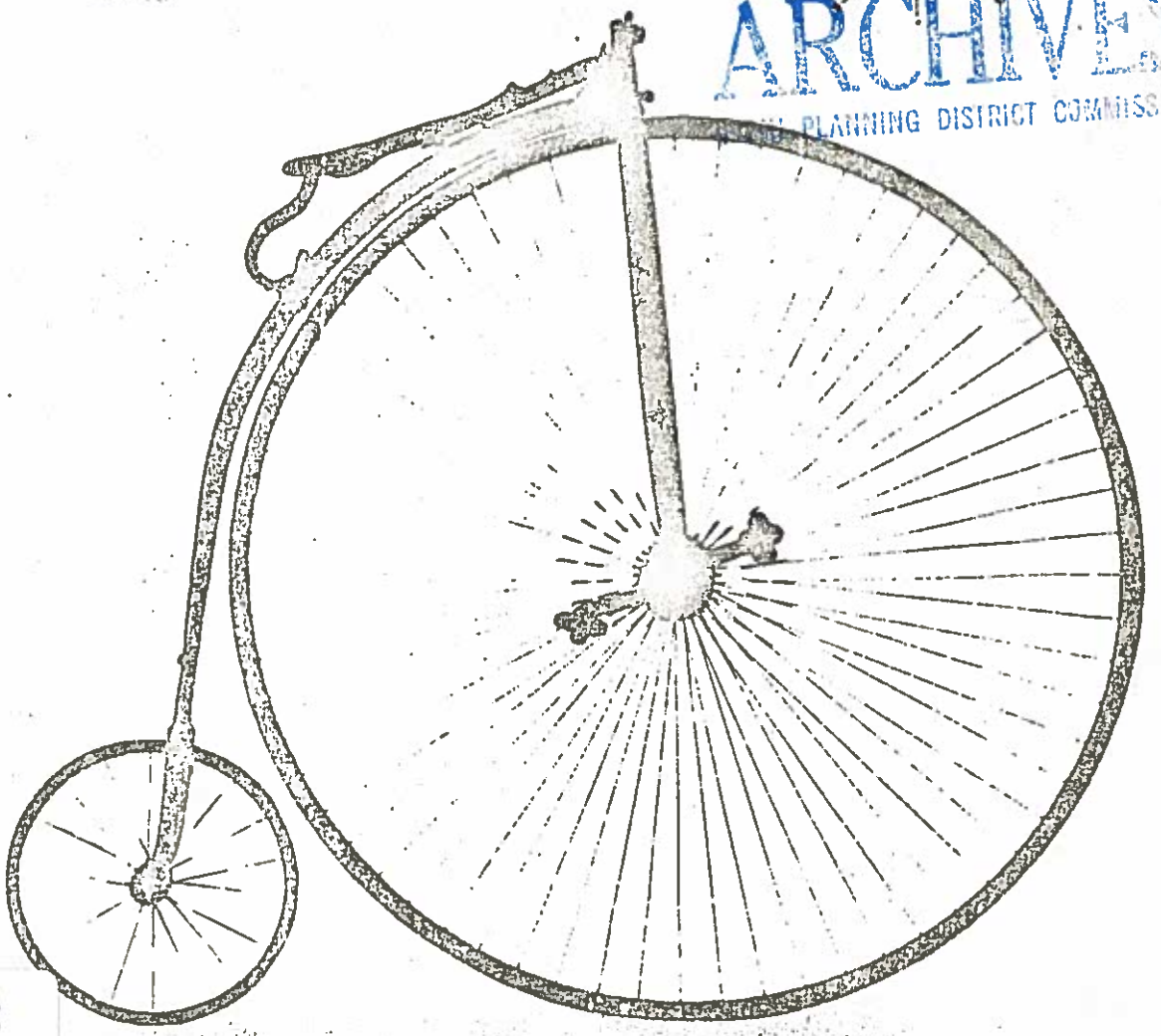
Bicycles ONCE AGAIN in Roanoke . . .



