------------------|--|----------------|-------------------|
| GA | 10s | 3s | <p>Must be effectively shielded so as to prevent beams or rays of light from being directed at any portion of the traveled way, which beams or rays are of such intensity or brilliance as to cause glare or to impair the vision of the driver of any motor vehicle or which otherwise interfere with the operation of a motor vehicle.</p> <p>Must not obscure or interfere with the effectiveness of an official traffic sign, device, or signal.</p> | Not specified. | May not contain flashing, intermittent, or moving light or lights except those giving public service information such as time, date, temperature, weather. | Not specified. | >5,000ft from another multiple message sign. | Not specified. | Not specified. |
| IA | 8s | 1s | The intensity of the illumination may not cause glare or impair the vision of the driver of any motor vehicle or otherwise interferes with any driver's operation of a motor vehicle. | Not specified. | No traveling messages (e.g., moving messages, animated messages, full-motion video, or scrolling text messages) or segmented messages are allowed. | No segmented messages allowed. | <p>>500ft from another LED display facing the same way in cities.</p> <p>>1000ft in rural areas.</p> | Not specified. | Not specified. |
| KS | 8s | 2s | Must be effectively shielded so as to prevent beams or rays of light from being directed at any portion | Not specified. | Cannot contain or display flashing, intermittent or moving lights, including | Not specified. | >1000ft from another CMS. | Not specified. | Not specified. |

| State | Duration ≥ | Inter- val ≤ | Brightness/ Illumination | Font Size | Visual Effects | Sequencing | Spacing | Locations | Billboard Size |
|-----------|---------------|-----------------|---|----------------|--|----------------|--|----------------|-------------------|
| | | | <p>of the traveled way of any interstate or primary highway and are of such intensity or brilliance as to cause glare or to impair the vision of the driver of any motor vehicle or to otherwise interfere with any driver's operation of a motor vehicle.</p> <p>Must not be so illuminated that they obscure any official traffic sign, device or signal, or imitate or may be confused with any official traffic sign, device or signal.</p> | | <p>animated or scrolling advertising.</p> | | | | |
| MA | 10s | 0s | <p>Must automatically adjust the intensity of its display according to natural ambient light conditions.</p> <p>May not cause beams or rays of light from being directed at any portion of the traveled way, which beams or rays are of such intensity or brilliance as to cause glare or to impair the vision of the driver of any motor vehicle or otherwise interfere with the operation of a motor</p> | Not specified. | <p>May not contain flashing, intermittent, or moving lights; or display animated, moving video, scrolling advertising; or consist of a static image projected upon a stationary object.</p> <p>May not display illumination that moves, appears to move or changes in intensity during</p> | Not specified. | <p>>500ft from any sign.</p> <p>>2000ft from another off premise electronic sign on the same side of the highway.</p> <p>>1000ft from another off premise electronic sign on the opposite side of the</p> | Not specified. | Not specified. |

| State | Duration ≥ | Inter- val ≤ | Brightness/ Illumination | Font Size | Visual Effects | Sequencing | Spacing | Locations | Billboard Size |
|-----------|---------------|-----------------|--|----------------|---|----------------|---------------------------|----------------|-------------------|
| | | | vehicle. May not obscure or interfere with the effectiveness of an official traffic sign, device or signal, or cause an undue distraction to the traveling public | | the static display period. This does not include changes to a display for time, date and temperature. | | highway. | | |
| NY | 6s | 3s | Not specified. | Not specified. | Not specified. | Not specified. | Not specified. | Not specified. | Not specified. |
| OH | 8s | 3s | Not specified. | Not specified. | A multiple message or variable message advertising device shall not be illuminated by flashing, intermittent, or moving lights. No multiple message or variable message advertising device may include any illumination which is flashing, intermittent, or moving when the sign face is in a fixed position. | Not specified. | >1000ft from another MMS. | Not specified. | Not specified. |
| OR | 8s | 2s | Must operate at an intensity level of not more than 0.3 foot-candles over ambient light as measured by the distance to the sign | Not specified. | No flashing or varying intensity light; cannot create the appearance of movement. | Not specified. | Not specified. | Not specified. | Not specified. |

