Drop Lanes vs. Lane Reductions

2015 TRANSPORTATION CONFERENCE
FEBRUARY 10, 2015
Items of emphasis

Compare and contrast two conditions
Lane Reductions on Conventional Roadways
Lane Reductions on Interstates
Lane Drops on Interstates/Expressways
Lane Drops at Intersections
Why the emphasis on this?

Because we have MANY locations around the state where markings for lane reductions and lane drop situations do not match MUTCD or ALDOT guidelines.

Because this inconsistency may be confusing to drivers who encounter different markings applied under the same condition.

Because the AASHTO ‘Green Book’ has muddied the waters with the terminology it uses, likely confusing designers.

Because Mr. Lorentson, Deputy Director of Operations, has brought it to our attention.
What’s the difference
Lane reduction vs. Dropped Lane?

Lane reduction is where the number of through lanes is reduced because of narrowing of the roadway.

Dropped Lane—a through lane that becomes a mandatory turn lane on a conventional roadway or becomes a mandatory exit lane on a freeway or expressway.  NOTE: this is NOT the same as a standard left or right turn lane with taper.
Contrast Reduce and Drop

- Reduce:
  - Remain on facility
  - Taper present
  - Absence of markings

- Drop:
  - Exit or turn required
  - Leave facility
  - Drop markings
  - No taper

- Merge Required

- Absence of markings 3-5
Are these new methods of markings?

Yes and No....depending on the condition.
Lane reductions
1948 MUTCD vs. 2009 MUTCD

Figure 3B-14. Examples of Applications of Lane-Reduction Transition Markings

A – Lane reduction

B – Lane reduction with lateral shift to the left

Notes:
1. Lane-reduction arrows are optional for speeds of less than 45 mph
2. See Section 3P.04 for delineator spacing
3. L = W0 for speeds of 45 mph or greater and L = W5/60 for speeds of less than 45 mph, where
   L = Length of taper in feet
   S = Posted, 85th-percentile, or statutory speed in mph
   W = Offset in feet
4. d = Advance warning distance (see Section 2C.05)
A. FROM 3 LANES TO 2 LANES

B. FROM 4 LANES TO 3 LANES

C. FROM 4 LANES TO 2 LANES

Figure 14.—Typical pavement-width transition markings.
**Figure 3B-12. Examples of Lane Reduction Markings**

a - From 3 lanes to 2 lanes

b - From 4 lanes to 3 lanes

c - From 4 lanes to 2 lanes

\[ L = \text{Length in meters (feet)} \]
\[ S = \text{Posted, 85th-percentile, or statutory speed in km/h (mph)} \]
\[ W = \text{Offset in meters (feet)} \]
\[ d = \text{Advance warning distance (see Section 2C.05)} \]

For speeds 70 km/h (45 mph) or more:
\[ L = 0.62 WS \quad (L=WS) \]

For speeds less than 70 km/h (45 mph):
\[ L = \frac{WS^2}{195} \quad \left( L = \frac{WS^2}{68} \right) \]

See Section 3D.04 for delineator spacing.
Figure 3B-14. Examples of Applications of Lane-Reduction Transition Markings

A – Lane reduction

B – Lane reduction with lateral shift to the left

Notes:
1. Lane-reduction arrows are optional for speeds of less than 45 mph
2. See Section 3F.04 for delineator spacing
3. L = WS for speeds of 45 mph or greater and L = WS^2/60 for speeds of less than 45 mph, where:
   L = Length of taper in feet
   S = Posted, 85th-percentile, or statutory speed in mph
   W = Offset in feet
4. d = Advance warning distance (see Section 2C.05)
Figure 3B-24. Examples of Standard Arrows for Pavement Markings

A - Through Lane-Use Arrow

B - Turn Lane-Use Arrow

C - Turn and Through Lane-Use Arrow

D - Wrong-Way Arrow

E - Wrong-Way Arrow Using Retroreflective Raised Pavement Markers

F - Lane-Reduction Arrow

Where a lane reduction transition occurs on a roadway with a speed limit of 45 mph or more, the lane-reduction arrow markings shown in Drawing F in Figure 3B-24 should be used (see Figure 3B-14). Except for acceleration lanes, where a lane-reduction transition occurs on a roadway with a speed limit of less than 45 mph, the lane-reduction arrow markings shown in Drawing F in Figure 3B-24 should be used if determined to be appropriate based on engineering judgment.

Option:

Lane-reduction arrow markings may be used in long acceleration lanes based on engineering judgment.
LANE Reduction Markings
So what should it look like when done correctly?

