John Forester, M.S., P.E.
Cycling Transportation Engineer
Consulting Engineer, Expert Witness, and Educator in
Effective Cycling, Bicycles, Highways and Bikeways, Traffic Laws
7585 Church St., Lemon Grove, CA 91945-2306
619-644-5481 forester@johnforester.com

Monday, May 27, 2013

Review of: Bicycle Guidelines and Crash Rates on Cycle Tracks in the United States

Lusk, Anne C.; Morency, Patrick; Miranda-Moreno, Luis F.; Willett, Walter C.; Dennerlein, Jack T.
American Journal of Public Health

1 Introduction

The subject paper is an attempt to promote the building of cycle tracks by claiming that cycling on cycle tracks has a very low car-bike collision rate. Lusk distributed the pre-publication file with the following note: “Here's hoping that we get better bicycle facilities in the years to come ... we certainly have more bicyclists!
Anne”

Lusk also attempts to make the claim that gender bias in the authors of standards in bicycle transportation engineering has produced unjustified standards.

2 Types of Facilities

The nineteen facilities studied in the subject paper have been divided into their types. I append to each description the crash rate per million bicycle-km assigned by the Lusk paper, as CRL X.

Note that five of the nineteen are not cycle tracks at all. The subject paper is supposed to show and compare the car-bike collision rates of various facilities. The object is to show that cycle tracks provide great protection against car-bike collisions.

This means that each facility studied must present some possibility of such collisions. That is, it must contain locations for turning and crossing movements by motor vehicles. Looked at in another way, for the facility to provide transportation utility, it must connect at two or more points with the road net. A park path that just happens to come near a road does not qualify as a cycle track.

Lusk appears to agree with this definition by writing: “that they [cycle tracks] not be completely adjacent to water (i.e., drivers would not drive over a cycle track to a beach).” Lusk then states that all the cycle tracks in the study met this criterion: “For all suggested cycle tracks, we used Google street view maps to verify their existence and whether they were separated from traffic.”

When I Googled all the subject supposed cycle tracks, I found that five out of nineteen were not cycle tracks at all, because they had no crossing or turning motor traffic.

As I Googled each of the cycle tracks listed in the study, I counted the number of intersections between the two ends, and, when possible, the number of driveways. These numbers are included in the description. I then calculated the number of intersections per km [(I+1)/km] [designated as I/k].

I also grouped the cycle tracks by the types of roadway with which they were associated.

2.1 Alongside Divided Arterial Road

1: Calle Barcelona, S. Carlsbad, CA. 2.11 km, divided arterial road; 1 each side; 3 intersections, signalized, no driveways. CRL 0.0; I/k 1.90

2: East Palomar St., Chula Vista, CA. 3.28 km, divided arterial road; 2 way, 1 side; 20 intersections, mostly signalized, 5 driveways. CRL 0.5; I/k 6.4

3: Friars Rd. San Diego CA, 3.46km, divided arterial road; 1 each side; 6 intersections, mostly signalized, 6 driveways. CRL 0.8; I/k 1.0

4: Broadway, Boulder, CO. 4.83 km, divided arterial road; 2 way, one side. Mostly campus frontage. 6 intersections, 1 driveway. CRL 0.2; I/k 1.45

5: Apopka-Vineland Rd, Orlando FL. 1.93 km, divided arterial road; 1 each side; 11 intersections, 9 driveways. Much undeveloped. CRL 0.0; I/k 6.22

6: Reed Market Rd, Bend OR 1.19 km. 1 each side. Divided highway with traffic circles. 3 intersections, 0 driveways. CRL 0.0; I/k 3.36

7: Dorset St, Burlington VT 1.85 km. 1 each side. Divided highway through commercial area. 7 intersections, 12 driveways (commercial). CRL 2.3; I/k 4.32

2.2 Alongside Normal Street

8: High St., Santa Cruz, CA. 0.16 km, 1 way counterflow. 1 intersection, 1 major driveway, 5 driveways serving residences. CRL 0.0; I/k 12.5

9: Vassar St, Cambridge MA. 0.32 km, street. 1 each side. 3 intersections, driveways uncountable from buildings. CRL 3.0; I/k 12.5

10: 1st Ave N, Minneapolis, MN. 1.13 km, street. 1 each side. 5 intersections, 5 driveways. CRL 16.0; I/k 5.31

2.3 Alongside and intersecting with one-way streets

11: 1st Ave, NYC, 1st to 34th st. 2.65 km. One way, one side, on one-way street intersecting with one-way streets (nearly all), 32 intersections, driveways uncounted. CRL 5.0; I/k 12.5

12: 2nd Ave, NYC, 34th to 1st st, 2.60km. One way, one side, on one-way street intersecting with one-way streets (nearly all), 32 intersections, driveways uncounted. CRL 6.5; I/k 12.7