| State | Duration ≥ | Inter- val ≤ | Brightness/ Illumination | Font Size | Visual Effects | Sequencing | Spacing | Locations | Billboard Size |
|-----------|---|-----------------|--|----------------|---|----------------|---------------------------|----------------|-------------------|
| | | | depending upon its size (150 feet if the display surface of the sign is 12 feet by 25 feet, 200 feet if the display surface is 10.5 by 36 feet, and 250 feet if the display surface is 14 by 48 feet). | | | | | | |
| TN | 8s | 2s | Not specified. | Not specified. | Video, animation, and continuous scrolling messages are prohibited. | Not specified. | >2000ft from another CMS. | Not specified. | Not specified. |
| WS | A single message or a message segment must have a static display time of at least two seconds after moving onto the signboard, with all segments of the total message to be displayed within ten seconds. | 4s | No electronic sign lamp may be illuminated to a degree of brightness that is greater than necessary for adequate visibility. In no case may the brightness exceed 8,000 nits or equivalent candelas during daylight hours, or 1,000 nits or equivalent candelas between dusk and dawn. Signs found to be too bright shall be adjusted as directed by the department. | Not specified. | Displays may travel horizontally or scroll vertically onto electronic signboards, but must hold in a static position for two seconds after completing the travel or scroll. Displays shall not appear to flash, undulate, or pulse, or portray explosions, fireworks, flashes of light, or blinking or chasing lights. Displays shall not appear to move toward or away from the viewer, | Not specified. | Not specified. | Not specified. | Not specified. |

| State | Duration ≥ | Inter- val ≤ | Brightness/ Illumination | Font Size | Visual Effects | Sequencing | Spacing | Locations | Billboard Size |
|-----------|---|-----------------|---|----------------|--|-------------------|----------------|----------------|-------------------|
| | A one- segment message may remain static on the signboard with no duration limit. | | | | expand or contract, bounce, rotate, spin, twist, or otherwise portray graphics or animation as it moves onto, is displayed on, or leaves the signboard. | | | | |
| WI | 6s | 1s | No variable message sign lamp may be illuminated to a degree of brightness that is greater than necessary for adequate visibility. | Not specified. | No flashing, intermittent or moving light. Traveling messages prohibited. | Not specified. | Not specified. | Not specified. | Not specified. |

- (B) 200 feet for 10.5' x 36'.
- (C) 250 feet for 14' x 48'.

Tennessee

Control of Outdoor Advertising, Chapter 1680-2-3, Rules of Tennessee Department of Transportation Maintenance Division, Tennessee Department of Transportation, February 2003.

Current regulations do not include electronic billboards:

<http://www.tdot.state.tn.us/environment/beautification/pdf/1680-02-03.pdf>.

However, proposed revisions are under review that include guidance on digital displays:

<http://www.tdot.state.tn.us/environment/beautification/docs/Revised-ODA-Rules-Redline.pdf>.

From the web site:

1680-10-01-.03 CRITERIA FOR THE CONTROL OF OUTDOOR ADVERTISING DEVICES.

4. Spacing

(i) (IV) The minimum spacing for changeable message signs with a digital display is two thousand (2,000) feet, except as follows:

- I. An outdoor advertising device that uses a digital display which does not exceed one hundred (100) square feet in total area to give public information such as time, date, temperature, or weather, or to provide the price of a product, the amount of a lottery prize or similar numerical information supplementing the content of a message otherwise displayed on the sign face shall not be subject to the two thousand (2,000) feet minimum spacing requirement in this item (IV).

5. Changeable Message Signs

Changeable message signs are permissible, subject to the following restrictions: (i) The message display time shall remain static for a minimum of eight (8) seconds with a maximum change time of two (2) seconds. (ii) Video, animation, and continuous scrolling messages are prohibited. (iii) Non-conforming devices shall not be converted to a changeable message sign. (iv) The changeable message sign shall contain a default design that will freeze the sign face to one position if a malfunction occurs. (v) The structure for a changeable message sign may contain sign faces that are in a double-faced, back-to-back, or V-type configuration. (vi) The minimum spacing for changeable message signs with a digital display is as provided in Rule 1680-10-.03(1)(a)4.(i)(IV).

Washington

Highway Advertising Control, M22-95, Washington State Department of Transportation, March 2011.

<http://www.wsdot.wa.gov/publications/manuals/fulltext/M22-95/HighwayAdvertisingControl.pdf>

From the report:

468-66-050 Sign classifications and specific provisions

(3) Type 3 – On-premise signs.

(b) Type 3(b) – Business complex on-premise sign. A Type 3(b) business complex on-premise sign may display the name of a shopping center, mall, or business combination.

- (i) Where a business complex erects a Type 3(b) on-premise sign, the sign structure may display additional individual business signs identifying each of the businesses conducted on the premises. A Type 3(b) on-premise sign structure may also have attached a display area, such as a manually changeable copy panel, reader board, or electronically changeable message center, for advertising on-premise activities and/or presenting public service information.