FIFTH PLANNING DISTRICT COMMISSION

145 W. Campbell Avenue
P.O. Box 2527
Roanoke, Virginia 24010

Chairman
NORMAN C. SCOTT

Executive Director
CHARLES L. HAEUSSLER

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Dear Citizens of the Roanoke Metropolitan Area:

It is indeed a pleasure to present to you this plan for bikeways incorporating the cities of Roanoke and Salem, Roanoke County, and the Town of Vinton. This plan is a result of urging from the U.S. Department of Transportation and Virginia's Department of Highways and Transportation as well as the citizens of this valley.

The Transportation Technical Committee of the Fifth Planning District Commission has consistently worked to provide facilities for various modes of transportation in the greater Roanoke Area. This plan promotes facilities for bicycle transportation in addition to bicycle recreation. There is a growing need to provide these facilities--especially in light of current usage of bicycles as transportation and safety hazards of cyclists and motorists sharing roadways in the valley.

I wish to thank the Citizen's Advisory Bicycle Committee and the Roanoke Bicycle Club for their input to this study, their assistance was invaluable. The Transportation Technical Committee wholeheartedly endorses the concepts of this plan and wishes continuing responsibility of the valley governments for its refinement and coordination and its implementation. Your interest in this program will be appreciated.

Sincerely,

William F. Clark

William F. Clark, Chairman
Transportation Technical Committee

1975 ROANOKE VALLEY BIKEWAY PLAN

FIFTH PLANNING DISTRICT COMMISSION

CITIZEN'S ADVISORY BICYCLE COMMITTEE:

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INTRODUCTION

The President's Advisory Committee on Environmental Quality points out that the automobile is not the most energy-efficient means of traveling, although for many people it is the most convenient. Our fixation on the car has led to neglect of other convenient, energy-efficient and sensible modes of transportation which are environmentally preferrable. Of the total amount of energy consumed in the transportation sector, automobiles use 14.3 percent; public transportation-which includes ground passenger traffic, airlines, freight, and farm vehicles-uses 10.8 percent.

Bicycles are 28 times as energy-efficient as cars, walking 17 times, buses almost 4 times, and railroads 2.5 times. Only airplanes are less energy-efficient than automobiles.

COMPARISON OF ENERGY EFFICIENCY OF TRANSPORTATION MODES

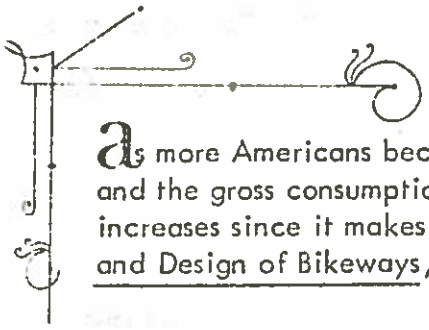
Mode Intercity	Energy (Btu/Passenger-mile)	Mode Urban	Energy (Btu/Passenger-mile)
Bus	1,600	Bicycle	200
Railroad	2,900	Walking	300
Automobile	3,400	Mass Transit	3,800
Airplane	8,400	Automobile	8,100

Bicycles are now being purchased by adults in increasing numbers and not so much for their kids. Adults are buying bicycles for themselves and for good reason. This historical resurgence is the strongest since the advent of the automobile 60 years ago. A great network of roads, streets, and highways have been built which accommodate automobiles (only 60 years?) and only marginally provide for bicycle use -- predominantly by school children who as soon as possible put aside their bicycles for cars.

Physical fitness, recreation, and "protection of the environment" all tie with our present bike boom, but none equals the shot in the arm bicycling got after last year's energy crisis. The crisis brought to each of us the awareness that gasoline is not the cheap and plentiful fuel we imagined. Therefore, bicycles are becoming more and more attractive and versatile as a mode of transportation, especially in light of the President's advisors calling for either a rationing program or a tax on foreign oil imports.

Bicycles are now lightweight, fast, and with a variety of speeds making hillclimbs easier, and ground speeds greater than conventional bikes. In 1960 the 10 speed bicycle was introduced and by 1967 the 15 speed bicycle was in use making cycling a truly viable alternative mode of transportation.

In other countries, the bicycle is and has been a major mode of transportation. Out of 6 million person trips per day by all modes in Copenhagen during 1971, one (1) million trips per day were bicycle trips.