No difference between interstate and conventional roadway application according to MUTCD and ALDOT guidelines
Figure 3B-14. Examples of Applications of Lane-Reduction Transition Markings

A – Lane reduction

B – Lane reduction with lateral shift to the left

Notes:
1. Lane-reduction arrows are optional for speeds of less than 45 mph
2. See Section 3F.04 for delineator spacing
3. \( L = WS \) for speeds of 45 mph or greater and \( L = WS^2/60 \) for speeds of less than 45 mph, where:
   - \( L = \) Length of taper in feet
   - \( S = \) Posted, 85th-percentile, or statutory speed in mph
   - \( W = \) Offset in feet
4. \( d = \) Advance warning distance (see Section 2C.05)
Where a lane-reduction transition occurs on a roadway with a speed limit of 45 mph or more, the lane-reduction arrow markings shown in Drawing F in Figure 3B-24 should be used (see Figure 3B-14). Except for acceleration lanes, where a lane-reduction transition occurs on a roadway with a speed limit of less than 45 mph, the lane-reduction arrow markings shown in Drawing F in Figure 3B-24 should be used if determined to be appropriate based on engineering judgment.

Lane-reduction arrow markings may be used in long acceleration lanes based on engineering judgment.
Are there examples of non-conforming lane reduction markings???
~800-825 feet
Example: Lane reduction
Signing and markings

Calculations

- **Given:** $S=70$ mph freeway
  12 ft. lane to be reduced NB
- **Solve:**
  - $d=1250$ ft. (From Table 2C-4)
    Warning Sign Placement
  - $L= WS= 12\text{ft.} \times 70$
    $= 840$ ft

Therefore, broken lane line ends at
  - $\frac{1}{4}d = 1250\text{ft.}/4 = 313$ ft

![Diagram of lane reduction and markings]

Expectation, preview distance need, PRT
Section 3B.09  Lane-Reduction Transition Markings

Support:
01  Lane-reduction transition markings are used where the number of through lanes is reduced because of narrowing of the roadway or because of a section of on-street parking in what would otherwise be a through lane. Lane-reduction transition markings are not used for lane drops.

Standard:
02  Except as provided in Paragraph 3, where pavement markings are used, lane-reduction transition markings shall be used to guide traffic through transition areas where the number of through lanes is reduced, as shown in Figure 3B-14. On two-way roadways, no-passing zone markings shall be used to prohibit passing in the direction of the convergence, and shall continue through the transition area.

Option:
03  On low-speed urban roadways where curbs clearly define the roadway edge in the lane-reduction transition, or where a through lane becomes a parking lane, the edge line and/or delineators shown in Figure 3B-14 may be omitted as determined by engineering judgment.

Guidance:
04  For roadways having a posted or statutory speed limit of 45 mph or greater, the transition taper length for a lane-reduction transition should be computed by the formula \( L = WS \). For roadways where the posted or statutory speed limit is less than 45 mph, the formula \( L = WS^2/60 \) should be used to compute the taper length.

Support:
05  Under both formulas, \( L \) equals the taper length in feet, \( W \) equals the width of the offset distance in feet, and \( S \) equals the 85\(^{th}\)-percentile speed or the posted or statutory speed limit, whichever is higher.

Guidance:
06  Where observed speeds exceed posted or statutory speed limits, longer tapers should be used.
If S=75 MPH based on 85\(^{th}\) %, then:

L would be 900 ft

d would be 1350 ft

\(\frac{1}{4}d\) would be 337.5 ft
So how do you correct these situations???
Figure 3B-14. Examples of Applications of Lane-Reduction Transition Markings

A – Lane reduction

B – Lane reduction with lateral shift to the left

Notes:
1. Lane-reduction arrows are optional for speeds of less than 45 mph
2. See Section 3F.04 for delineator spacing
3. \( L = WS \) for speeds of 45 mph or greater and \( L = WS^2/60 \) for speeds of less than 45 mph, where:
   - \( L \) = Length of taper in feet
   - \( S \) = Posted, 85th-percentile, or statutory speed in mph
   - \( W \) = Offset in feet
4. \( d \) = Advance warning distance (see Section 2C.05)
Special Dwg LT-703, Index No. 711
Drawn 1983, Revised 2007 for “D”
Example: Lane Reduction Deficiency

A Fairly easy fix to nominally safe

Given: 55 MPH
Std calls for  D=990 ft, L=660 ft

Given a short taper L= 300’
Layout new edgeline taper of adequate length L=660ft.
Reposition signs based upon new L and D.
Remove portion of broken lane line to ¼ D downstream of W4-2 sign
LANE DROP

Different markings from standard turn lane.
Utilizes a 3/9 dotted pattern.
Twice the width of 2/4 dotted pattern.
NOTE: pattern length and spacing difference.
Standard:
A wide dotted white lane line shall be used:
A. As a lane drop marking in advance of lane drops at exit ramps to distinguish a lane drop from a normal exit ramp (see Drawings A, B, and C of Figure 3B-10),
B. In advance of freeway route splits with dedicated lanes (see Drawing D of Figure 3B-10),
C. To separate a through lane that continues beyond an interchange from an adjacent auxiliary lane between an entrance ramp and an exit ramp (see Drawing E of Figure 3B-10),
D. As a lane drop marking in advance of lane drops at intersections to distinguish a lane drop from an intersection through lane (see Drawing A of Figure 3B-11), and
E. To separate a through lane that continues beyond an intersection from an adjacent auxiliary lane between two intersections (see Drawing B of Figure 3B-11).

