



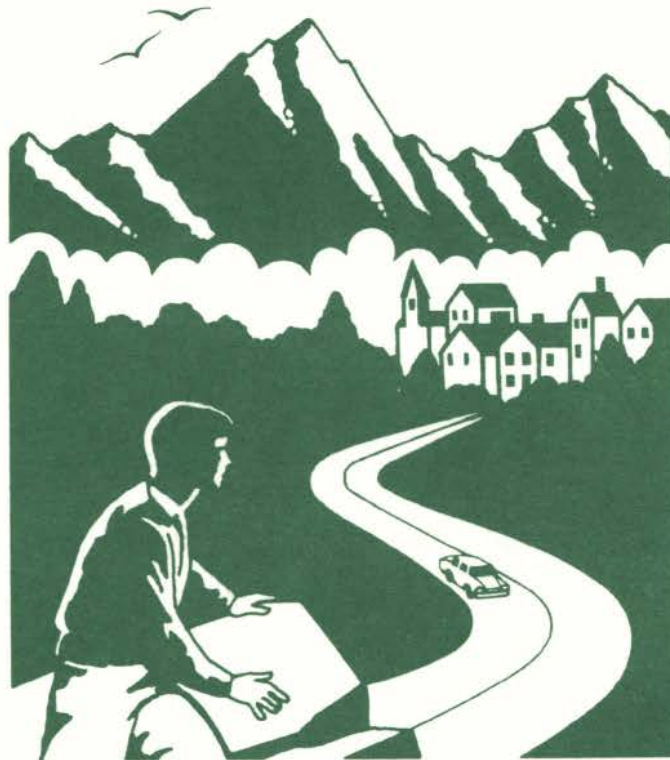
U.S. Department
of Transportation

**Federal Highway
Administration**

Final Case Study for the National Scenic Byways Study

The Impact of Bicycling on Scenic
Highways: Planning Requirements that
Affect Bicycle Use and Safety on Scenic
Highways

Scenic **BYWAYS**



September 1990

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Final Case Study
for the
National Scenic Byways Study

**THE IMPACT of BICYCLING on SCENIC HIGHWAYS:
PLANNING REQUIREMENTS THAT AFFECT BICYCLE
USE and SAFETY on SCENIC HIGHWAYS**

SEPTEMBER 1990

Prepared for
The Federal Highway Administration

Submitted by
The Bicycle Federation of America

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EXECUTIVE SUMMARY

BICYCLING AND SCENIC HIGHWAYS

The popularity of bicycling in the United States continues to grow as people enjoy the freedom, exercise and pleasure of riding quiet rural roads and other safe places to ride.

Most states have excellent and extensive networks of "backcountry" roads well suited to bicycling. Typically they are reasonably well-maintained roads with little traffic, great scenery adequate pavement widths and unspoiled, quiet surroundings: scenic highways!

The development of state and national scenic highway programs could improve these routes and could result in the signing of thousands of miles of unexplored state and federal roads.

It cannot be assumed, however, bicyclists will universally welcome the development of such programs. Bicyclists may be less than eager to share roads they currently enjoy with more traffic, especially large recreational vehicles.

Greater exposure to traffic may make these roads less attractive to bicyclists and may increase the rate and incidence of bicycle-vehicle collisions. In turn, this may create the perception that bicyclists are a "safety problem" on scenic highways.

This study, therefore, starts with the premise that the potential impact of increased bicycle use on scenic highways is of minor significance compared to the potential impact of scenic highway designation on bicyclists. Without some attempt to mitigate the consequences of the additional traffic scenic highways are likely to generate, bicyclists may lose many of their favorite routes.

There is also anxiety that a scenic highways program could result in the destruction of the qualities that make the route scenic. In order to prevent this, some basic guidelines are recommended:

a) The federal government role in scenic highways should be limited to technical assistance. Funding should only be available for planning and enhancement measures, such as signing and publicity.

b) Scenic Highways programs should not be construction programs. Priority must be placed on scenic corridor preservation.

c) Scenic Highways are recreational facilities, not transportation corridors. The design and character of the road, together with supporting literature, maps and signing should make this clear to users.

Further, the following criteria are used to determine the suitability and desirability of routes for bicyclists:

- a) A combined width for the right lane and shoulder of between 14 and 16 feet will enable motorists and bicyclists operate without conflict, provided traffic volumes and speeds are not too high.
- b) Frequent pavement maintenance, especially those areas where bicyclists ride, is essential. Driver alerting devices such as rumble strips should be restricted as they make the road unridable.
- c) As motor vehicle traffic volumes increase so does the need for more space in which bicyclists may operate.
- d) Traffic speeds should be restricted to 35 mph on the great majority of scenic highways. Exceptions should exist for routes that have a major transportation function.
- e) If design and geometrics make a route unsuitable for Recreational Vehicles either the route should not be designated, or RVs should be restricted.
- f) Bicyclists should be able to use tunnels, bridges and other potential barriers along scenic highways. Many creative solutions exist to facilitate continued access for bicyclists.
- g) Maps and informational materials should provide information to potential users of scenic highways on the quality and type of road they are considering using.

If these criteria and guidelines are followed many of the concerns of bicyclists can be allayed. Wherever possible, representatives of the bicycle community should be involved in the development of scenic highways programs, and the needs of bicyclists must be integrated into the thinking of those managing the scenic highways programs.

INTRODUCTION

In the last two years the U.S. Forest Service has designated fifty scenic byways in 26 states, with a total combined length of 2668 miles. The Bureau of Land Management has launched a "Backcountry Byways" program and states such as North Carolina and Colorado have initiated scenic byway studies or set up commissions in addition to the numerous other states with scenic byway programs.

This renewed interest in scenic highways stems in large part from the report of the President's Commission on American's Outdoors (PCAO). A key finding was the high level of driving for pleasure, with as much as 43 per cent of the population saying they participated in this activity in 1982. Adult participation in 1986 was reported to be as high as 77 per cent.

From the comparison of recreational activity trends carried out in 1960 and 1982, however, it would appear that the amount of driving for pleasure has actually fallen by up to 8 per cent. In contrast, bicycling has increased from less than 10 per cent of the population in 1960 to 25 per cent in 1982. Growth has continued since then. The PCAO survey of adult participation in selected activities showed 46 per cent enjoyed bicycling. In 1988, just two years later, the Gallup organization put the figure at 52 per cent.

Since 1982 the sales of new bicycles have outstripped those of new cars. The number of people riding bicycles has increased by 18 million in that time and 13 million more now ride on a regular basis, at least once a week. Vacationing by bicycle has more than doubled in popularity. The 1988 Gallup poll estimated that by 2010 there would be a further 24 million more bicyclists, giving a national figure of some 115 million bicyclists.

The reasons for this tremendous growth are beyond the scope of this study, except to say that bicycling both reflects current trends in recreation and to some extent has helped to shape them.

Throughout the 1980's people have become more concerned about their health, preferring to choose active, outdoor, participatory pursuits such as bicycling rather than spectator or sedentary pastimes. As recreation and leisure time has become more scarce people have turned to activities that give them quick access to the countryside for pleasurable day trips and weekend stays. Bicycling meets these needs and is an easy sport in which to participate.

Newcomers can choose the degree to which they wish to become involved in the sport. A new bicycle can be bought for as little as \$79 or as much as \$5,000. Riders can choose to travel 5 miles in a day or 500 miles over a week-long trip. Bicycling is a sport truly open to anyone.

Older Americans find bicycling an attractive option offering companionship and conditioning that can "not only help you enjoy the life you have but can help you to have more life to enjoy." For children bicycling remains the only independent means of transportation available to them.

In September 1989 a group of 25 leaders from the bicycle world -- manufacturers, retailers, government officials, users and the bicycle press -- met to discuss what was necessary for this remarkable trend to continue. Known as the "Aspen Group", they concluded that further growth in bicycling depends to a very great degree on the availability of safe places to ride. Without opportunities for "safe" and pleasant bicycling, the activity will be stifled and will decline.

Currently, most bicycling takes place on ordinary roads and highways that have had nothing done to them to either encourage or deter bicycling. Indeed, most roads have been designed and built with no thought to the needs of either bicyclists or pedestrians. If possible, bicyclists prefer to ride on quiet, low-traffic roads that have a variety of scenery, topography and points of interest along the way.

It is exactly these roads that come to mind when thinking of scenic highways, and just the type of roads that might become scenic highways under a federal, state, or local scenic byways program. That is why bicyclists are interested in the issue.

Bicyclists have the same basic desires and needs as other recreational travelers for refreshment facilities, scenery and other features. Thus bicyclists have something to gain from a good network of routes with these types of facility. However, with a scenic highway designation bicyclists also stand to lose some of the very qualities they look for in safe places to ride -- such as low volumes of traffic.