As more Americans become concerned about the environment, population and the gross consumption of natural resources, the attraction for the bicycle increases since it makes the least demand on the earth's resources." (Planning and Design of Bikeways, 1974, p. 12)

HISTORICAL PERSPECTIVE

The United States has seen somewhat of a long and turbulent history of the bicycle. The first bicycle was very primitive, called the Dandy Horse or Draisine after its inventor Karl von Drais. Introduced in 1819 its inventor had not realized he had first developed what was to become the "most efficient form of power for land transportation ever devised by man." (Blacksburg Bicycle Trail Study, 1974, p. 7) The Velocipede was later introduced in 1869 and was supplanted in 1879 by an unstable machine manufactured in Boston labeled the "Ordinary" or "High" Wheeler' -- named after its characteristic large front wheel which was custom made to the dimensions of its rider.

The British Rover 'Safety Bicycle' developed in 1885 along with the addition of pneumatic tires, roller chain drive and 'diamond' frame in 1893 evolved the Rover into a bicycle essentially the same in form to the bike of today.

Additional sophistications introduced before the turn of the century are: suspension wheels, ballbearings for the crank and hubs, weldless steel tubing for the frame, and coaster brakes.

By 1900 the Safety Bicycle had almost completely supplanted the High Wheeler. Costing $313 at its outset, the High Wheeler dropped in cost to $150 by the turn of the century. The Safety Bicycle on the other hand cost $60 at its outset and could be purchased for $18 by 1900. The high cost of the High Wheeler was attributable to its large front wheel which did not lend itself well to mass production. The Safety Bikes, however, by 1900 were being made from components provided by other manufacturers -- an important facet of mass production was therefore attained, parts interchangeability.

As the Bicycle gained in popularity in the United States, bicyclists were demanding and obtaining better roads upon which to ride. In 1879, a Massachusetts court ruled that "bicycles cannot be deemed a nuisance, but are entitled to a reasonable use of Highways". In 1880, bike riders organized the League of American Wheelmen. By 1893, L.A.W. had close to 40,000 members and was spearheading many legal battles leading to lighted streets, street name signs at intersections and by 1896, 16 states had appropriated money to improve roads -- a time which by the way was dominated by railroad transportation.

The coming of the automobile ushered in the 'Dark Ages' for the American bicycle. Ironically provisions made for the bicycle served many of the needs of the automobile: roads, experience in mass production technology and several inventions (differential steering and expansion brakes). Bicycle repair shops were widely distributed lending

well to auto repair as the 'Hostles' built for bicyclists easily adapted to the needs of auto drivers. It was in the bicycle repair shops of Charles and Frank Duryea that the first American car was made. Henry Ford was attributed as saying in his bicycle repair shop that he would "build a motor car for the great multitude...so low in price that no man...will be unable to own one and enjoy with his family the blessing of hours of pleasure in God's great open spaces." (God's Own Junkyard, 1969, p. 58). An ironic statment to contemporaries as highways cater to the motor car which scar the face of this nation. In 1964 there were some "180 million people in the United States, each occupying about 2 square feet of our land surface; (while there were) close to 70 million private automobiles in the United States, each occupying about 120 square feet of land. In short, only 360 million square feet of America (was) being used (at any given moment) by people; but 8.4 billion square feet of this country..(were) covered with private automobiles." (Ibid, p. 119). Not to mention the thousands of acres of 'great open space' marred by scrapped automobiles. The aeroplane, the least efficient form of transportation, was also born in a bicycle repair shop -- that of the Wright Brothers.

The shift of high caliber talent to the infant auto industry, the redirection of capital for development of the car, and the auto's range, convenience, carrying capacity and popularity, led to the nearly complete elimination of the bicycle as a transportation mode in America. Until the 1960's except for brief resurgences during the Depression and the two World Wars, when fuel was scarce and low cost transportation was desirable, the Bicycle in the USA served primarily as transportation and recreation for children not yet old enough to drive.

