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**Guide for Reducing Collisions Involving Bicycles:
Guidance for Implementation of the
AASHTO Strategic Highway Safety Plan
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1 General

1.1 Advance Summary

In summary, this report is no more than a collection of actions, some good but many irrelevant, that is not organized according the aim of reducing car-bike collisions and, therefore, cannot be expected to have much effect in reducing collisions.

1.2 Failure to use existing information

The Summary, and the Introduction, both start out with the inaccurate statement that safety improvements have awaited crash reports: "waiting for crashes before responding with countermeasures carries a high price because many bicycle crashes tend to be severe." This is false on two counts: most bicycle crashes are minor, and we have had adequate car-bike collision data since 1976 (the Cross report) that we have failed to use in making countermeasures.

1.3 Crash Reduction Goal

This report repeats, without apparently understanding it, the combined usage volume and crash reduction goals adopted by the FHWA in 1994. That is, to double the number of trips while reducing the number of crashes by 10%. This means reducing the crash rate by 55%. The report fails to consider whether the measures (I don't call many of these countermeasures) that it considers will produce such an enormous reduction.

1.4 Known Problem Areas

The report describes the known problem areas of deficient nighttime equipment, wrong-way cycling, and sidewalk cycling. Deficient nighttime equipment is discussed in a reasonable way in its own section. The other two are never discussed further, presumably because there are no physical countermeasures to them.

1.5 Basic Collision Classification Errors

This report classifies car-bike collisions into two groups, Crossing Path Crashes and Parallel Path Crashes, as done by Hunter in 1996. Hunter's work was shallow compared to that of Cross in 1976; several of Hunter's types contain crashes with entirely different causes. One large error in the basic classification is that crashes caused by turning movements, by either cyclist or motorist, are classified as Parallel Path Crashes.

I much prefer my division into Crossing and Turning Crashes versus Overtaking Crashes, and I used Cross's data sheets to divide his classes further so that each subclass contained only one significant causal movement. This is necessary to consider proper countermeasures.

Hunter's classification gives an improper picture and improper relationship to potential countermeasures, because turns and merges are associated with intersection conditions and their appropriate countermeasures involve considerations of intersection maneuvers. This misclassification also overstates the proportion of car-bike collisions of the parallel path type, which thereby

overstates the desirability of bike lanes and bike paths. Possibly, this misclassification is a deliberate means to advocate bikeways over better methods of making cycling safer. Equally possibly, this simply shows that the American public, motorists, and traffic researchers, in fact everybody except a few well-informed cyclists, considers the bicycle traffic problem to be the cyclist they see ahead of them.

1.6 Detailed Collision Classification Errors

Here are some of the classification errors that lead to mistaken recommendations, listed by Crash Group.

1: Crash Group 5: "The motorist drove across the sidewalk on into the street from a non-intersection location (including residential or commercial driveway or other midblock location) without yielding to the bicyclist."

The error here is confounding right-way and wrong-way cyclists, and roadway and sidewalk cyclists, which all require different consideration.

2: Crash Group 7: "The motorist made a left turn or merge into the path of a bicyclist traveling in the same or opposite direction."

The usual motorist improper left turn movement produces a collision with a cyclist traveling in the opposite direction on his proper side of the roadway. This classification includes the wrong-way cyclist moving in the same direction as the motorist, and the sidewalk cyclist, which are entirely different situations. Also, turning and merging are two entirely different situations.

3: Crash Group 8: "The motorist made a right turn or merge into the path of a cyclist traveling in the same or opposite direction."

Cyclists traveling in the same direction are either on the roadway (the right hook collision) or on the sidewalk, which are entirely different situations. Cyclists traveling in the opposite direction are either wrong-way cyclists or sidewalk cyclists, again different from the others. Also, turning and merging are two entirely different situations.

4: Crash Group 9: "The bicyclist made a left turn or merge into the path of a motor vehicle traveling in the same or opposite direction."

This includes both cyclist improper left turns and cyclist swerves, which are entirely different.

5: Crash Group 10: "The bicyclist made a right turn or merge into the path of a motor vehicle traveling in the same or opposite direction."

This includes cyclist improper right merge and actions by wrong-way and sidewalk cyclists, all of which are different.

6: Crash Group 12: "The bicyclist was overtaking the motorist (passing on the right or the left) at the time of the crash. (Includes crashes involving bicyclists striking parked cars or extended doors.)"