Almost 1,000 bicyclists are killed in bicycle/vehicle crashes every year. Approximately half of these fatalities occur on rural roads, despite the fact that most bicycling takes place in urban and suburban areas. Studies have shown that while crashes are less common on rural roads they are more likely to involve serious or fatal injury to the bicyclist and that the speed of the vehicles involved is much higher in rural areas than in urban areas.

Any increase in traffic volume, particularly if the vehicles are trucks, buses or recreational vehicles, could quickly increase the accident rates experienced on these roads and create a heightened perception of danger for the bicyclist and of conflict for the motor vehicle operator. In such a situation it is not uncommon for bicyclists to be branded as "the safety problem" and restricted or penalized in some way.

One of the main interests of the bicycling community is maintaining our ability to enjoy the roads and highways that might become scenic highways. The fact that North Carolina is, to our knowledge, the only state so far to include representatives of the state bicycle program in its scenic highways deliberations is a cause of real concern for the bicycling community.

This lack of involvement is especially distressing as there are things to be gained. As an additional benefit, scenic highways may make off-road trails and paths more accessible, and in very rare circumstances may help create new off-highway paths and facilities. It is also possible that certain major trails and particularly abandoned railroad conversions might become scenic trails or corridors dedicated solely for the use of non-motorized modes.

The original scope of this study was to look at the impact bicycling would have on scenic highways. As the work progressed it became clear that:

- a) sufficient data on the impact of bicycling simply doesn't exist;
- b) designation and development of scenic highways are more likely to have an impact on bicycling than vice versa;
- c) there is a real danger that the only easily quantifiable impact will be that more bicycle-vehicle accidents occur, and that bicycles on scenic highways become a "safety problem" that has to be dealt with.

The report will, therefore, look at the advantages and disadvantages scenic highway designation could have on bicyclists and will try to determine ways in which these differences can be reconciled. For example, most bicyclists would prefer to ride on a smooth, wide shoulder, or widened outside (right-hand) lane rather than the ordinary traffic lane -- but are they prepared to accept better riding surfaces at the cost of having recreational vehicles speed by them, or see roads widened in sensitive ecological areas to create this extra space?

Chapter one will look at the use, sales and demographics of bicycling to determine who is doing the kind of riding that might occur on scenic highways. An attempt will also be made to determine the possible economic impact of bicyclists using such roads.

Then Chapter 2 will look at what bicyclists hope to get from the experience of riding on scenic highways, or roads that could be scenic highways. There will be a discussion of the factors influencing enjoyment of roads: traffic levels, safety (perceived and real), speed, design, facilities (food, water, lodging, bike shops, parking), access, maps and/or signing, landscape, topography, and historic/cultural attractions.

This section will make clear the potential impacts of scenic highway designation on bicycling and bicyclists.

From this we will be better able to deduce how the impact of scenic highways on bicycling can be mitigated, and vice versa, through planning (e.g. billboard control, speed restrictions), engineering (shoulders, wide lanes, sightlines, parking etc), and education (information, signing, publicity etc). This will be Chapter 3.

Conclusions and recommendations will be contained in Chapter 4.

What do we mean by the term Scenic Highway?

Throughout this report we refer to scenic highways with the intention it be given a broad definition and understanding. We are talking of roads passing through beautiful scenery, historic areas and from one cultural attraction to another. We refer to scenic highways as shorthand for the whole corridor they pass through, as these are the very features that give the route its scenic quality.

We are assuming that the predominant user of these roads -- both before and after designation -- will be passenger cars. Exceptions to this will occur where bicycles or recreational vehicles are found in significant numbers.

CHAPTER 1

BICYCLING IN AMERICA, 1990

The popularity of bicycling as a form of recreation and means of transportation has grown throughout the 1980's, during which time more new bicycles were sold than new cars.

Table 1 provides a detailed breakdown of bicycling activity in 1989, together with a summary of activity in different categories for the last 7 years of available statistics. Growth has been consistent in most areas, with a doubling of participation, and spectacular in others, such as mountain bicycling.

Mountain bikes were just appearing in California in 1983 and in just seven years they have come to dominate the retail market, accounting for at least half of all bikes sold through bike stores. On the west coast the figure is closer to 90 percent. Many mountain bikes are never ridden "off-road" and are being chosen by recreational riders for their comfort, stability, and durability.

A Gallup Organization poll in December 1988 revealed that as many as 52 percent of adult American's had ridden a bike at least once during the previous twelve months, and they estimate that by the year 2010 there will be at least another 24 million bicyclists in the U.S.

It is estimated that over three million American's commute to work by bicycle, up from 475,000 in 1975. As urban and suburban motor vehicle traffic speeds drop, and health and fitness concerns continue to grow, this number can also be expected to rise as people realize they can get to work and work out at the same time.

Most bicycles in the U.S. are used by adults for recreation. During 1988 approximately 43 percent of the 47 million adult cyclists were riding at least once a week for enjoyment and a further five percent participated in one of many special, non-competitive cycling events such the RAGBRAI (Register's Annual Great Bike Ride Across Iowa). Indeed, more than 40 states now have equivalent "cross-state rides" with between 200 and 7,500 riders, each providing a significant boost to the local economies through which they pass.

While multi-day events of this kind flourish most riding is still done close to home and in one-day rides of anywhere between 5 and 100 miles. Bicycle clubs -- of which there are more than 1,000 in the United States -- report continuing growth in membership and participation in their organized, non-competitive rides.

The following estimates were developed by the Bicycle Institute of America (BIA). The data for 1989 and the projections for growth in 1990 are followed by a summary chart for the last seven years.

<u>BICYCLE USE IN 1989</u>		
Total U.S. bicyclists		90 million
Adults (persons 16 and over)	48 million (53%)	
Children	42 million (47%)	
Male/Female ratio (for adults)		45% / 55%
<u>CATEGORY OF USE</u>	<u>1989 LEVEL</u>	<u>89 -> 90</u>
Adults cycling regularly (average once a week)	23 million	+ 20%
Bicycle commuters	3.2 million	+ 20%
Adults cycling in competition (racing)	200,000	+ 20%
All-terrain bike users	11 million	+ 30%
People touring or vacationing by bike	1.1 million	+ 10%
Recreational event participants	2.7 million	+ 10%

<u>SUMMARY: 1983 - 1989</u> (in millions)							
	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>
Total U.S. bicyclists	72.0	75.0	78.0	82.0	85.0	88.0	90.0
Adults riding regularly	10.0	11.0	12.0	14.0	17.0	20.0	23.0
Bicycle commuters	1.5	1.6	1.8	2.0	2.2	2.7	3.2
Racing (in thousands)	40 K	75 K	100 K	120 K	150 K	180 K	200 K
All-terrain bike users	0.2	0.5	1.1	2.6	5.0	7.5	11.0
Touring & vacations	0.50	0.55	0.60	0.75	0.85	1.0	1.1
Event participants	n.a.	1.0	1.2	1.5	1.8	2.4	2.7

SOURCE: Bicycle Institute of America, Inc.

Bicycle touring has, as with other types of bicycling, more than doubled in popularity since 1983, although the typical bicycle tourist of 1990 is very different from a counterpart in 1980. Self-contained touring, with everything carried on the back of the bike, is still enjoyed by many, but more cyclists now prefer "Lite-touring", using credit cards to enjoy gourmet meals and the comfort of cozy country inns after spending a day in the saddle.

The number of commercial bicycle touring companies providing packaged bicycling vacations has increased from approximately 20 in 1980 to well over 100 in 1990. Their itineraries lead bicyclists over quiet, country roads through every state in the nation.

Bicycle Users

Table 1 makes clear that the majority of bicyclists are adults. Nearly every child has and still uses a bicycle, and it remains their only independent means of transportation, but you are far more likely to see adults on bicycles today than ever before.

Similarly, you are far more likely to see "seniors" on bicycles. Bicycling is second only to swimming and walking as a favorite recreational activity of people 50 and over.

It is no longer possible to dismiss bicycling as child's play, or bicycles as toys. Adults are spending large sums of money on bicycles, equipment and bicycle touring, and are increasingly sophisticated and discerning tourists demanding quality recreational experiences.

Economic Impact of Bicycling

Other than inferences that can be drawn from the sales and use figures given above, there are very few reliable sources of information on the economic impact of bicycling on communities and regions in which bicycling is popular as a recreational activity. Where they exist, figures tend to be very localized, based on individual trails or routes. For example:

Pacific Coast Highway, Oregon: The Oregon state bicycle coordinator reports that approximately 7,500 people bicycle the length of the Pacific Coast Highway in Oregon each year, a trip of some 400 miles. A detailed survey of spending patterns is scheduled for August 1990. In the meantime, one can estimate based on travel times (an average of one week for the trip) and likely spending levels that as much as \$2.5 million is spent by riders on this route each year. The bicycle coordinator also stated that some 80 percent of riders are from out of state.