Internationally, the bicycle has long been a viable mode of transportation. Economic factors have played a major role in the popularity of the bicycle abroad. Bicycles are considered an integral part of the transportation systems of Copenhagen, Denmark; Uppsala, Sweden; the Netherlands; Germany; Austria; Tehran; Iran; Japan; Bangalore; India; the USSR; and the British 'New Towns'.

Almost all of the international 'Cyclepath' Systems provide separated lanes exclusively reserved for bicycles (and sometimes moped use). For the most part 'Cyclepaths' separate bicycles from motorized traffic by barriers, hedges, physical separation or grade separation.

The predominant method of 'separation' employed in the United States to date has amounted to symbolic separation. With several notable exceptions the majority of U.S. 'Bike Routes' currently consist of little more than signs to guide bicyclists along a scenic route and at the same time warn motorists of their presence.

AMERICAN BICYCLE RENAISSANCE

In 1961, Homestead, Florida started the current bicycle renaissance -- to provide a safer way for children to bike to school. Between 1966 and 1971 Dade County, Florida, (which includes Miami in addition to Homestead) completed 100 miles of bike routes. A bank in Miami even has a pedal-up teller window.

The state of Wisconsin has an extensive, 300 mile statewide system -- the state of Ohio has 237 miles of routes in at least 7 different portions of the state.

In 1971 the state of Oregon passed House Bill 1700 which "requires the State Highway Commission, cities and counties to spend at least 1 percent of their highway revenue on foot paths and bicycle trails." This money cannot be spent on other projects. This bill should produce about $1.5 million in funds which may be matched by the Federal Government.

The District of Columbia claims to have 1200 Bike commuters per day during their eight months of 'fair weather'. They have spent $9,000 for 4 miles of route and have opened a route from the Georgetown waterfront to the RFK Stadium. The Smithsonian Institution reports plans for 130 miles of routes in the city, and 500 miles of routes within an afternoon's traveling distance by bicycle.

Texas has established routes in Austin and Dallas, and Houston has plans for routes throughout the city. New Jersey has built and has plans underway for routes in Princeton. Arizona has bike trails in Phoenix. In Colorado routes exist in Ft. Collins, Colorado Springs and Denver. Seattle, Washington has routes which use much of pre-existing street system. Wichita, Kansas also has proposed plans for routes -- one of which is a trail beside a proposed elevated freeway.

Probably the most spectacular example of the re-birth of the bicycle in America is Davis, California -- an academic community of approximately 24,000 people. The folks in Davis were able to convince the city and the university to recognize the locality's 18,000 Bicycles as transportation vehicles. The university itself is closed to all motorized traffic with the exception of the university maintenance vehicles. City streets incorporate a variety of bicycle routes from painted line to physical barrier. New housing construction must provide for bike routes with lanes separated from motorized traffic. On one major arterial in Davis the rush hour traffic is 40 percent bicycles -- 90 percent ridden by adults (even during summer with few students). It was surveyed that up to 10,000 persons ride to and from campus every day. Another inovative system in Marin County, California crosses the Golden Gate Bridge making it now possible to leave the city of Sausalito by a non-motorized vehicle. Routes also exist in

San Francisco, Sacramento, Berkeley, San Luis Obispo, Riverside, Santa Barbara, San Diego and Orange County in California.

On the Federal level, Edward C. Crofts, Director of Bureau of Outdoor Recreation (U.S. Department of the Interior) in 1966 announced plans at that time for 150,000 miles of urban and suburban bicycle routes to be provided over a ten (10) year period. A government report concluded that ideally there should be 25 to 55 miles of foot and bicycle trails for every 50,000 persons. Herbert F. Desimone stated -- "I'm determined to lend assistance of my office to make it (bicycling) a more viable mode of transportation". Indications are that the Department of Transportation is willing to cooperate with the Department of the Interior to achieve the goal of providing more extensive bicycle facilities in this country for both transportational and recreational use.

In Virginia today, there are nearly 100 miles of bikeways to the nations nearly 3,000 miles. Many additional bikeways are being planned in conjunction with other transportational facilities. The popularity of the Bicycle in the Commonwealth is expected to continue unabated in the years immediately ahead.

