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Impact of Transportation Infrastructure on Bicycling Injuries and Crashes: a Review of the Literature

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1 Introduction

This is a survey of the literature done by people who know nothing about the subject being surveyed. Four are in the public health field, one is a mechanical engineer. These reviewers fail to recognize major errors in the papers that they review. Considering that in the field of bicycle transportation traffic engineering most published papers have major errors, this survey merely repeats the errors as if they were true. And, even when the referenced paper provides accurate information, the reviewers misstate it according to their own biases.

Furthermore, while the subject of this review is the effect of bicycling infrastructure on casualties, it is equally important to consider whether or not the infrastructure was being used properly or improperly. Several statements by the reviewers indicate that they have no understanding of this issue, not even that it exists.

The details of this review are limited to those parts of infrastructure that affect traffic operations: roadway and bikeway design, in which this reviewer considers himself an adequate expert in the subject.

2 Reviewers' Conclusions

2.1 Not much information available

“Although the effect of infrastructure design on cyclist safety was first studied more than three decades ago, the literature on the topic remains remarkably sparse. This review highlights opportunities for more detailed and controlled studies of infrastructure and cycling injuries.”

2.2 Suggestions of improved safety

“The evidence to date suggests that purpose-built bicycle-only facilities (e.g. bike routes, bike lanes, bike paths, cycle tracks at roundabouts) reduce the risk of crashes and injuries compared to cycling on-road with traffic or off-road with pedestrians.”

2.3 Specific bike-lane information

“On-road marked bike lanes were found to have a positive safety effect in five studies, consistently reducing injury rate, collision frequency or crash rates by about 50% compared to unmodified roadways [61, 62, 65-67]. Three of those studies [61, 66, 67] found a similar effect for bike routes. One study [63] found ... [no effect] sustained over the long term.”

2.4 Bases for above conclusions

When reviewers find that very little information on the specific subject is available from published papers, that is likely to be a correct evaluation. Only if it is demonstrated that they have missed significant papers on the specific subject can the evaluation be shown to be incorrect.

The most obvious paper not considered (1 Jensen) is that from Copenhagen providing before and after collision data for their typical bikeways, data showing a general increase in collisions. A before and after evaluation of cycle tracks in Copenhagen shows that collisions between intersections decreased by 10 percent while collisions at intersections increased by 18 percent.

However, there may be papers that bear on the subject without being within the specific field.

For example, Cross's study of car-bike collisions (2 Cross 1978) is the world's most statistically robust study of such events, although limited to the USA. Forester's analysis of Cross's data (3 Forester 1976, 1994) demonstrates the detailed collision patterns and proportions that infrastructure is intended to reduce. Quite obviously, knowledge of this information would have been very useful to the reviewers in evaluating the other papers.

The papers reviewed all consider bits and pieces of infrastructure, many of them considering longitudinal facilities in isolation, several on roundabouts, and none on normal intersections. In short, the reviewers fail to consider the cycling system as a whole. One cannot have bike lanes or side paths without intersections, or bike paths away from roads without bike crossings. There's no advantage to a bike lane that reduces crashes along it if the result is a greater increase in crashes at the intersections. The reviewers show no sign of understanding this problem.

3 Errors invalidating reviewers' conclusions

3.1 Defective Definitions

Vehicular cycling is defined as merely cycling on the roadway.

Wide curb lane is characterized as "can accommodate cyclists." Well, of course it can. The reviewers fail to recognize that normal lanes can also accommodate cyclists.

Sharrows "indicate that bicycles can share the lane with motor vehicles." Again, the reviewers fail to recognize that this is no different from normal lanes.

These errors indicate the reviewers' bias in favor of cyclist-inferiority and bikeway views.

3.2 Roundabouts

Only three studies described and distinguished different types of roundabout [53, 54, 57].

Roundabouts with cycle lanes showed the worst safety performance [53, 57]. To be expected, since cycle lanes keep cyclists to the right in a facility where all turns are right turns.

Roundabouts with two traffic lanes showed worse safety performance than those with only one traffic lane [54, 57].

Roundabouts with cycle tracks showed better safety performance than those in which the cyclist used the traffic lane [53, 54,], but this effect

was not shown in [57].

Study [53] showed considerable reduction in crash rates for all types of roundabout, although each type had a different reduction, as indicated above. Studies [54, 57] showed no increased crash rates for single-lane roundabouts.