13: 8th Ave NYC, W14th to W34 st, 1.57 km, one way, one side, on one-way street intersecting with one-way streets (nearly all), 19 intersections, driveways uncounted. CRL 7.2; I/k 12.7

14: 9th Ave NYC, W 34st to W 14 st, 1.57 km, one way, one side, on one-way street intersecting with one-way streets (nearly all), 19 intersections, driveways uncounted. CRL 6.0; I/k 12.7

2.4 Not Cycletracks

15: Beach Street, Santa Cruz, CA. 1.22 km. This is the beach frontage road, with 1 intersection serving the wharf. CRL 3.2; I/k 1.64

16: Loring Greenway, Minneapolis MN. 1.13 km. Path in park, 0 intersections, 0 driveways. CRL 3.0; I/k 0.88

17: Prospect Park West, Pritchard Sq to Union St, 1.51 km. This is a path alongside a park, with one intersection and 3 driveways. CRL 0.0; I/k 1.32

18: Ayers Road, Eugene OR. 0.80 km. Two lane street, alongside a pond and a gated community. One driveway, into the gated community. CRL 0.0; I/k 1.25

19: 13th St., Boulder, CO. 0.34 km, 1 way counterflow. 2 intersections, 1 driveway, part is in park. CRL 0.0; I/k 8.82

2.4.1 Notes on Peculiar Non-Cycle Tracks

Loring Greenway has 0 intersections and 0 driveways, yet it has a CRL of 3.0. Google shows a lengthy set of paths in Loring Park, only one short length of which could be called a cycle track. This parallels the driveway to the park parking lot; the separating shrubbery is quite clear, and entry to that section is through that driveway and parking lot. Google shows both the driveway and the cycle track with the same name: Loring Greenway. I suggest that the collisions occurred in the driveway and parking lot, not in the cycle track.

Beach Street in Santa Cruz is the beach frontage road, lined with commercial establishments between the road and the beach. Traffic along Beach Street and into the wharf is often crowded and confused.

3 Gender Bias Claim

“In the United States, the guidelines of the American Association of State Highway and Transportation Officials (AASHTO) favor bicycling on roadways, even though most women, children, and seniors prefer separation from vehicles ... Because bike facility preferences have been identified as a gender issue, we also assessed the gender of the guideline authors.”

The attempt to make this a gender issue is plain absurd. Most authors of engineering standards are male, simply because most of the people with the knowledge to write them are male. Contrariwise, typical bicycle advocates are male, yet they urge the same facilities as does Lusk.

The issue does not concern a division over gender as it does the division between the general public (the women, children, and seniors, etc.), who know little about bicycle traffic, and those with much better knowledge of bicycle traffic. The critical difference is in obeying the rules of the road for drivers of vehicles (RRDV). The general public refuse to obey those rules, while the few who are better informed have learned that cyclists do best when they obey those rules.

4 History of Standards Argument

Lusk argues favorably for the first California proposed bikeway standards, written by UCLA Transportation Studies. The supports her argument with: "Barriers at the interfaces can range from symbolic (e.g. striping), to physical (e.g. berms, median barriers, islands, fences). Symbolic barriers may be used to indicate to cyclists, drivers, and pedestrians their separate rights-of-way. However, symbolic barriers may be easily encroached either voluntarily or involuntarily by conflicting modes at the same grade. . . .In the absence of adequate horizontal clearance between the bikeway and the adjacent motor vehicle right-of-way a physical barrier is inherently safer than a symbolic one."

In the source documents for that document was a German study showing that cyclists using a cycle track in the reverse direction had a car-bike collision rate several times greater than that for proper-direction cyclists. That ought to have alerted the California authors, but it apparently did not. They largely copied Dutch and German cycle track designs.

The above was written when only a little was known about car-bike collisions. That statement is based on a hidden assumption: because the greatest danger to cyclists is same-direction motor traffic, we need to provide greatest protection against that danger, despite the dangers of the other types of car-bike collision.

We experienced cyclists knew that that assumption was wrong; the dangers that confronted us had to do with turning and crossing movements by both parties, rather than from same-direction motor traffic, and that if we obeyed the RRDV traffic worked well.

Therefore, we argued against those proposed UCLA bikeway designs, with me leading, as president of the California Association of Bicycling Organizations. We forced California to start with a new set of bikeway designs largely based on the RRDV. California contracted with Ken Cross for a statistical study of car-bike collisions, obviously expecting that this study would support their claim of the great danger of same-direction motor traffic. And Ken's study, his first one of car-bike collisions in Santa Barbara County, completely disproved the claim. Only 0.5% of those car-bike collisions involved straight-ahead cyclists hit by straight-ahead motorists. Cyclists were correct and government, and motorists, the general public, and the women, children, and seniors were utterly wrong about bicycle traffic.