Overtaking on the right and on the left are entirely different situations, parked cars are another situation, while opened doors are still another.

When researchers lump together situations with entirely different causes and entirely different countermeasures, nothing useful is likely to be produced.

2 Recommended Strategies

2.1 Reduce Bicycle Crashes at Intersections: Class A

2.1.1 Improve Visibility at Intersections: A1

General traffic safety improvements

2.1.2 Improve Signal Timing and Detection: A2

1: Longer clearance interval to allow for very slow cyclists.

2: Advance green for cyclists. The argument makes no sense. This "enables bicyclists to at least establish their presence within, if not clear, the intersection which should reduce the potential for conflicts with motor vehicle traffic." This applies only to cyclists who arrive during the red phase. Are these expected to behave differently from cyclists who arrive on the green phase? Or are those cyclists expected to wait through the remaining green and the red until they get a new advance green?

3: Separate signal phases for cyclists. These necessarily create more delay for both motorists and cyclists. The authors refer to a study indicating a great reduction in crashes through the use of special bicycle phases. However, the description is inaccurate and the circumstances very unusual. The intersection was a four-legged intersection, but with no motor, only bicycle and pedestrian, traffic on the south leg. Furthermore, there was a side path

on the north side of the east-west road. Precisely the situation in which special signal phases are required to sort out the confusion and conflicts. Not a recommendation for general use.

4: Better signal detectors. Good

2.1.3 Improve Signage: A3

Use the standard signs wherever appropriate. There apparently is no good information on effectiveness, but probably useful and rarely harmful.

2.1.4 Improve Pavement Markings at Intersections: A4

Considers only bike-lane stripes, and has all the defects of that system. The comments about advanced stop lines (bicycle boxes) are interesting. "The primary purpose of a bicycle box is to improve the visibility of bicyclists at intersections ... where they are in full view of motorists on all sides of the intersection." This is nonsense. Cyclists enter the box only on the red phase. Motorists coming from their right, on their own green phase, have no need at all to see those cyclists stopped before their red. When these motorists become stopped by their red, then they have no need to see the cyclists who will be starting out from their new green. Once the traffic flow has started, there will be no more cyclists in the bike box. Exactly the same logic applies to the motorists coming from the left of the cyclists. The motorists coming from the opposite direction will normally be stopped, but may be proceeding on a protected left turn signal phase. In neither case do these motorists have any reason to be concerned about cyclists stopped in the bike box. The motorists stopped immediately behind the cyclists who are in the bike box can certainly see the cyclists, but what advantage is that? Without the bike box, the waiting cyclists would either be alongside the line of motorists, or in the line of motorists, directly behind some and directly ahead of others, and equally visible to the motorists behind them.

Another stated advantage of the bike box is that it "Reduces conflicts between turning bicycles and motor vehicles by clearly delineating locations for the movements to occur." I fail to see that it persuades right-turning cyclists to start adjacent to the curb, or that it persuades left-turning cyclists to start adjacent to the centerline, particularly in a multi-lane street where the bike box extends only across the outside lane. And, of course, if any cyclist is persuaded to use the box during a green

signal phase, he has likely endangered himself.

Furthermore, these supposed experts fail to consider that using the bike box requires that the cyclist overtake on the right-hand side of traffic that may turn right, which is a most dangerous action.

This section also considers colored bike lanes, where the color indicates the section where the cyclist and the motorist are directed, by their own lanes, into direct conflict on diagonal paths. There is no consideration of not using bike lanes where these force cyclists into moving diagonally in direct conflict with motorists.

This is called a weaving movement, with standard rules for the length thereof, thus allowing both motorists and cyclists to judge for themselves when it is best to make their lateral movements, and to do so before they reach the intersection. Observation of colored lanes across weaving sections show that the lane persuades cyclists to proceed directly into conflict with motorists.

An interesting comment. Bike lanes "indicate assigned travel paths" for bicyclists. In short, these supposed experts are instructing cyclists that if they follow the bike lane exactly they will be safe, a dangerously incompetent instruction.

2.1.5 Improve Intersection Geometry: A5

The first recommendation is to reduce the crossing distance by narrowing the lanes to be crossed. This the very old argument that cyclists are the mechanical ducks in a shooting gallery. Even if the lanes are narrowed, the cyclist still has to cross the same number of lanes with the same amount of traffic, and at a location where the motorists are having to adjust to the narrowing of their lanes.