Elroy-Sparta Trail, Wisconsin: 50,000 people visited the Elroy-Sparta trail in 1988, almost half of whom were from out-of-state. These trail riders spent \$1.25 million in the area of the trail (\$25.14 each for trip related expenses), which is only 32 miles long. Most trips are for two days or less. ("A Look at Visitors on Wisconsin's Elroy-Sparta Bike Trail; July-August 1988", University of Wisconsin)

Bicycle Touring in Vermont: Estimates from touring companies in Vermont suggest that as many as 20,000 riders participate in organized bicycle tours in the state each year, for an average of 3.3 days each. Assuming organized tours account for more than half of the total amount of bicycle touring, and self-contained tourists spend less than organized groups (who stay in more luxurious accommodations, for example), a total expenditure of more than \$16 million annually is estimated.

Bicyclists visiting North Carolina, according to a survey by the state bicycle program in the late 1970's, spend similar amounts of money to other visitors to the State, making them just as important in economic terms as car and RV users.

Mountain bike events: A mountain bicycle event in Devil's Den state park, Arkansas, generated per person expenditures of over \$80 during the 1 1/2 day event. A University of Colorado study into the economic benefits of staging mountain bike events reported average daily expenditure by participants (not including spectators, family etc) of almost \$40. The report estimates that "a medium size 2-day event attracting 100 people will produce direct expenditures of \$11,900".

More and more communities are feeling the economic benefits of increased bicycle traffic. Ski resorts in Colorado, Vermont and West Virginia rely on the mountain bike industry to sustain them during the previously lean summer months. Trails and long-distance bicycle routes attract an increasing number of wealthy recreational travelers with healthy appetites.

It seems appropriate, therefore, to treat the economic impact of bicyclists as equal in dollar-levels to other modes, but also to recognize that bicycle activity is likely to be concentrated in specific locations.

Bicycle Accidents

Every year between 900 and 1,000 bicyclists are killed in traffic accidents. Of the 910 who died in 1988 the overwhelming majority were male (781), and approximately half were children. (Table 2) Based on police records, there were a further 50,000-70,000

reported injury accidents and more than 500,000 injuries to bicyclists treated in hospital emergency rooms.

Over half of the fatal accidents occurred in urban areas, where accidents tend to be more frequent but less severe, whereas on rural roads accidents are likely to be more serious as the speed differential between a bicyclist and motor vehicle increases.

One of the most serious classes of accident is the overtaking of a bicycle by a motorist. This type of accident accounts for almost 40 percent of fatal accidents, and typically these occur on rural roads, frequently at night. Half of all rural cycling deaths are caused by this type of accident, compared to just 10 percent of urban fatal accidents.

A study of touring bicyclists carried out in 1976 revealed that among a large sample of bicyclists, typically riding in small groups, accidents were most often caused by other bicyclists (40 percent)! However, the more serious accidents were caused by poor road surfaces (27 percent) and motor vehicles (20 percent).

So, while bicycle accidents are less frequent on rural roads, when they do occur they are more likely to result in serious or fatal injuries.

SCENIC HIGHWAY RIDING

Clearly bicycling is a mass participatory sport with people from age 3 to 103 enjoying the freedom and exercise it brings. With such a broad range of users it is difficult to ensure that the needs of different users are all met by the same facilities -- as a 35 year old triathlete is not going to be satisfied by the same provisions required by a child riding in the neighborhood.

It is important, therefore, to understand what kind of bicycling is going to be most commonly undertaken on roads that are or may become scenic highways.

Who is likely to ride on a Scenic Highway?

These routes are not likely to be used by bicycle commuters or by unsupervised children passing the time of day with friends. Much more likely the routes will be chosen by:

- a) Long-distance riders, who tend to be more experienced and competent bicyclists -- but who may be riding with heavily laden touring bags and equipment. These riders will typically be traveling long distances -- more than 50 miles a day -- and are likely to be making multi-day trips.

b) Bicycle club riders, either on club rides or rides with friends. Again, these riders tend to be more experienced but there are specific problems and dangers associated with group riding that need consideration. Most will be on one-day or weekend rides, and will often have some kind of motorized support along with them.

c) Recreation and vacation riders. These riders represent a wide range of skills and experience. They may bring bicycles with them (on their cars) to use during a vacation trip, or they may be riding on an organized (commercial) tour or event.

d) Family groups enjoying the countryside together. Although the unpredictability of children requires special consideration (by motorists), family groups are likely to be more concerned and aware of safety issues. Typically, these riders will have a mixture of experience, but will be firmly led by one member of the family. Length of trip and distances ridden vary tremendously according to capability, ages and experience of riders.

In general, bicyclists on scenic highways are likely to want to ride a good distance in a day, perhaps from between 30 and 100 miles. Many have probably made a very deliberate decision as to their choice of riding areas.

Experience suggests these riders will endure or accept detours, that would not be acceptable to bicycle commuters, for example, in order to avoid traffic hazards and other unpleasant potential experiences. Riders are out to enjoy the countryside, escape from urban life and pressures of work and the city environment, and want to take in sites of special beauty, cultural and historic interest along the way.

These desires are, of course, precisely the same as the motoring public except that bicyclists also enjoy the exercise and sense of achievement that bicycling offers, and prefer an absence of motor vehicle traffic!

But, there are some important differences in the way these needs and desires are fulfilled for those on bicycles compared to those in cars.

The single most important factor for bicyclists is that they have a place to ride where they feel comfortable and safe. Narrow lane widths and a lack of shoulders are not compatible with high traffic volumes, high speeds, and a preponderance of recreational or heavy vehicles. All detract from the enjoyment of recreational bicycling.

A more complete list of concerns would include:

- * narrow lane widths with no shoulders
- * high traffic volumes
- * high speed traffic
- * recreational vehicles and trucks
- * quality of the pavement/road surface, maintenance
- * regular supply of places to eat and drink
- * safe places to leave bikes at rest stops, overlooks etc.
- * the ease of identifying routes to ride on
- * the ease of following them once started
- * access to and from scenic roads
- * continuity of the route, number of intersections
- * barriers, such as bridges, tunnels.

Chapters 2 and 3 explore these concerns and describe possible strategies for mitigating their consequences.

1. The first part of the document is a list of names.

- 1. John Doe
- 2. Jane Smith
- 3. Robert Johnson
- 4. Mary White
- 5. William Brown
- 6. Elizabeth Black
- 7. Thomas Green
- 8. Margaret Gray
- 9. Charles White
- 10. Susan Black
- 11. David Green
- 12. Nancy White
- 13. James Black
- 14. Karen Green
- 15. Michael White
- 16. Lisa Black
- 17. Christopher Green
- 18. Jennifer White
- 19. Daniel Black
- 20. Rebecca Green
- 21. Andrew White
- 22. Stephanie Black
- 23. Matthew Green
- 24. Ashley White
- 25. Ryan Black
- 26. Nicole Green
- 27. Kevin White
- 28. Heather Black
- 29. Timothy Green
- 30. Samantha White
- 31. Jonathan Black
- 32. Kristina Green
- 33. Steven White
- 34. Amber Black
- 35. Eric Green
- 36. Melissa White
- 37. Jeffrey Black
- 38. Courtney Green
- 39. Benjamin White
- 40. Victoria Black
- 41. Gregory Green
- 42. Mandy White
- 43. Alexander Black
- 44. Kaitlyn Green
- 45. Joseph White
- 46. Lauren Black
- 47. Nicholas Green
- 48. Sydney White
- 49. Aaron Black
- 50. Haley Green
- 51. Samuel White
- 52. Ariana Black
- 53. Benjamin Green
- 54. Isabella White
- 55. Nicholas Black
- 56. Sophia Green
- 57. Alexander White
- 58. Olivia Black
- 59. Christopher Green
- 60. Lucas White
- 61. Andrew Black
- 62. Emma Green
- 63. Matthew White
- 64. Sophia Black
- 65. David Green
- 66. Isabella White
- 67. James Black
- 68. Olivia Green
- 69. Robert White
- 70. Sophia Black
- 71. William Green
- 72. Isabella White
- 73. Daniel Black
- 74. Olivia Green
- 75. Michael White
- 76. Isabella Black
- 77. Christopher Green
- 78. Isabella White
- 79. Benjamin Black
- 80. Isabella Green
- 81. Alexander White
- 82. Isabella Black
- 83. Nicholas Green
- 84. Isabella White
- 85. Jonathan Black
- 86. Isabella Green
- 87. Steven White
- 88. Isabella Black
- 89. Eric Green
- 90. Isabella White
- 91. Jeffrey Black
- 92. Isabella Green
- 93. Benjamin White
- 94. Isabella Black
- 95. Gregory Green
- 96. Isabella White
- 97. Alexander Black
- 98. Isabella Green
- 99. Joseph White
- 100. Isabella Black

2. The second part of the document is a list of addresses.

CHAPTER 2

SAFE PLACES TO RIDE

Providing "safe" places to ride can mean all things to all people. In choosing this phrase as a rallying cry for the bicycle community, the Aspen Group of bicycle industry, government, media and consumer group representatives, deliberately left the phrase open to different interpretation.