Guidance:
Lane drop markings used in advance of lane drops at freeway and expressway exit ramps should begin at least 1/2 mile in advance of the theoretical gore.
On the approach to a multi-lane exit ramp having an optional exit lane that also carries through traffic, lane line markings should be used as illustrated in Drawing B of Figure 3B-10. In this case, if the right-most exit lane is an added lane such as a parallel deceleration lane, the lane drop marking should begin at the upstream end of the full-width deceleration lane, as shown in Drawing C of Figure 3B-8.
Lane drop markings used in advance of lane drops at intersections should begin a distance in advance of the intersection that is determined by engineering judgment as suitable to enable drivers who do not desire to make the mandatory turn to move out of the lane being dropped prior to reaching the queue of vehicles that are waiting to make the turn. The lane drop marking should begin no closer to the intersection than the most upstream regulatory or warning sign associated with the lane drop.
The dotted white lane lines that are used for lane drop markings and that are used as a lane line separating through lanes from auxiliary lanes should consist of line segments that are 3 feet in length separated by 9-foot gaps.

Support:
Section 3B.20 contains information regarding other markings that are associated with lane drops, such as lane-use arrow markings and ONLY word markings.
Section 3B.09 contains information about the lane line markings that are to be used for transition areas where the number of through lanes is reduced.
Figure 3B-11. Examples of Applications of Conventional Road Lane-Drop Markings
(Shoot 1 of 2)

A – Lane drop at an intersection

- Optional dotted extension
- Wide solid white lane line
- Varies (see Section 3B.04 for lane-drop markings at intersections)
- Wide dotted white lane line
CONVERSION OF A THROUGH LANE TO A DROP LANE
So what does it look like on the ground?
Lane Drop at Intersections

02/02/2010
Lane Drops on Interstates
Figure 3B-10. Examples of Applications of Freeway and Expressway Lane-Drop Markings (Sheet 1 of 5)

A – Lane drop at a single lane exit ramp

- White channelizing lines
- Exit Ramp
- Physical gore
- Optional white chevron markings in neutral area
- Theoretical gore
- Wide solid white lane line (optional, variable length) or wide dotted white lane line
- Optional speed measurement marking
- Direction of travel

Legend
Figure 3B-10. Examples of Applications of Freeway and Expressway Lane-Drop Markings (Sheet 2 of 5)

B - Lane drop at a multi-lane exit ramp having an optional exit lane that also carries the through route

Legend

- Direction of travel
Figure 3B-10. Examples of Applications of Freeway and Expressway Lane-Drop Markings (Sheet 3 of 5)

C – Two-lane lane drop at an exit ramp

- White channelizing lines
- Physical gore
- Optional white chevron markings in neutral area
- Theoretical gore
- Wide solid white lane line (optional, variable length) or normal width broken white lane line
- Physical gore
- Optional white chevron markings in neutral area
- Theoretical gore
- Wide solid white lane line (optional, variable length) or wide dotted white lane line
- 1/2 mile MIN.
- Wide dotted white lane line

Legend
- Direction of travel
Figure 3B-10. Examples of Applications of Freeway and Expressway Lane-Drop Markings (Sheet 4 of 5)

D – Route split with dedicated lanes

- Physical gore
- White channelizing lines
- Optional while chevron markings in neutral area
- Wide solid white lane line (optional, variable length) or wide dotted white lane line
- Theoretical gore
- Various
- 1/2 mile MIN.

Legend:
- ← Direction of travel
Figure 3B-10. Examples of Applications of Freeway and Expressway Lane-Drop Markings (Sheet 5 of 5)

E - Auxiliary lane, such as at a cloverleaf interchange

Legend
→ Direction of travel

- Physical gore
- Optional white chevron markings in neutral area
- White channelizing lines
- Theoretical gore
- Wide solid white lane line (optional, variable length) or wide dotted white lane line
- Wide dotted white lane line for full length of auxiliary lane between the theoretical gors of the entrance and exit ramps or between the upstream and downstream ends of the optional wide solid white lane lines
- Wide solid white lane line (optional, variable length) or wide dotted white lane line
- White channelizing lines
- Neutral area
- Physical gore
**NOTICE:** If a parallel deceleration lane is used instead of a dropped lane, the markings shall be a dotted line instead of a lane drop marking. The dotted line shall be used from the beginning of the deceleration taper to the beginning of the channelizing line. The dotted line separates the optional lane from the deceleration lane.