The second recommendation is to change the angles of diagonally intersecting streets to be more orthogonal. Says this is a good idea for all classes of traffic.

The third recommendation concerns merges to and diverges from the main road. The standard two movement patterns are offered for each situation, the sharp swerve across the incoming or outgoing traffic lane, and the straight continuation as if nothing was occurring. There is no consideration for the cyclist making his own judgement and positioning himself as is best for that location and the specific motor traffic in view. And no consideration for the cyclist moving into the through lane until the merging traffic has sorted itself out. In short, the designs assume incompetent cyclists and don't consider competent cyclists.

The fourth recommendation is for raised median islands. Often reasonable according to present practice.

2.1.6 Restrict Right Turn on Red Movements: A6

This is to prevent collisions between right-turning motorists and wrong-way cyclists. This protects wrong-way cyclists only at signalized intersections, not at other intersections or driveways. No consideration given to persuading cyclists to ride on the right-hand side.

2.1.7 Accommodate Bicyclists through Roundabouts: A7

The recommendation is for roundabouts without bike lanes. Good for both motorists and cyclists.

2.1.8 Provide an Overpass or Underpass: A8

What appear to be a reasonable set of warrants are suggested, including consideration of most relevant variables.

2.2 Reduce Bicycle Crashes along Roadways: Class B

2.2.1 Provide Safe Roadway Facilities for Parallel Travel: B1

- 1: Bike lane striping
- 2: Shared lane marking
- 3: Paved shoulder
- 4: Colored bike lane

Nothing new here, same usual simplistic claims.

One is the thirty-year-old claim that bike-lane stripes “provide for more predictable movements for both bicyclists and motorists,” a claim that has never been verified.

When considered from the standpoint of normal operation, the cyclist who stays in the lane when he should is not operating more predictably than normal. The cyclist who leaves the lane when he should is not operating more predictably than normal. The cyclist who stays in the lane when he should not is clearly operating less predictably. The cyclist who stays outside the lane when he should be in it is clearly operating less predictably than normal.

When considered from the standpoint of the motorist who believes that the cyclist should remain in the lane, that motorist considers any move outside the lane to be unpredictable,

whether the cyclist should be inside or outside the lane.

In short, bike-lane stripes produce less predictable behavior that produces more confusion.

Furthermore, whatever may be the cyclist's lateral movement, it is made predictable, not by the stripe, but by proper signaling and yielding. There has never been any evidence that a bike-lane stripe teaches cyclists the proper method for lateral movements.

The authors repeat Wilkinson's 1994 claim that bike lanes convert unsuitable roads into roads suitable for cyclists who don't have the skill of obeying the rules of the road. Neither Wilkinson, nor anybody else, has demonstrated which traffic-cycling skills are not needed in cities with bike-lane systems. Indeed, I, a well-known expert in traffic-cycling skills, have demonstrated that bike-lane cycling requires all the traffic-cycling skills.

There is a rather remarkable defense of bike-lane stripes. “Most crashes associated with marked bike lanes are concentrated where the marking ends...” That's not because the protection ends there, but because that's where the difficult movements begin.

Wide outside lanes are mentioned without a heading, with the surprising statement that cyclists might not recognize a wide lane when they see it.

2.2.2 Provide Contraflow Bicycle Lanes on One-Way Streets: B2

The benefits are stated as shortening the route and incurring fewer traffic conflicts, for those particular situations where such advantages exist. In most American cities I suggest that the possible shortening is insignificant, two blocks or so. A significant reduction in traffic conflicts would occur only if a one-way street had on its left-hand side a riverbank or other traffic-stopping area. I suggest that few such streets exist.

The strategy admits that wrong-way cycling across intersections and driveways is dangerous, but there is no indication of how little of this must be avoided to achieve a safety improvement over normal streets.

Furthermore, the illustration of this type of facility shows a side path, not a bike lane.

2.2.3 Improve Bicyclists' Visibility: B3

Very general discussion of benefits and costs of street lighting..

2.2.4 Improve Roadway Signage: B4

Share the Road signs, bicycle route signs,

and such. Largely so what; safety effect unknown.

