

# Safety effects of by-pass lanes at T-junctions

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- By-pass lanes at a T-junctions consist of a widened through lane on the main road to allow through traffic to pass waiting left-turning vehicles in the presence of oncoming traffic.
- By-pass lanes can under certain conditions be used instead of left-turn lanes. Among countries using by-pass lanes are Norway, Finland, USA, Denmark, and Australia.
- How by-pass lanes affect safety varies between studies. International studies found mostly crash reductions.
- Analyses of Norwegian crash data indicate unchanged or increased crash numbers at T-junctions where by-pass lanes were installed.
- Conditions under which by-pass lanes may be an acceptable alternative to left-turn lanes are, according to the Norwegian studies: (a) Traffic volume above 3000, speed limit 50 km/t or higher; (b) Many through vehicles pass waiting left-turning vehicles on the right side; (c) By-pass lane harmonizes with the roads curvature and sight conditions; (d) Not exceptionally many head-on collisions.

The main questions to be answered in the present study were:

- How do by-pass lanes affect road safety?
- Under what conditions can or should by-pass lanes be allowed or recommended in Norwegian road standards?

We conducted a literature review and reviewed international guidelines and standards. Additionally, we analyzed Norwegian crash statistics to investigate the effects of by-pass lanes in a before-after study and in crash prediction models with and without control for endogeneity. Crash data are from 2010-2019 and based on 2227 T-junctions. Of these junctions, 63 had by-pass lanes during the whole study period, at 31 junctions a by-pass lane was installed during the study period, and the remaining 2133 junctions had no by-pass lane throughout the whole study period.



## How do by-pass lanes affect road safety?

**Number of crashes:** The main conclusion from literature review and crash data analysis is that the effect of by-pass lanes on the number of crashes at T-junctions is relatively weak. International studies found for the most part crash reductions (mostly non-significant). In Norway, a crash reduction was found in a before-after study, while crash prediction models indicate that by-pass lanes increase crash numbers.

**Crash types:** Crash types that are more common at T-junctions with by-pass lanes than at other T-junctions are head-on collisions and collisions with left-turning vehicles

Whether rear-end collisions are more or less common at T-junctions with by-pass lanes than at other T-junctions, varies between studies. However, T-junctions with by-pass lanes have more rear-end collisions than T-junctions with left-turn lanes.

**Crash severity:** Crashes at T-junctions with by-pass lanes are on average more serious than crashes at other T-junctions in Norway. In international studies, no systematic differences were found.

## Under what conditions can or should by-pass lanes be allowed or recommended in Norwegian road standards?

Based on empirical results, by-pass lanes may be beneficial for capacity and neutral or beneficial for safety in the following types of T-junctions:

- Traffic volume above 3000, speed limit 50 km/t or higher and channelization on the side road
- Many through vehicles pass waiting left-turning vehicles on the right side
- By-pass lane harmonizes with the roads curvature and sight conditions
- Not exceptionally many head-on collisions.