In past years much of the energy of the bicycle community has been dissipated by internal wrangling about the virtues of one kind of "bicycle facility" over another, and over whether any special treatment for bicyclists is desirable at all. In reality, no-one can claim to have been right, as there are so many different types of bicyclists desiring so many different experiences.

What is common to all bicyclists is that they need space in which to ride. Space may be created by converting abandoned railroad rights-of-way into trails, providing shoulders on highways, allowing access to Interstate shoulders, by marking bicycle lanes on streets or widening curb lanes. Every situation is different and there is not one simple answer.

Space enables bicyclists to feel comfortable when riding. Without space, bicyclists are constantly having to worry about traffic coming up behind them and a) overtaking when it is not safe to do so; b) overtaking too close, whether there is space and time to pass safely or not; c) getting impatient as they wait behind them, often coming very close to the rear wheel of the bike; d) and simply not seeing them and forcing them off the road.

These fears are exacerbated by trucks, recreational vehicles and other large vehicles, as they create more wind as they pass, and are generally more threatening to bicyclists.

The perception of safety and "actual" safety as described by accident statistics are two very different things. Roads with good accident records may in fact be so dangerous and intimidating that bicyclists rarely venture on to them, and when they do so are extremely cautious and safety-conscious.

Roads with low bicycle accident records may not be the best or safest places to ride. If a road does not feel safe to ride on most bicyclists will avoid it and use alternatives -- if one exists.

A similar distinction exists between roads considered "desirable" and those considered "suitable". For example, an eight lane freeway-style road with ten foot shoulders might be very suitable for bicyclists, as there is plenty of space in which to ride. But, the route may not be desirable for bicyclists to use because of heavy traffic volumes, large numbers of trucks and unattractive views.

What makes bicyclists feel safe? Most would say, without much hesitation, an absence of traffic! Unfortunately, this is rarely possible, and in a lot of instances (canal and abandoned railroad corridors being notable exceptions) not desirable or practical.

For example, separating bicycles from motorized vehicles has not, on the whole, been done well in the United States. "Bike paths" achieved notoriety in the 1970's and 80's as a result of poor design, implementation and maintenance that left bicyclists using sub-standard facilities that were less direct and functional than parallel highways (which they were often then forbidden from using), often shared with pedestrians, and which usually failed to help bicyclists where they most needed it: at intersections.

In a 1978 report by Burgess and Burden, Bicycle Safety Highway Users Information Report (The Bikecentennial report or study), respondents to a survey were asked what improvements to busy roadways they would like to see. More than half wanted an identified bike lane, one third favored a separate bike path, and 12 percent suggested widening the pavement.

All these solutions will benefit motorists by getting bicyclists out of their way. If designed correctly, all of the solutions can be implemented without negatively impacting the bicyclist.

We have identified nine major criteria by which bicyclists judge their safety and comfort:

- Lane widths
- Separate space for bicyclists
- Pavement quality
- Traffic volumes
- Traffic speeds
- Traffic mix
- Sight distances
- Intersections
- Barriers and special features.

a) Lane widths

The AASHTO Guide to the Development of New Bicycle Facilities (The AASHTO Guide) states that:

On highway sections without bicycle lanes, a right lane wider than 12 feet (3.7 meters) can better accommodate both bicycles and motor vehicles in the same lane and thus is beneficial to both bicyclists and motorists. In many cases where there is a wide curb lane motorists will not need to change lanes to pass a bicyclist.

A usable lane width of 14 - 15 feet is considered ideal, and when widths are greater consideration should be given to striping a bicycle lane. The term usable is highlighted as the effective width of a road might be considerably less than the actual width if drainage grates, debris, poor surfaces and other obstructions make portions of the roadway unridable.

New Jersey Department of Transportation developed recommended lane widths dependent upon traffic conditions in 1982 and where the traffic mix includes heavy trucks, "15 feet of paved surface in the outside lane ... are sufficient, since it allows cars to pass bicyclists in the same lane, and the air turbulence caused by heavy trucks is minimal either because of lower speeds or the infrequency of the occurrence."

The state of Wisconsin has a series of "Bicycle Escape Guides" showing recommended routes and routes not considered suitable for bicycling. The designations were made according to a formula based on average daily traffic flows, traffic mix and pavement widths from as narrow as 14 feet (for two lane roads) up to 32 feet. (Table 2)

In general, once lane width falls below 12 feet passing motorists have to leave the lane in which they are traveling to pass a bicyclist safely. Where traffic flows are low this does not normally present a problem.

Wilkinson's 1986 FHWA study, "Highway Route Designation Criteria for Bicycle Routes" (Wilkinson study) states the "magnitude of possible impacts on highway capacity and level of service of bicycle traffic operating on narrow lanes has not been definitively established. At best, there is recognition of the advantages of wide outside lanes and the potential of negative impacts with narrow lanes."

The report concludes, however, that it is not possible to determine a minimum acceptable lane width for bicycle suitability as prevailing traffic conditions can vary so much. "So, no street or highway can be categorically excluded from consideration as a bike route solely on the basis of lane width."

MAXIMUM ALLOWABLE ADT ON COUNTY AND LOCAL ROADS

	-----PAVEMENT WIDTH UP TO-----									
PCT-TRUCK	14	16	18	20	22	24	26	28	30	32
10	399	564	798	1,071	1,515	1,761	2,033	2,490	4,981	6,431

CALCULATED FROM THE FOLLOWING MINIMUM DISTANCES BETWEEN CONFLICTS:

CAR-CAR	48.00	24.00	12.00	6.00	3.00	1.75	*****	*****	*****	*****
CAR-TRK	*****	*****	*****	60.00	30.00	16.00	14.00	11.00	*****	*****
TRK-TRK	*****	*****	*****	*****	*****	200.00	150.00	100.00	25.00	15.00

B) Dedicated or separate space for bicyclists

Many bicyclists feel safer if space for them is marked in some way, as in the case of shoulders, bike lanes and bike paths. As we do not feel the provision of bike paths along scenic highways is necessarily desirable or feasible (not least because it would require a considerable amount of new construction) we concentrate on just shoulders and bike lanes in this report.

Having a white line marking the boundary of space meant for cars and bicycles often makes bicyclists feel safer. It tends to improve lane discipline -- motorists are less likely to stray over the white line -- and provide for "more predictable movements by each," according to the AASHTO guide.

For the type of rural road most likely to become, or already be, a scenic highway, we are usually dealing with the issue of highway shoulders. Referring to the AASHTO guide we read that:

Adding or improving shoulders can often be the best way to accommodate bicyclists in rural areas, and they are also a benefit to motor vehicle traffic. Where funding is limited, adding or improving shoulders on uphill sections first will give slow moving bicyclists needed maneuvering space and decrease conflicts with faster moving motor vehicle traffic.

In urban areas some bicyclists prefer to have a wide curb lane for their use rather than a shoulder (except on high speed arterials), but on rural, two lane roads most prefer a shoulder. Indeed, most bicyclists prefer any width of shoulder rather than none at all.

In its more comprehensive Green Book AASHTO explicitly states that one important advantage of providing shoulders is that space is provided for bicyclists and pedestrians. Another is that a shoulder can substantially increase the lifetime of the roadway by preventing the collapse of the edge of the road surface under the onslaught of trucks and other traffic.

As Florida DOT detailed in a 1984 memo, shoulders do more than just provide protection for bicyclists, improve traffic flow and increase highway capacity. In addition, they:

- i) allow motorists to pass bicyclists without delay
- ii) reduce edge of pavement drop-off due to wind erosion created by trucks
- iii) provides better roadway pavement drainage and reduces hydroplaning potential
- iv) reduces potential for "run off the pavement" accidents.

Shoulders appear to be a good way of accommodating the needs of bicyclists for space. However, some words of caution are necessary.

a) Shoulders must have as good a surface as the roadway, or bicyclists will still ride in the roadway. Surface conditions are crucial for bicyclists, and potholes, cracked and rutted lanes will substantially reduce the usability of the shoulder.

b) Traffic control devices such as rumble strips and deliberately roughened surfaces, can render shoulders useless for bicyclists. Motorists may then encounter bicyclists in the roadway even though an apparently adequate riding space is available. This can cause considerable conflict and resentment.

c) A space used almost exclusively by bicyclists, such as bike lanes or shoulders, can quickly collect broken glass, loose gravel and other debris that makes them unridable. As vehicles are not using these areas of the road they are not subject to the same "sweeping" by the wind caused by cars and trucks. This is why bicyclists are usually seen riding close to the shoulder line rather than close to pavement edge. Regular maintenance and sweeping of shoulders and bike lanes is essential if they are to continue to be functional.

d) Some states, especially those considering bicycles as vehicles, have traffic regulations that forbid vehicles to use shoulders except in emergencies. This may create legal problems for the state, although bicyclists will tend to ride wherever is most comfortable and safe rather than where they are told to ride! Other states, such as Illinois and Oregon, specifically mark some shoulders as being bicycle facilities. Some clarification may be necessary.

e) A road with a great many intersections poses particular problems, as bicyclists using a shoulder become involved with merging and turning traffic. In such a situation, a wide curb lane or marked bicycle lane to the right of the shoulder line may be preferable.