2.2.5 Provide Bicycle-Tolerable Shoulder Rumble Strips: B5

This is an excuse for providing rumble strips to waken motorists, but that are not too harmful to cyclists. The number of cyclists who might also be saved from collisions with drowsy motorists who are awakened by contact with such strips is unknown. Only grooved strips are considered, typically 5" wide in the direction of travel, 3/8" deep, and 6" apart in the direction of travel, and with a width across the direction of travel of 12" to 16". Not pleasant to cycle over, but probably not dangerous. These are supposed to be placed so there is the typical bike-lane width between the line of rumble strips and the edge of the paving. The effect of such rumble strips on the behavior of cyclists is unknown but probably depends greatly on the characteristics of the road on which they are installed. Note that these rumble strips narrow the usable width of the roadway by a foot or more, and the effect of this characteristic on the status of cyclists is also unknown.

2.3 Reduce Motor Vehicle Speeds: Class C

2.3.1 Implement Traffic Calming Techniques: C1

Slow the motor traffic or send it elsewhere, by speed berms, chicanes, and narrowing. There is no consideration of the very narrow range of streets on which any of these might be done, or of the prevailing speeds on these streets before treatment. They don't say so, but speed berms of proper design are probably the most useful of these installations.

2.3.2 Implement Speed Enforcement: C2

Apparently there is much information available about such programs, but apparently not much information about the effectiveness in reducing car-bike collisions.

2.4 Reduce Bicycle Crashes at Mid-block Crossings: Class D

2.4.1 Improve Driveway Intersections: D1

The justification for the measures in this group is all wrong. The justification states that 20% of car-bike collisions are caused by motorists or cyclists exiting the driveway. However, almost

all the measures are aimed at slowing motorist entry to the driveway. In any case, only 2.1% of car-bike collisions are caused by motorists entering driveways; nearly all the car-bike collisions have to do with cyclists exiting without yielding 8.2% or with cyclists riding on the sidewalk.

The recommendations do include smooth entries (no lip to trip cyclists) and, for gravel driveways, sufficient length of paving to prevent gravel from getting into the roadway.

2.4.2 Implement Access Management: D2

Standard methods for managing the spacing of driveways and the access to them, including raised medians to prevent left turns into or from driveways. Reduces all types of collisions, including car-bike to some extent. No consideration of the reduction in cycling convenience.

2.5 Improve Safety Awareness and Behavior: Class E

Justified by reference to the large proportions of car-bike collisions in which cyclists have been found at fault. Greater proportions for young cyclists, smaller proportions for older cyclists.

2.5.1 Provide Bicyclist Skill Education: E1

This is a very strange discussion that never touches its title subject, development of traffic operating skills in cyclists, traffic-cycling skills. Several pages of general descriptions and considerations regarding education, but never a specific statement that the object is to teach cyclists how to operate according to the rules of the road for drivers of vehicles.

There are several references to the fact that most Americans refuse to take the time to learn proper cycling, but no recognition of the consequences of this attitude.

Oh, yes, there's the Wear Your Helmet advocacy also.

2.5.2 Improve Enforcement of Bicycle-related Laws: E2

This discussion lists many programs for training police officers; some may be good, some deficient, but no criteria are listed by which to evaluate these. However, there is continuous emphasis on "bicycle-related laws", no discussion of the difference between cyclist harrasing laws and genuine traffic laws, and almost no mention of the fact that the standard traffic laws apply to cyclists. A thoroughly disappointing performance.

2.6 Increase Use of Bicycle Safety Equipment: Class F

2.6.1 Increase Use of Bicycle Helmets: F1

The usual propaganda, including quoting the most optimistic of injury-reduction statistics.

2.6.2 Increase Rider and Bicycle Conspicuity: F2

This starts out with the usual statement that a motorist must recognize the object ahead or approaching as a bicyclist before he will decide not to hit it. I have never understood that logic, but it is repeated endlessly.

There's the usual bit about retroreflective clothing, without stating the limited proportion of situations in which these might be effective.

There is solid endorsement of the need for headlamps at night and at least a reflector to the rear. There is criticism of the all-reflector regulation of the Consumer Product Safety Commission of the United States, both for its regulation and for its effect on public opinion, reducing the understanding of why headlamps are a safety necessity.

2.7 Reduce Effects of Hazards: Class G

2.7.1 Fix or Remove Surface Irregularities: G1

There is a lengthy discussion of diagonal rail-road crossings, using the drawing that I first supplied about 1973. However, there is no discussion of the general principle that grooves or slots parallel to travel are very dangerous, and no mention of such grooves that often exist between the sections of concrete roads. There is reasonable discussion of drainage grates.