- (g) Electronic signs may be used only as Type 3 on-premise signs and/or to present public service information, as follows:
 - (i) Advertising messages on electronic signboards may contain words, phrases, sentences, symbols, trademarks, and logos. A single message or a message segment must have a static display time of at least two seconds after moving onto the signboard, with all segments of the total message to be displayed within ten seconds. A one-segment message may remain static on the signboard with no duration limit.
 - (ii) Displays may travel horizontally or scroll vertically onto electronic signboards, but must hold in a static position for two seconds after completing the travel or scroll.
 - (iii) Displays shall not appear to flash, undulate, or pulse, or portray explosions, fireworks, flashes of light, or blinking or chasing lights. Displays shall not appear to move toward or away from the viewer, expand or contract, bounce, rotate, spin, twist, or otherwise portray graphics or animation as it moves onto, is displayed on, or leaves the signboard.
 - (iv) Electronic signs requiring more than four seconds to change from one single message display to another shall be turned off during the change interval.
 - (v) No electronic sign lamp may be illuminated to a degree of brightness that is greater than necessary for adequate visibility. In no case may the brightness exceed 8,000 nits or equivalent candelas during daylight hours, or 1,000 nits or equivalent candelas between dusk and dawn. Signs found to be too bright shall be adjusted as directed by the department.

- (h) The act does not regulate Type 3(a), 3(b), 3(c), and 3(d) on-premise signs located along primary system highways inside an incorporated city or town or a commercial or industrial area.

Wisconsin

Control of Outdoor Advertising Along and Visible from Highways on the Interstate and Federal-Aid Primary Systems, Chapter Trans 201, Wisconsin Administrative Code, February 2005.

http://docs.legis.wisconsin.gov/code/admin_code/trans/201.pdf

From the web site:

Trans 201.15 – Electronic signs

(3) Variable Message Signs.

- (c) No message may be displayed for less than one-half second.
- (d) No message may be repeated at intervals of less than 2 seconds.
- (e) No segmented message may last longer than 10 seconds.
- (f) No traveling message may travel at a rate slower than 16 light columns per second or faster than 32 columns per second.
- (g) No variable message sign lamp may be illuminated to a degree of brightness that is greater than necessary for adequate visibility.

(4) Multiple Message Signs.

- (a) The louver rotation time to change a message shall be one second or less.
- (b) The time a message remains in a fixed position shall be 6 seconds or more.

84.30 Regulation of Outdoor Advertising, Wisconsin Legislative Documents, 2012.

<http://docs.legis.wisconsin.gov/statutes/statutes/84/30>

From the web site:

- (3)(c)(1) Signs that contain, include or are illuminated by any flashing, intermittent or moving light or lights are prohibited, except electronic signs permitted by rule of the department.

(4)(bm) Signs may contain multiple or variable messages, including messages on louvers that are rotated and messages formed solely by use of lights or other electronic or digital displays, that may be changed by any electronic process, subject to all of the following restrictions:

1. Each change of message shall be accomplished in one second or less.
2. Each message shall remain in a fixed position for at least 6 seconds.
3. The use of traveling messages or segmented messages is prohibited.
4. The department, by rule, may prohibit or establish restrictions on the illumination of messages to a degree of brightness that is greater than necessary for adequate visibility.

APPENDIX

State Changeable Message Chart (Source: OAAA State Statute Matrix)

**No changeable
message
signs allowed:**

(3 STATES)
ND, NH, WY

Tri- action Only

(5 STATES)
MD, MA, OR,
TX, WA,

**Changeable Message
/Digital Technology**

(38 STATES)
AL, AR, AZ, CA, CO, CT
DE, FL, GA, ID, IL, IA, IN,
KS, KY, LA, MI, MN, MO,
MS, MT, NE, NV, NJ, NM,
NY, NC, OH, OK, PA, RI,
SC, SD, TN, UT, VA, WV, WI

State-by-state breakdown of the 38 states allowing Changeable Message/Digital technology

- States which have statutes (19):

CA, CO, CT, DE, FL
GA, IN, KS, MI, MO
MN, NJ, NY, OH
OK, UT, TN, VA, WI

- Regulations (10):

AR, ID, IL, IA*, LA, NE,
NV, NC, SC, WV

- States with interpretations of the federal/state agreement (7):

AL, AZ, KY, MT,
NM, RI, SD

- Policy memoranda (2):