The Oregon DOT has determined that shoulders appropriate for bicycle use should be between four and six feet wide. Five feet is considered ideal. Beyond this width they collect debris and become less rideable. For shoulders to be designated as bike lanes, five feet is the minimum. Caltrans and Florida DOT also set a minimum width of four feet for shoulders on most roads. For heavily traveled roads and those with a high percentage of trucks and recreational vehicles, a minimum of six feet is suggested.

Oregon DOT has also taken a unique approach in the use of shoulders along the Pacific Coast Highway. The best direction to travel the highway by bicycle, primarily because of the direction of prevailing winds and because the ocean is immediately to your

right, is from north to south. A very conscious decision has been taken to improve and widen the shoulder of the highway on the southbound side of the highway ahead of that on the north side. So, where roadway width or funds are limited, the southbound lane is widened or given a shoulder first.

The New Jersey DOT guidelines provide an excellent perspective to the provision of shoulders and wide curb lanes. Each method provides bicyclists with space in which to ride with a good degree of comfort. When determining road widths, sufficient width should be provided at the design stage to allow for either final solution -- wide curb lanes or shoulders or marked bike lanes.

C) Pavement Quality

The comfort and safety of bicyclists is much more sensitive to the quality of pavement surfaces than any other road user. A North Carolina DOT report from 1975 states:

" Rough pavement (low-bituminous) increases the road resist resistance to the tire, thus increasing the effort a bicyclist must expend to push themselves forward. Road shock cannot be absorbed by the bicycle on this type of road and is transmitted to the cyclist..."

The safety of bicyclists is also adversely affected by the presence of sand and gravel, railroad crossings, drainage grates that can swallow a bicycle wheel, potholes, other surface irregularities, utility covers, glass, cattle guards, rumble strips and a variety of other defects and debris.

Any of the irregularities and obstructions can cause a bicyclist to ride in the roadway rather than a shoulder or other designated location; may force a bicyclist to swerve unexpectedly -- either in to the side of the road or into traffic; may cause direct damage to the bicycle or bicyclist; and may encourage the rider to choose a less desirable, busier but more comfortable alternative route.

The Bikecentennial study reported that poor road conditions were responsible for 27 percent of all accidents, and that states with good rural roadway design and maintenance -- such as Missouri and Montana -- had significantly lower accident rates than those -- such as Kentucky -- with poor maintenance and design.

The Zilpo scenic highway in Kentucky, for example, "is not used by cyclists in Kentucky" according to the League of American Wheelmen Touring Information Contact because of "very poor maintenance". Traffic levels are not considered to be too bad, but "there is lots of trash" and poor maintenance.

Solutions to all of these problems exist, but the problems persist due to lack funding, poor design, infrequent maintenance and ignorance of the effect of these defects on bicyclists. The AASHTO guide provides good descriptions of many of the counter-measures and design criteria necessary to avoid many of these problems. They are all capable of solution and therefore should not be used as an excuse for excluding bicyclists from a particular route. The problems should be remedied!

The apparent adoption of the mountain bicycle as the "basic bike" for most adult riders may have a marked impact on the choice of routes bicyclists make. Mountain bikes can withstand rougher surfaces and are more comfortable than traditional sports bikes. We do not believe this justifies highway agencies lowering the standards of maintenance -- but we do believe it presents bicyclists with great opportunities for using stretches of unsurfaced, or poor quality surface roads that previously would not have been considered desirable riding routes.

For example, Vermont has thousands of miles of unsurfaced roads. These roads may be ideal routes for bicyclists as they have very low average daily traffic flows and are not suitable for bus, truck and recreational vehicle use. They pass through remote and beautiful areas of countryside and through small villages and settlements.

We do not believe these should be paved in order to make them into scenic highways for the benefit of cars, recreational vehicles and tourist buses as the unique character of the roads would be changed. However, the potential is there to designate them as being scenic through routes suitable for mountain bikes. Similarly, there may be routes along existing or proposed scenic highways that have alternative routes suitable for bicyclists that could be signed as scenic alternatives. The Bikecentennial survey reported that even before the age of mountain bikes bicyclists would consider using gravel roads for short distances in order to avoid busy sections of roadways.

If scenic highways are designated, and more traffic (including bicycle traffic) uses them, special attention to roadway defects must be paid. If nothing else, as potential users of scenic highways bicyclists should be warned of their existence, if the problem cannot be removed.

D) Traffic levels

The biggest single influence on the enjoyment of bicycling is, almost without exception, the presence of motor vehicle traffic. Although the availability of space on the roadway, traffic speeds

and other factors (continuity of the route, topography, facilities for food and lodging for example) mitigate the impact of higher traffic volumes, most bicyclists will try and choose routes that have little traffic.

a) The Bikecentennial routes use roads with ADTs between 200 and 1000, wherever possible. Approximately one third of the 4,200 mile route used in 1976 was on roads with an ADT of less than 500.

b) The approach of directing bicycle tourists onto low volume roads has been used to identify more Bikecentennial routes in Oregon, California, Washington, and North Carolina.

c) States such as Wisconsin, Ohio, Tennessee and North Carolina have developed maps for bicycle tourists that highlight low volume roads as being the most suitable for bicyclists to use (although other factors such as those listed above are also important).

d) Many urban bicycle routes are designed to direct bicyclists away from heavily trafficked roads and onto lower volume alternatives that do not seriously compromise the speed, directness and continuity of the trip being made.

Wilkinson makes the important point that "for rural bicycle routes ADT is more important as a "qualitative" factor (i.e desirability) than it is as a measure of suitability."

Van Valkenberg (1982) explains what it is about traffic volumes that affects bicyclists:

"From the standpoint of the bicyclist, significant conflict with motor vehicles occurs when a bicycle, an oncoming motor vehicle and an overtaking motor vehicle are within a section of roadway of a length required by the overtaking vehicle to pass the bicycle and safely return to its lane of travel..."

"Clearly the statistical probability of these motor vehicle/bicycle/motor vehicle conflicts has a major impact on the suitability of a roadway for shared use as very few road sections are of adequate width to allow the three vehicles to comfortably share the same linear space."

In developing a bicycle suitability map for Wisconsin Van Valkenberg developed a formula that includes consideration of lane widths, traffic speeds and traffic mix as well as ADT to determine the most suitable routes for bicyclists to use.

Any increase in traffic flows will clearly influence the desirability and suitability of a route for use by bicyclists. This has been demonstrated on a seasonal basis in New England, for example. The Kancamagus Highway is recommended by the League of American Wheelmen's Touring Information Contact as a route for bicyclists crossing the White Mountains, but

"It is a very popular fall foliage route for motorists and therefore not very pleasant for cyclists on weekends during that period".

This is true even though the route is described as having "adequate shoulders and good pavement".

Similarly, bicycle touring companies in Vermont report the population of the state increases on fall weekends from 600,000 to 1.5 million people -- most of whom are driving from one place to another. The only reason they are able to continue leading tours in that period is because of their ability to take groups on quiet, backcountry roads unknown to the vast majority of motorists. If those roads were designated as being scenic -- or "fall foliage" routes, for example -- their viability as good "bicycle routes" would be reduced or eliminated and fall bicycle touring could become impossible.

In Ohio bicycle clubs consider scenic highways to be "no more popular than any other county road. Generally, scenic highways are state highways that cyclists do not use because of traffic".

The Bikecentennial study specifically asked bicyclists what they would be prepared to "suffer" or give up in order to avoid heavily traveled routes. The survey asked riders to state whether they would be prepared to choose alternatives to a "busy" 25 mile stretch of road:

81% said they would use a quieter route that had 10 to 30 percent more hills.

89.8% would add five miles to their overall route.

80% would ride 1 mile on gravel
62% would ride 2 miles on gravel
48% would ride 3 miles on gravel
33% would ride 5 miles on gravel

88.4% preferred a coarsely paved 25 mile stretch with some potholes but deserted of almost all traffic.

95.6% prefer rural roads with little traffic and only occasional services to a roadway with frequent services but heavy traffic.

87.2% preferred a route that meanders through quiet back country and occasionally returns to dramatic geography -- such as the Pacific Coast in California -- for short 20-70 mile stretches, as opposed to 11.9 % who felt they could cope with 500 miles of moderate to heavy traffic on a route that hugged such dramatic geography.

While these answers are applicable only to touring and long-distance bicyclists, and relate only to desirability rather than suitability, they make very clear the importance bicyclists attach to the presence on motor vehicles in choosing their routes and in making bicycling enjoyable.

All other factors (such as road widths) being equal, bicyclists will be deterred from using roads if traffic volumes increase. If the designation of a road as a scenic highway generates more traffic along that route it will make it less desirable and enjoyable for bicyclists.