2.7.2 Provide Routine Maintenance of Bicycle Facilities: G2

Reasonable discussion of surface maintenance problems, particularly near the right-hand edge of the roadway, including sweeping of debris. It is here that the danger of slots or ridges parallel to travel is mentioned.

3 Outline for a Model Implementation Process

I did not study this section carefully, but it appears to be a typical outline of the typical bureaucratic process. It does indicate that safety problems ought to be prioritized according to the

combination of casualty quantity and likelihood of reducing them.

4 My Conclusions

This is not a rational safety program. Rational safety programs consider the frequency and severity of the known types of accident, against the cost and effectiveness of the countermeasures that may be applied. Instead of such a rational program, this report presents a compendium of actions largely classified by area (intersections, roadways, driveways, surface defects, speed reduction devices) plus two other classes (safety equipment, safety awareness and behavior), without much concern to either evaluating their importance or their effectiveness. And those evaluations that are made are largely inaccurate.

This is supposed to be a program for reducing car-bike collisions. But, to its credit, it contains a bit more, considering road surface defects that cause only cyclist falls; and doing that fairly well.

But we have had for thirty years the most detailed study ever made of car-bike collisions, the subject of this program, a study whose pattern has been confirmed by recent studies to still exist. (The second Cross study of 1976.) Not only was no use made of these data at the time, but they are still ignored by this study, which uses a data set with a much cruder classification system and level of investigative detail. For these several reasons, the NCHRP Vol 18 Bicycle Crash Reduction program fritters itself into a collection of independent programs, many of which have little significance for reducing car-bike collisions.

One obvious error is the collection of actions regarding driveways, which is largely devoted to methods of reducing the speed at which motorists enter commercial driveways. However, the Cross statistics demonstrated (thirty years ago) that the main car-bike collision problems with driveways have to do with sidewalk cyclists and cyclists who exit the driveway without yielding to traffic.

Probably at the heart of the systematic set of defects in this collection of actions are the twin hidden and false American beliefs about cycling, that cyclists cannot, even should not, be expected to operate lawfully and that facilities correct for this unlawful cycling. I say hidden and false because the report, supposedly the nation's program for reducing car-bike collisions, never mentions these two prime causes and problems associated with car-bike collisions, nor the measures that they indicate to be appropriate.

The belief that facilities correct for this deficiency is the basis for the extensive coverage of bike lanes, which have never been shown to either be directed at the significant causes of car-bike collisions, nor to have significantly reduced car-bike collisions. Furthermore, there is no discussion of the problems caused when the bike-lane pattern deviates from the movements required by the rules of the road. The standard assumption appears to be that the cyclist must obey the bike-lane pattern, particularly at those locations where, because the bike-lane pattern strongly contradicts the rules of the road, the bike lane is painted a distinct color to show the greater danger of using it.

We have known, also for thirty years or so, that the largest cause of car-bike collisions is cyclist failure to obey the rules of the road for drivers of vehicles. And we have good evidence that cyclists who operate according to those rules also manage to avoid a considerable proportion of those potential motorist-caused car-bike collisions that are incurred by other cyclists. Yet this program, if one could call it that, fails to mention these facts that ought to be firmly in the foundation of any bicycle safety program.

There is no consideration that the cyclist needs to operate according to the rules of the road and that operating in this manner requires the use of judgement. So the bike-lane and similar designs are intended to be followed without the use of traffic skill and judgement, regardless of the fact that such designs still require the cyclist to use both traffic skills and judgement.

It is true that there is one section, rather lengthy, that provides short descriptions of many cyclist training programs. But neither the report itself, nor any of the descriptions it provides, state that the objective of the training is to develop the skill of operating according to the rules of the road for drivers of vehicles, and the test of the program is the demonstrated ability of its students to operate according to those rules. Instead the report makes such diffuse statements as: "The most successful education programs encourage people to think about their own travel attitudes and behaviors and help them make informed, better choices." When we teach swimming, we require that the students pass a swimming test. When we teach motorists we require them to pass a driving test. And so on, ad infinitum. But we refuse to apply the same criteria for teaching traffic cycling, and, therefore, we can never get cycling done properly and safely.

In summary, this report is no more than a collection of actions, some good but many irrelevant, that is not organized according the aim of reducing car-bike collisions, and, therefore, cannot be expected to have much effect in doing so.