MS approved a policy DOT memorandum
PA approved the technology through an internal PENNDOT memorandum (2002)
IA* regulations are undergoing a comment period

OAAA Changeable Message Criteria
Dwell Time Sequence – By State

| <u>Dwell Time (Static Message)</u> | <u>State</u> |
|---|--|
| <u>4 seconds</u> | CA, CO, IA, VA |
| <u>5 seconds</u> | NM, PA |
| <u>6 seconds</u> | AL, AZ, CT, FL, GA, IA, MI, MN, NV, NY, SD, WI, RI (average) |
| <u>8 seconds</u> | AR, ID, IN, KS, LA, MO, MS, NJ, NC, OH, OK, OR, SC, TN, UT, WV, WA |
| <u>10 seconds</u> | DE, IL, NE, MD, TX |
| <u>Other/State-Company Discretion</u> | KY, MA, MT |

Dwell and Twirl Times for message changes and spacing criteria

States Allowing Changeable Message/Digital Technology

| <u>State</u> | <u>Dwell time</u> | <u>Twirl time</u> | <u>Spacing</u> <small>*traditional 500 ft</small> |
|--------------|-------------------|-------------------|--|
| AL | 6 seconds | | |
| AR | 8 seconds or more | 2 seconds or less | 1500 feet |
| AZ | 6 seconds | 1 second | * |
| CA | 4 seconds | 4 seconds | 1000 feet |
| CO | 4 seconds | 1 second | 1000 feet |
| CT | 6 seconds | 3 seconds | * |
| DE | 10 seconds | 1 second | 2500 feet |
| FL | 6 seconds | 2 seconds | 1000 to 1500 feet |
| GA | 10 seconds | 2 seconds | 5000 feet |

Dwell and Twirl Times for message changes and spacing criteria (cont'd)

States Allowing Changeable Message Including Electronics

| <u>State</u> | <u>Dwell time</u> | <u>Twirl time</u> | <u>Spacing</u> |
|--|-----------------------------------|--------------------------|-----------------------|
| ID | 8 seconds | 2 seconds | * |
| IL | 10 seconds | 3 seconds | * |
| IN | 8 seconds | 2 seconds | * |
| IA | 6 seconds | 1 second | * |
| KS | 8 seconds | 2 seconds | 1000 feet |
| KY | <u>At discretion of state DOT</u> | | |
| LA | 8 seconds | 4 seconds | * |
| MI | 6 seconds | 1 second | * |
| MN | 6 seconds | none | * |
| MS | 8 seconds | instantaneous | * |
| MO | 8 seconds | 2 seconds | 1400 feet |
| MT | <u>At discretion of state DOT</u> | | |
| NE | 10 seconds | 2 seconds | 5000 feet |
| NV | 6 seconds | 3 seconds | * |
| *NJ <u>(regulatory change pending)</u> | 8 seconds | 1 second | 3000 feet |
| NM <u>Company discretion</u> | 5 seconds | 1-2 seconds | * |
| NY | 6 seconds | 3 seconds | * |
| NC | 8 seconds | 2 seconds | 1000 feet |
| OH | 8 seconds | 3 seconds | 1000 feet |
| OK | 8 seconds | 4 seconds | * |

Dwell and Twirl Times for message changes and spacing criteria (cont'd)

States Allowing Changeable Message Including Electronics

| <u>State</u> | <u>Dwell time</u> | <u>Twirl time</u> | <u>Spacing</u> |
|-----------------------------------|--------------------------|--------------------------|-----------------------|
| PA | 5 seconds | 1 second | * |
| RI | 5-7 seconds | 2-3 seconds | * |
| <small>Company discretion</small> | | | |
| SD | 6 seconds | none | * |
| SC | 8 seconds | 2-3 seconds | * |
| TN | 8 seconds | 2 seconds | 2000 feet |
| UT | 8 seconds | 3 seconds | * |
| VA | 4 seconds | none | * |
| WV | 8 seconds | 2 seconds | 1500 feet |
| WI | 6 seconds | 1 second | * |

States Allowing Changeable Message Including Electronics

Tri-action Only

| <u>State</u> | <u>Dwell time</u> | <u>Twirl time</u> | <u>Spacing</u> |
|---------------------------------|--------------------------|--------------------------|-----------------------|
| MD | 10 seconds | 4 seconds | * |
| MA | none | none | * |
| OR | 8 seconds | 4 seconds | 1000 feet |
| TX | 10 seconds | 2 seconds | * |
| <small>Rural Roads Only</small> | | | |
| WA | 8 seconds | 4 seconds | * |