As well as providing an indication of the suitability and desirability of different roads for bicyclists, ADT can also provide a measure of exposure. Unfortunately, there is a lack of authoritative bicycle accident studies that have considered the impact of exposure rates and other such variables. It is difficult, therefore, to determine whether the increase in traffic on a given road will or will not affect the accident rates.

Instinctively, however, we know that the more traffic -- either bicycle or other vehicle traffic -- on a road, the more likelihood there is of conflict and collision between different users.

As we have seen, however, the existence of shoulders, wide lane widths and bicycle lanes can affect this. Similarly, the absence of such facilities, coupled with short sight distances, higher speeds and large vehicles will most likely increase bicycle/vehicle collision rates.

The Bikecentennial study considered different accident rates occurring in different states along the route. Missouri and Montana had the lowest rates and this was considered a function of wide, well-designed and maintained roads. The two most hazardous states were Kentucky and Virginia, a function of narrow, windy roads, truck traffic and deteriorating road surfaces.

However, two additional areas were singled out for special attention before the ride even began. Around Yellowstone National Park, and across the entire state of Wyoming, average ADTs were expected to be over 1,000 and many precautionary steps were taken to reduce the chances of conflict. Handouts to drivers and bicyclists, posting of special warning signs and other measures -- including the requirement that extension mirrors for vehicles towing trailers

be removed whenever the trailer was not being towed -- are all credited with reducing potential problems.

Greater exposure may well lead to more crashes. This is undesirable per se, but can also be detrimental to the status accorded to bicyclists on the scenic routes in question. For many traffic engineers -- and motorists -- bicyclists represent a "problem" to be dealt with. The occurrence of crashes involving bicyclists can heighten this perception and quickly lead to the idea of banning bicyclists from the route. Examples exist of popular roads for bicyclists being closed or access restricted because of conflict between modes, and the safety of bicyclists is usually cited as the reason for closure.

E) Traffic Speeds:

A major study into the attitudes of bicyclists in Europe found that in almost every nation bicyclists feel particularly threatened by speeding vehicles. Motorists often have no idea of the impact they can have on a bicyclist when they pass too close or too fast (or both).

This feeling of "unsafety" is borne out by accident statistics. Speed is a crucial factor both in the causation of crashes and also in the severity of their outcome. Almost without exception, when speed limits (and actual speeds) increase so does the frequency and severity of accidents. Similarly, a lowering of speed limits and actual vehicle speeds has almost always been followed by a reduction in accidents and accident severities.

We have already seen that speed is a decisive factor in the incidence and severity of bicycle/vehicle crashes. In addition to this, the "wind blast" effect of motor vehicles (especially recreational vehicles, trucks and buses) passing bicyclists can cause bicyclists to swerve, fall or be blown on to or off the road or into potholes and other dangerous road features.

An important FHWA study in 1975 concluded that mixed traffic flows (where lane width is limited to the point that bicycles and motor vehicles cannot share the lane laterally) are generally undesirable because of speed differential except:

- * surface streets in urban areas
- * long downgrades
- * at or near intersections where stopping is required
- * on lightly traveled streets on which encounters between bicyclists and motor vehicles are infrequent.

Thus speed ceases to be such an important factor where vehicles are traveling at similar speeds; where there are likely to be few encounters; or where there is adequate lateral separation.

It is also important to note that bicyclists are more likely to have accidents the higher their speeds. The Bikecentennial study revealed that the average speed of riders throughout the trip was 11-13 mph and the average speed at the time of accidents was 12-14 mph. As the speed increased, so did the severity of the injuries.

F) Traffic Mix:

Once again, the actual impact of higher numbers of large vehicles (trucks, buses and recreational vehicles) has to be considered as something different from the perceived impact on bicyclists. Truck traffic may have little quantifiable effect on the safety of bicyclists -- because a wide shoulder exists, for example -- but may make a route so unpleasant as to deter bicyclists from using it.

Wilkinson states this in certain terms: "Bicyclists prefer routes which avoid as much as possible sharing the road with large vehicles." They choose routes that promise "an almost total absence of large vehicles".

Previous studies (Van Valkenberg and others) have all treated the traffic mix as a crucial factor in route choice, and the Bikecentennial route was devised so as to avoid roads frequented by large vehicles. In Kentucky this was impossible, as coal trucks are ubiquitous on roads within the state. Even with this knowledge and a series of special warnings and accident reduction efforts in the state, Kentucky had one of the worst accident records on that trip.

The Bikecentennial study also highlighted the degree to which bicyclists perceive large vehicles to be a greater threat than passenger cars. Respondents to the survey placed recreational vehicles at the top of the list of potential hazards, followed by trucks and passenger vehicles. Although no indication is given as to exposure rates (i.e. the number of these different vehicles in the traffic mix) the involvement of these different vehicles in accidents is in the exact reverse order. Almost 40 percent of accidents involved passenger cars, and 9 percent involved recreational vehicles.

Finally, as bicyclists are so sensitive to pavement conditions it is important to remember that heavier vehicles do a disproportionate amount of damage to the highways, and that the damage caused by large vehicles is usually worst in just the places bicyclists are expected to ride - the right edge of the roadway.

G) Sight Distances

Bicyclists need to be seen. Sharp curves, foliage, and undulating countryside may all contrive to making bicyclists less visible and more vulnerable.

In particular, short sight distances can mean that either:

- a) Motorists traveling in the same direction as a bicyclist do not have sufficient time to reduce their speed, or
- b) motorists traveling in the same direction as a bicyclist do not have as many safe opportunities to pass the bicyclist.
- c) motorists traveling in the opposite direction and passing other vehicles fail to detect oncoming bicyclists.

One of the states with the worst accident records in the Bikecentennial study, Virginia, is described as having many rural roads "with poor visibility and sharp turns with steep descents ... through much of the state", and "dense foliage also cut down on the overall visibility."

H) Intersections:

Every study into bicycle/vehicle accidents identifies intersections as the most common location for conflict. AASHTO states quite simply that " A high proportion of bicycle accidents occur at intersections. Facilities should be selected as to minimize the number of crossings."

The 1976 Bikecentennial route was deliberately chosen so as to have a minimum of intersections and yet 13 percent of the accident victims reported that their most serious accidents occurred at intersections.

I) Barriers:

Certain road features, most notably bridges and tunnels, warrant special attention in any consideration of bicycling conditions. On "scenic highways" this is even more crucial as so many highways derive their scenic quality from mountains, rivers and water.

Along the Pacific Coast Highway in Oregon, for example, bridges are one of the greatest concerns for bicyclists and a majority of the fatal bicycle accidents occur on or near bridges.

(Strong winds and the presence of trucks also contribute to this heightened incidence of accidents.)

In many locations, this has been sufficient justification for the authorities to ban or restrict bicyclists using these facilities. Similarly, tunnels are often closed to bicycle traffic. The reasons are usually obvious. In order to reduce the cost and size of these structures, minimum pavement and lane widths are provided, leaving little or no space for bicyclists and motor vehicles to share the road without conflict. Fortunately, Oregon is one of the more progressive states with regard to bicycling and this negative approach has not been taken.

In tunnels, visibility and the lack of lighting exacerbates the problem, as do high winds on bridges. The design of bridges, such as one in North Carolina that is both a scenic highway and part of the bicycling highway network, may also be compromised by the desire to reduce the visual impact of the structure -- in this instance, by reducing the height of the safety barriers.

Once again, any increase in the number of motor vehicles using these roads will magnify the problems associated with these barriers.

Conclusion:

Bicyclists currently enjoy using a vast network of secondary and tertiary roads that are characterized by low traffic volumes, marginally adequate lane or shoulder width, an absence of large vehicles, reasonably well maintained surfaces and possessing scenic qualities. These routes are sought out with considerable care by bicyclists out for a day or weekend ride or on extended bicycle tours.

Any change in these circumstances (e.g. due to designation of these routes as scenic highways) could render them more dangerous and less pleasant roads on which to bicycle.

In addition to these concerns, there are a variety of secondary factors affecting a bicyclists choice of route that may cause a them to choose a more direct or better maintained road rather than the road with lowest traffic volumes.

For example, the necessary detour to avoid a short stretch of busy highway may be unacceptably long, or the alternative may not be clearly marked as a through road. A bicyclist may also choose a busier and faster road in order to gain from the presence of refreshment facilities, or lodging.

Secondary factors affecting route choice include:

- * Maps and signing. If one route is clearly marked on a map and a second potential route -- promising less traffic -- may not be shown clearly as a through route, most bicyclists will not risk riding a considerable distance on the off-chance that it is. The signing of roads is important to bicyclists who are more sensitive to the impact of making a wrong turn and having to double-back and add distances to a trip.