The reviewers conclude that "cycle tracks at roundabouts reduce the risk of crashes and injuries compared to cycling on-road with traffic." But they also caution: "However, because the cyclist-specific safety effect of roundabouts appears to be highly dependent on their design, transportation planners should carefully consider interactions between cyclists and other traffic modes. ... It may be prudent to avoid installing roundabouts in areas where there is a high proportional volume of bicycle traffic."

The reviewers fail to note that two of the roundabout studies quoted come from nations with much cycle-track infrastructure (Netherlands and Belgium), while the other comes from a nation that appears to have considerable cycle-track infrastructure (Sweden). Cyclists who are accustomed to cycle tracks may take better to roundabouts that also have them.

Cycle tracks in general require that cyclists make many more stops to prevent car-bike collisions. Cycle tracks around roundabouts work in the same way. The straight-through cyclist has to stop and yield once to two-way motor traffic, while the left-turning cyclist has to stop and yield twice to two-way motor traffic.

In short, the reviewers do not recommend roundabouts, and even their recommendation that roundabouts be equipped with cycle tracks is not supported very well.

3.3 Bicycle Crossings and Intersections

There are three papers in these two categories, and they all consider cycle-track situations. One considers raised crossings, another blue-painted crossings, the third considers sidewalk cycling in Tokyo. It is apparent that the raised and colored crossings are attempts to reduce the increased crash rate that is created by cycle-track (sidepath) situations.

The fact that raised or colored crossings are considered desirable is not an argument for them, but an argument against cycle-tracks (sidepaths).

3.4 Bike Lanes

The reviewers state that "On-road marked

bike lanes were found to have a positive safety effect in five studies, consistently reducing injury rate, collision frequency or crash rates by about 50% compared to unmodified roadways. [61, 62 65-67].”

Kaplan’s study [61] does not do so. It groups bike lanes and bike routes, but in 1975 there were almost no bike lanes in America.

The Lott and Lott study [62] does not do so. The Lotts divide intersection traffic collision movements into those that supposedly are affected by bike lanes and those that supposedly are not. They use crashes supposedly unaffected by bike lanes as the surrogate for traffic volume, so they can predict the number of crashes that would be affected, and compare those with the actual number. Well, the Lotts didn’t understand traffic movements and improperly classified many. The result within statistical confidence limits is that bike lanes either increase or decrease collisions.

The Rodgers study [65] is that done for the Consumer Product Safety Commission of the US. It contains so many bloopers that nothing is reliable. One result of the data from two surveys is an average cycling speed of 1.26 mph (4).

The Moritz study of LAW cyclists [66] gives relative crash rates per mile for different types of facility. Major street 0.66; minor street 0.94; bike routes 0.51; bike laned streets 0.41; etc. etc. This does not show that bike lanes reduce crash rates, but only that bike lanes are typically installed where it is easiest, on those streets that are already the safer.

The Moritz study of commuting cyclists [67] produces somewhat different values for normal streets: major streets 1.26; minor streets 1.04. However, its value for combined bike routes and bike lanes has both the error of preselected safer streets and that of combining two types.

Therefore, the literature reviewed says nothing at all about reductions of crash rates produced by bike lanes.

3.5 Bike Routes

The reviewers state: “Three of those studies [61, 66, 67] found a similar effect [about 50% reduction] for bike routes.

Kaplan’s classification [61] combined lanes and routes, as described above, but the data must have largely come from routes because there were almost no lanes at that time.

Moritz’s LAW study separates these, while Moritz’s commuter study combines these.

However, all that these data demonstrate is the well-known fact that bike routes are selected from streets already considered safe. There is no evidence of increased safety from designating a street a bicycle route.

3.6 Sidewalks

The reviewers consider Wachtel’s study comparing crash rates for roadway cyclists with those of side path (sidewalk) cyclists at the same intersections. Sidewalk cycling is more dangerous. The reviewers did not read, and therefore did not understand, Wachtel’s explanation that side path cycling is excessively dangerous in both directions, even though the raw data appear to show that wrong-way is much more dangerous than right-way.

4 Conclusions of This Reviewer

There is no substantial evidence in the literature reviewed by these authors that bikeways reduce car-bike collisions. While these reviewers claim to have detected such a reduction in several papers, these reviewers have been misled by the combination of bias and ignorance of the subject. Several of their statements indicate ignorance of bicycle traffic engineering, and the authors have failed to consider the one modern paper that more clearly than others provides data from complete trips rather than from only bits and pieces of infrastructure (1 Jensen).

5 References

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