**NOTE:** The traffic stripe shown is an optional 4", 5" or 6". The paint for the traffic stripe width will be identified in the pay item used.

**OPTIONAL w/PARALLEL DECELERATION**

**OPTIONAL w/LANE DROP**

<table>
<thead>
<tr>
<th>Broken White Traffic Stripe</th>
<th>(Marked when)</th>
<th>(Mark Material)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid White Traffic Stripe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid Channelizing Line White</td>
<td></td>
<td>(Double Width)</td>
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</tbody>
</table>

**NOTICE:** Lane widths shown are typical.

NOT TO SCALE
So what does it look like on the ground?
Are there examples of non-conforming lane drop markings???
Signs have been covered to protect the guilty.
Should be 1250 feet minimum per ALDOT Std Drawings

760 feet
**AUXILIARY LANE FUNCTIONING AS A DROP LANE**

Conversion of a Through Lane to a Drop Lane

**GENERAL NOTES**

1. A LANE DROP MARKING IS MADE THE WIDTH OF A NORMAL LANE MARKING. THE LANE DROP MARKING CONSISTS OF 3' LINE SEGMENTS SEPARATED BY 6' GAPS.

2. WHERE MINIMUM LENGTHS OF MARKINGS CANNOT BE ATTAINED ON DROP LANE, IT IS DESIRABLE TO REDUCE THE LENGTH OF THE 30' LANE MARKING OR THE MINIMUM LANE DROP MARKING LENGTH CAN BE ATTAINED.

3. BROKEN WHITE TRAFFIC STRIPES (0.10") FOR AUXILIARY LINES MAY BE INSTALLED CONDITIONALLY AS FOLLOWS:
   - THE MINIMUM LENGTH OF LANE DROP MARKINGS ARE PROVIDED AND THE MINIMUM NUMBER OF BROKEN WHITE TRAFFIC STRIPES (0.10") ARE PROVIDED
   - A: 1.75 BROKEN STRIPES IF S ≤ 40 MPH OR
   - B: 1.10 BROKEN STRIPES IF S > 40 MPH

**TRANSITIONAL TAPER TABLE**

<table>
<thead>
<tr>
<th>S (mph)</th>
<th>L (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>10.4</td>
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<tr>
<td>30</td>
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</tr>
<tr>
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<tr>
<td>60</td>
<td>60.0</td>
</tr>
<tr>
<td>65</td>
<td>65.0</td>
</tr>
</tbody>
</table>

**W = WIDTH OF TRANSITION IN FEET**

S = 85th PERCENTILE OR POSTED SPEED

**NOT TO SCALE**
Non conforming--Interstates
Drop Lane plus option lane
Drop lane
Auxiliary lane becomes a drop lane
Figure 3B-10. Examples of Applications of Freeway and Expressway Lane-Drop Markings (Sheet 5 of 5)

E - Auxiliary lane, such as at a cloverleaf interchange

Legend
→ Direction of travel

- Physical gore
- Optional white chevron markings in neutral area
- White channelizing lines
- Theoretical gore
- Wide solid white lane line (optional, variable length) or wide dotted white lane line
- Wide dotted white lane line for full length of auxiliary lane between the theoretical gores of the entrance and exit ramps or between the upstream and downstream ends of the optional wide solid white lane lines
- Wide solid white lane line (optional, variable length) or wide dotted white lane line
- White channelizing lines
- Neutral area
- Physical gore
How you can help

Stop doing it incorrectly!

Don’t assume what is out there now is correct.

Don’t say “that’s the way we’ve always done it!!!”

Consult MUTCD and ALDOT Standard Drawings and apply appropriately.

Tell your friends, neighbors, coworkers!
How you can help (ALDOT)

Make list of locations and classify them as lane reduction or lane drop situations. Determine if they are conforming or not (including distances). Perform any ‘easy fixes’ at your discretion (Don’t forget accompanying signs).

Attend resurfacing and IM scope reviews and begin process of including affected locations for remarking/resigning.

Attend PS&E meetings offering input into correct markings layout for lane reductions and lane drops.

Assist Construction personnel in properly applying markings for each situation.

Incorporate correct markings on contract jobs (Construction inspectors).

*Gently* persuade contractors of proper markings per MUTCD & ALDOT guidelines.
Don’t assume what’s out there now is correct.

IF IN DOUBT CALL US, WE’RE HERE TO ASSIST YOU!
Questions???

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