- * Scenery. The view from the saddle of a bicycle is very different to that experienced from behind the wheel of car. As bicyclists are traveling more slowly they are more able to take in sights and sounds in greater detail. Thus, large structures such as billboards, are a particular intrusion to the enjoyment of the countryside as they remain in view for so much longer than for motorists.

- * Availability of food, drink and accommodation.

However, as we have seen from the survey of riders participating in the 1976 Bikecentennial tour, bicyclists will go to considerable lengths to avoid traffic. That helps to explain the concern many bicyclists have of a major "scenic highways" program.

CHAPTER 3

MITIGATING THE IMPACTS OF SCENIC HIGHWAY DESIGNATION: ACCOMMODATING THE NEEDS AND INTERESTS OF BICYCLISTS.

We have seen how bicyclists will usually choose routes with the least amount of traffic on them. We have also been introduced to the idea that the design and character of the road itself directly affects the level of enjoyment, comfort and safety of bicyclists. For example, roads with very low ADTs do not have to have wide shoulders or lanes in order to make them suitable for bicycle use.

We do not really know what bicyclists will tolerate before a road that is popular among riders becomes unpopular because of traffic conditions. There are examples of how existing roads can be made more attractive to bicyclists, but we do not know whether bicyclists are willing to trade the benefit of more space for the potential damage to the scenic corridor that such improvements might cause.

In the Pensacola region of Florida there is a scenic highway that for many years had two lanes, no shoulders and a 55 mph speed limit. Very few bicyclists used the route, even though the coastal scenery is spectacular. However, now that four foot shoulders have been added, and a 45 mph speed limit imposed, it has become one of the most popular recreational routes for bicyclists in the area.

Any of the following "shopping list" of improvements is based on certain premises and guiding policies we feel are essential to understand.

- 1) Scenic highways are recreational facilities, and not transportation routes. This should be made clear to users before they reach the road, and the design and character of the road should make it clear to users that they are not using a road designed for high speed transportation.
- 2) Preservation of the scenic corridor is the paramount reason for scenic highways designation. Designation should confer on the corridor a strong degree of protection from development that would destroy the scenic quality of the route.
- 3) Designation of a route as a scenic highway should not negatively impact existing users of the highway, and all potential users should be considered in decisions affecting the use of the highways.
- 4) A scenic highways program should not be a major construction program.

"IMPROVEMENTS"

We are wary of major investment in the "improvement" of highways. Too often the "improvement" of highways has become synonymous with increasing capacity, widening, speeding up the traffic flows -- and generally making the roads less hospitable for anything except motor vehicles.

"Improvement" has also become closely associated with development and the last thing we want to see happen along scenic highways is development that destroys the very character of the road. The development of fast-food restaurants, billboards, condos or whatever it happens to be, will increase traffic levels and destroy the inherent scenic quality the corridor.

Our perception of "improvements" to scenic highways is based upon a desire to see:

- * more space for bicyclists, where traffic levels are high enough to warrant it.
- * better pavement and shoulder surfaces
- * introduction of low speed limits
- * the removal of barriers to bicycle movement
- * signing and mapping
- * special facilities for bicyclists, such as bicycle parking at attractions along the route.

NEW CONSTRUCTION

We do not believe a scenic highways program at the state or federal level should be a major new construction program. Not only would this create yet more competition for transportation dollars, but it would in effect be a program that deliberately encourages recreational travel. The Bicycle Federation firmly believes we have more than enough traffic on our highways at present and that it makes no sense to start encouraging more people to drive more often.

However, if new construction does take place there are very clear design considerations that must be taken into account for the benefit of all potential users. In most instances there is no need or desire for separate bicycle paths to be created -- the provision of a shoulder or wide curb lane will usually suffice.

However, in the case of the construction of a major road such as the George Washington Memorial Parkway, which is used as a major commuter route as well as being a scenic highway, there probably is a justification for providing a separate bicycle and pedestrian trail, similar to the Custis Trail that parallels I-66 in Washington D.C. In this instance the magnitude and importance of the project is such that special construction of a separate facility is desirable, and would be well used as both a transportation and recreation facility.

In contrast, were the Blue Ridge Parkway to be built in the 1990's, there would be no need to provide such a separate facility. The best option would be for the construction of a wide shoulder or lane in which bicyclists can mix safely with motor vehicles.

A) Lane Widths

Although there is little that can be done to significantly alter the total amount of pavement space on most scenic highways, and although we are not advocating a great deal of construction, there are ways in which additional space for bicyclists can be created from existing traffic lanes.

a) If the highway has more than two lanes, restriping can often be accomplished so as to provide wider outside curb lanes. This can benefit users of large vehicles as well.

b) Even on two lane roads, if the highway has significant grades it is feasible to provide a wider lane or shoulder for bicyclists and other slow moving vehicles traveling uphill. They will be traveling considerably slower than motor vehicle traffic wanting to pass them, whereas bicyclists going down hill will often be able to maintain similar speeds to motor vehicles. In such instances, the bicyclist is best advised to "claim the lane" to deter motorists from attempting to pass them at reckless speeds. Bicyclists often need more space to maneuver their vehicles at higher speeds.

c) Warning and informational signs can be posted, and details included in any promotional brochures, where conditions for bicyclists fall below a desirable standard.

The Pacific Coast Highway in Oregon provides an interesting example of how these techniques can be utilized. The majority of the route has adequate space for bicyclists. Where this is not possible, priority has been given to providing space for bicyclists traveling south. Where space is limited special signs have been erected warning motorists of the likely presence of bicyclists.

In some instances it may be necessary to restrict the use of certain roads to some vehicles. Narrow roads with poor surfaces may not be suitable for recreational vehicle use, and there are some examples of roads that are only open to bicyclists at certain times of the day. While this arrangement on the "Going to the Sun Highway" in Montana is not ideal (bicyclists may not use the Western side of the pass between 11am and 4pm between Memorial and Labor Day), the concept of time-sharing might be a last resort worthy of consideration in other areas.

Chapter 2 discussed ideal lane widths in some detail. A combined width for right lane and shoulder of between 14 and 16 feet is a good target for which to aim. For roads with low to moderate traffic flows, high speeds and a small number of recreational vehicles and buses this will allow motorists to pass bicyclists safely and without conflict.

B) Shoulders

Except where it can be done without impacting the environment and harming the scenic qualities of the road, and for reasonable cost, we would not advocate the construction or addition of extra pavement to provide a shoulder for bicycle use. However, we also recognize shoulders may be necessary and/or desirable to retain the integrity of the roadway pavement if an increased number of recreational vehicles use the route.

Where shoulders already exist, or are being provided anyway, we recommend they be at least four feet wide. If they are to be designated for the use of bicyclists Oregon DOT requires they be a minimum of five feet wide, and where traffic flows are expected to be heavy or large numbers of large vehicles are expected to use the road, a minimum of six feet is recommended.

Once again, there are certain techniques applicable where less than adequate space is available.

- a) Any shoulder is better than none. Simply marking the edge of the road or travel lane and leaving a very small shoulder (i.e. one or two feet) can help bicyclists feel less vulnerable by better channeling traffic.
- b) Providing a shoulder on the uphill side of the road rather than the downhill side. Bicyclists can maintain motor vehicle speeds on the downhill.

C) Pavement Maintenance:

The quality of the riding surface is of utmost importance for bicyclists. It is especially important for the right hand side of the travel lanes to be in good condition as this is where bicyclists most frequently ride. If shoulders are present these too should be regularly swept and maintained to at least as high a standard as the roadway.

The use of alerting devices such as rumble strips should be avoided or restricted as they make the road surface unridable for bicyclists.

D) Traffic Volumes:

If scenic highway designation is being considered the impact of additional traffic volumes on existing users must be considered. It has to be expected that designation will attract traffic -- either new trips or diversions from other routes -- and it is difficult to prevent this happening.

The impact of extra traffic will be less severe if there is space for bicyclists to ride and the formula developed by Van Valkenberg provides a useful illustration of the likely tolerance of bicyclists to different traffic volumes in different highway situations.

There is some evidence to suggest that in many states -- such as North Carolina, Ohio and Vermont -- scenic highways and recreational driving has been focused on state highways (although in North Carolina virtually all highways under state authority), where traffic levels may already be so high as to have deterred most bicyclists from using them.

Bicyclists may feel that as long as the programs remain at the state level, using state highways, their traditional riding areas on secondary and tertiary roads will be left relatively unspoiled. Other states, however, such as Wisconsin, have developed their scenic highways (or Rustic Roads) on county and local roads. More sensitivity to the needs and concerns of bicyclists is required, if this is the case.

E) Traffic Speeds:

As scenic highways are primarily designated for the benefit of recreational travel we can see no problem in limiting speed on these roads. Indeed, there is every reason to suggest that the limits should be lower:

- a) so that the scenic quality of the corridor can be admired
- b) as many users will be driving on unfamiliar roads, and possibly in hired cars and recreational vehicles that they have not grown accustomed to handling
- c) to deter their use as transportation corridors
- d) to reduce the speed differential between bicyclists and motor vehicles.