Cross did a later study of a quasi-national sample of collisions, which provided more specific classifications. The reasonable conclusion from his data is that, in urban areas in daylight, only about 2% of car-bike collisions are of the cyclist-straight, motorist-straight type. Considering a wider range of conditions, I describe the best conclusion as less than 5% of car-bike collisions are cyclist-straight, motorist-straight, while 95% or more are caused by crossing or turning movements by one or both parties.

Providing protection against this 2 to 5% of car-bike collisions would be worthwhile if there were no unfavorable side effects. But there are. The California/AASHTO bike lane has few unfavorable side effects. The cyclist who obeys the RRDV can operate as he should, despite the additional social disapproval for disobeying the lane stripe when he should. The cyclist who believes that the lane stripe protects him from great danger can always obey the lane stripe, in which case he cycles just as incompetently and dangerously as he always does; the lane stripe does not change that. Contrariwise, cycle tracks force the cyclist to operate so that, at intersections and driveways, he and the motorists are on collision courses with little opportunity to see and avoid each other. This puts the cyclist who obeys the RRDV in great danger. All this was written up in my *Cycling Transportation Engineering Handbook* in 1977, with its latest form being *Bicycle Transportation 2d ed*, published by The MIT Press in 1994.

It is these additional serious increases in car-bike collision situations that killed cycle tracks in the USA until recently. That's why, Ms. Lusk, even if you choose not to believe it.

5 Analysis

In accordance with the principle that the great majority of car-bike collisions stem from turning and crossing movements by either or both parties, the relationship between CRL and I/k was plotted. However, that plot does not show a single pattern, except a large division between those with high CRLs and those with low CRLs. Those numbered 7, 9, 10, and 11-14 are in the high group. The 11-14 group are the four NYC avenue cycle tracks, all rather similar with CRLs around 6.0 and I/k around 12.7, the highest of all. The next highest I/k is for #9, at the low end of the high CRLs. This suggests that high intersection frequency goes with high crash rate, not an unexpected result. However, the cycle track with by far the highest CRL, #10, CRL = 16.0, has only a high moderate I/k = 5.31.

Turning and crossing movements can occur at both intersections and driveways. Residential driveways generate very few movements; commercial driveways significantly more, while intersections probably generate many more still. However, the intersection frequency indicates only the number of locations at which high frequency turning and crossing movements can occur; it does not indicate the number that do occur. It is apparent that I/k provides only a rough indication of the likely crash rate.

However, all the high crash rate cycle tracks are situated in “downtown” or “commercial” areas with moderately high to extremely high intersection frequencies and high traffic volumes. Contrariwise, all but one of the low crash rate cycle tracks are alongside divided arterial roads with few intersections, mostly signalized or circular, and few driveways. The exception, #8, serves a residential area.

6 Conclusions

Lusk’s gender argument is nothing more than an attention-grabbing facade to her underlying argument that traffic engineering standards should be designed by the general public instead of by persons with traffic-engineering expertise and qualifications. This is because the greatly exaggerated fear of same direction motor traffic, that both she and the general public share, conflicts with traffic-engineering knowledge and principles. Satisfying one necessarily conflicts with the other.

The selection of items to call cycle tracks demonstrates Lusk’s ignorance of traffic engineering. Cycle tracks are not just paths that happen to be near roads. A cycle track is a path attached to a road that necessarily encounters the same crossing and turning traffic as does that road. Lusk writes that all the selected subject items were checked by Google maps for accuracy, yet five of the nineteen items lacked the connection to the turning and crossing movements of the road to which they were attached.

This review does not evaluate Lusk’s method of calculating car-bike collision rates. However, the cycle tracks with high collision rates are all in high-traffic areas with high volumes of crossing and turning traffic, while the cycle tracks with low collision rates are all in areas with low volumes of turning and crossing traffic. That is what should be expected, but it says nothing about any reduction in collisions that might have been caused by the introduction of cycle tracks. The data of this study provide no evidence that cycle tracks reduce car-bike collisions.

Cycle tracks increase the difficulty of safely handling each of the same number of turning and crossing movements that originally existed. Any reduction in collisions must more than offset that increased difficulty by means other than the mere cycle track, such as extensive signalling with separate phases for motor, cycle, and pedestrian traffic.

Nearly all of the cycle tracks with low collision rate are attached to divided arterials with few driveways, but with well-signalized intersections. That may well account for their low car-bike collision rate.

The four NYC high collision rate, high intersection frequency cycle tracks are all on one-way streets that intersect almost only with one-way cross streets. These one-way.one-way intersections greatly simplify the problem of preventing collisions from the added dangers created by cycle tracks, but, it appears, to no avail.

The subject paper demonstrates the troubles created when investigations into traffic-engineering problems are carried out by people both ignorant of traffic engineering and driven by contrary ideology. Its conclusions are not supported by its data or theory.