For these reasons we advocate a maximum speed limit for scenic highways of 35 mph, with rare exceptions for facilities such as the George Washington Memorial Parkway.

F) Traffic Mix:

As with traffic volumes, it is difficult to influence the traffic mix without regulation. Bearing in mind the desire of bicyclists to stay as far away as possible from trucks, we recommend that, where possible scenic highways be restricted for truck access, except for the legitimate supply of communities along the routes.

We also recognize that recreational vehicles will be heavy users of scenic highways. This is inevitable, although not a very pleasant prospect for bicyclists -- who perceive recreational vehicles to be the most threatening of vehicles. This concern is based on the fact that

- a) RV's are wider than other motor vehicles
- b) RV's are often being operated by marginally-skilled drivers
- c) RV's have rear-view mirrors that have hit and killed cyclists

Where RV use of roads is not compatible with the road, there should be no hesitation in restricting their use or not designating the route as a scenic highway (the approach taken in North Carolina).

G) Sight Distances:

As we have seen, bicyclists need to be visible to motorists, especially when motorists are overtaking them, or coming in the opposite direction and overtaking other vehicles. In order to facilitate this every effort should be made to ensure that vegetation does not obscure the bicyclist. Most restrictions of

sight distance can be solved -- but once again we would stress that any such management should not compromise the scenic quality of the corridor or roadway.

Signing of danger areas -- such as winding stretches of road, where bicyclists are likely to be riding in the middle of the road (such as on long descents), and where visibility is often poor -- can make motorists aware of the need to take extra care in overtaking and passing.

In Oklahoma there is a winding stretch of highway that is very popular with bicyclists and is also quite a busy road. Because of conflicts in the past a new device was installed in 1989 to warn motorists of the presence of bicyclists. Amber flashing warning lights are triggered by bicyclists passing over a loop detector as they approach the winding section of roadway.

A more traditional approach is to install warning signs telling motorists of the likelihood of encountering bicyclists, as this is a popular activity in the area. In North Carolina "Share the Road" signs are used along stretches of their "Bicycling Highways" where average daily traffic flows are higher than normally encountered.

H) Intersections:

As these have traditionally been such a common place for accidents we would encourage the development of scenic highways that have intersections conforming to the AASHTO guidelines.

I) Barriers:

Bridges and tunnels are likely to be the most significant barriers faced by bicyclists on scenic highways. Bridges act as pinch points for all traffic and are crucial links in the highway system. Too often they are constructed to minimum width standards that make the use of bicycles very unpleasant or make bicyclists vulnerable.

Wherever possible adequate space for bicyclists should be found to allow them to use bridges without restriction. However, the longer and narrower the bridge the more likely it is that restrictions may exist. Bicyclists may be required to use sidewalks (assuming these have been provided), and may be required to walk their bicycles across the bridge.

Not surprisingly, bicyclists resist having to dismount from their bicycles for any significant period. Walking a fully laden bicycle presents problems of its own, especially on a narrow walkway on a windy and exposed bridge.

In both North Carolina and Oregon scenic highways and bicycle routes coincide where there are major bridges. Both states have sought to maintain full access for bicyclists and on the Pacific Coast Highway sign have been erected warning motorists to look out for bicyclists in the roadway, and telling bicyclists they may use the sidewalks. Both options are available.

The League of American Wheelmen has developed a brochure on gaining access to bridges that more fully examines the issues relating to bridge access.

Another unique feature of the Pacific Coast Highway in Oregon has been their treatment of two long tunnels along the route. Clearly bicyclists using these tunnels are vulnerable once inside, as visibility is poor and lane widths often diminish within such structures. Rather than ban bicyclists from tunnels, or send them on some tortuous route to avoid them, the highway administration has installed special warning lights at the entrances of tunnels.

Bicyclists approaching the tunnel can trigger the warning lights which flash notification to motorists that a bicyclist is in the tunnel. After an appropriate time the lights stop flashing automatically.

This type of facility can also be applied to bridges, where motorists can be made aware of the likely presence of bicyclists through warning lights.

SIGNING AND INFORMATION

Throughout the research and writing of this report it has been clear that scenic highways can be everything from narrow two lane country roads in the backcountry of Vermont or Oregon, right up to four lane arterial routes such as the George Washington Memorial Parkway. Roads such as the Pacific Coast Highway combine a variety of features and have been heavily developed in some areas with strip development.

It is not possible to describe a typical scenic highway. We would not want all scenic highways to be uniform and to all look the same -- as none would have their own character. So, it is not feasible to lay down minimum or common standards or design criteria that must apply to all roads designated as scenic highways.

However, it is extremely important that users of scenic byways know what to expect from the road they are planning to use, or are heading towards. If the road is busy with a high proportion of recreational vehicles, and there is little or no shoulder for long stretches, bicyclists need to know this before embarking upon a trip along that road.

Similarly, recreational vehicle users need to know what they can expect from scenic highways so that they don't head for a narrow, twisting road with gravel surfaces and steep hills -- which might be unsuitable for RV use.

Maps and promotional literature developed for scenic highways should state the suitability of the route for different users and ask users to share the road responsibly.

RESOURCE PROTECTION

The least pleasant stretches of the Pacific Coast Highway, for bicyclists at least, are those where strip development has taken place. The scenic quality of the route is clearly compromised by the presence of commercial buildings, billboards and other trappings of development.

Traffic volumes, mix and patterns are significantly more threatening to bicyclists in these areas. This has happened because of a lack of controls over development along the corridor -- the development often occurred before the road was designated or considered as a continuous highway of significant scenic quality.

In the future, designation of a route as a scenic highway should mean that certain controls over development are put into place to preserve the integrity of the corridor and to maintain the qualities that make it scenic.

It is not appropriate to delve into the techniques and rules and regulations that can achieve these goals, but our support for them needs to be stated. A scenic highways program should not become an economic development program.

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CONCLUSION

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CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

The bicycling community reacted with considerable caution and concern over renewed interest in a major scenic highways initiative, at either the state or federal level. The perception remains that such a program would generate more traffic and direct it to roads that bicyclists currently enjoy using.

Unless great care is taken in designating and developing a national or state scenic highways program, bicyclists will be driven from quiet rural roads by an increase in motor vehicle traffic. Once pleasant places to ride will become dangerous -- either in fact, with accident rates rising, or by perception.

Some of these fears can be allayed by accepting the principles that:

- a) this is not a major construction program
- b) resource protection is paramount
- c) designation must take into account, and not negatively impact, existing use of the resource.
- d) this is primarily a state level program.

Similarly, bicyclists would be encouraged by assurances that certain qualities will pertain to all or most roads designated as scenic highways:

- a) maximum speed limits set at 35 mph
- b) all but essential truck traffic should be excluded or restricted
- c) bicyclists will not be banned from using bridges and tunnels found on scenic highways.

Where this is not done, information to this effect should be posted so that potential users are informed. For example, the scenic routes around the Great Lakes are almost all unsuitable for bicycle use, and it would be a mistake for bicyclists to try and ride around them! Many of the roads are actually controlled access highways from which bicyclists are excluded.

State versus federal role:

We do not believe that the federal government should play a major role in the development of a scenic highways program. Involvement should be limited to:

- a) Authorizing the use of federal-aid highway funds for state scenic highways programs meeting certain organizational and

resource protection management requirements. Such funds should only be available for non-capital or non-construction projects; enhancements that benefit the resource corridor; planning and technical assistance and signing.

b) the identification of a small number of scenic highways of truly national significance and importance, such as the Pacific Coast Highway and the Great River Road.

c) the development of standard informational signing methods for use on state and nationally significant scenic highways, so that users may better know what to expect from the highways. This should not compete or interfere with existing state logo signs being used.

Generally, scenic highways are better dealt with at the state level. Experience from Ohio and other states suggests that state programs will utilize state highways -- and not designate secondary and tertiary roads.

For the bicycling community this is the best option, as it will leave the quiet low-trafficked roads alone, and will create scenic highways along roads that are more likely to have sufficient space for bicyclists (such as shoulders). However, this will likely make the introduction and application of low speed limits and truck restrictions more difficult.

Wherever possible the methods of accommodating bicyclists outlined in preceding chapters should be followed. There are a great many ways in which to make bicyclists more comfortable and welcome, without major expenditure.

Where scenic highways are particularly suitable for bicycle use, such as the Blue Ridge Parkway and Natchez Trace, special bicycle route symbols could be devised to add to the scenic highway signs, without adding to sign pollution.

Where scenic highways program are underway, representatives of the bicycle community, or state and local bicycle officials, should be included in any steering or advisory committee, working group or other such administrative and policy making body.

Bicyclists fear scenic byways will be developed with no input from them and with little or no concern for their welfare. If these fears can be allayed, and bicycling integrated into the thinking of those developing scenic highways, there is much less to fear.

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North Carolina: North Carolina Bicycling Highways
Tennessee: Tennessee Bicycling Highways.

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