STATISTICS

Sales

In 1972 bicycle sales commenced to out number auto sales, this trend is expected to continue. Also in 1972 the sales of adult bikes accounted for one-half of the new bike sales whereas in 1969, adult bike sales constituted only 12 percent of new purchases.

Accidents

As sales of bicycles increase, the number of accidents and deaths also increase. The Consumer Product Safety Commission has designated the bicycle as the number one safety hazard on the American market based on the number of accidents and severity of injuries to children.

Virginia accident statistics reveal a consistent and significant annual increase in bicycle-motor vehicle accidents. The official State Police records for the 4-year period from January 1, 1969 through December 31, 1972 produced a total of 2,955 reported bicycle-motor vehicle accidents. Bicyclists are particularly vulnerable to injury or death when they are involved in collisions with motor vehicles. There were 43 persons killed in bicycle-motor vehicle accidents during the 4-year period in Virginia -- the State Police were pleased to report that none of these deaths occurred in the Roanoke Urban Area.

DEFINITIONS

Bicycle

A device having two-wheels tandem, propelled exclusively by human power, upon which a person may ride.

Bikeway

Also referred to as a bike route or bicycle way is any road, street, path or way which is specifically designated as being open to bicycle travel, regardless of whether such facility is designated for the exclusive use of bicycles or is to be shared with other transportational modes.

Bicycle Trail

Also referred to as a Class I Bikeway, a bicycle trail is a separate trail or path which is generally for the exclusive use by bicycles. Where such a trail is a part of a highway it is separated from the roadway and motor vehicle traffic by an open space or barrier.

Bicycle Lane

Also referred to as a Class II Bikeway, a bicycle lane is a portion of a roadway which has been designated generally for the exclusive use by bicycles. It is distinguished from the portion of the roadway and motor vehicle traffic by paint stripes, curbs, parking blocks or other similar devices.

Shared Roadway

Also referred to as a Class III Bikeway, a shared roadway is a roadway which is officially designated and marked as a bike route but also is open to motor vehicle travel. No provision is made for physical separation of the travel modes.

SELECTION OF BIKEWAYS

Bikeway

In developing bikeways, any one or a combination of the three (3) types of facilities might be selected. The ultimate selection of a given type of bikeway facility should be based on a variety of factors -- safety considerations, individual site conditions and economic considerations.

Bicycle Trail

Advantages:

1) Separates bicyclists from motorists (except where trails intersect roadways) minimizes probability of a bicycle-motor vehicle accidents.

2) They minimize the exposure of bicyclists to vehiclar fuel emissions and undesirable noise levels emitted by some vehicles.

3) They provide bicyclists with scenic transportation routes in areas detached from highway corridors.

Disadvantages:

1) They are the most expensive type of facility to develop and may require a separate right-of-way.

2) The time interval to develop this type of bicycle facility may be longer, particularly if the acquisition of additional right-of-way is required.

3) Enforcement of bicycle ordinances and protection of bicyclists from possible criminal offenses may be more difficult than with other types of bicycle facilities.

Bicycle Lanes

Advantages:

1) They provide a means to psychologically separate bicycle traffic from motor vehicle traffic.

2) A wide variety of design alternatives exists depending on the presence or prohibition of on-street parking.

3) The location of bicycle lanes readily facilitates the enforcement of bicycle ordinances by law enforcement officers who patrol roadways.

Disadvantages:

1) If street widths are inadequate and existing parking provisions cannot be modified, additional right-of-way may have to be acquired to make the bicycle lanes operational.

2) On-street parking may have to be banned to facilitate the development of bikeways.

3) Conflicts between bicyclists and motorists entering or leaving parked vehicles may occur.

Shared Roadways

Advantages:

1) This type of bikeway facility is the least expensive inasmuch as the riding surface is in place and only signs need to be installed.

2) No new right-of-way needs to be acquired to make the bikeway facility operational.

3) Maintenance costs are minimal since only sign posts and panels need to be maintained.

4) This type of bikeway facilitate the enforcement of bicycle ordinances by law enforcement officials.

Disadvantages:

1) This type of facility offers the least protection for bicyclists.

2) Vehicles and bikes use the same roadway and potentially hazardous conditions may need correction where sight distance is restricted.

3) This type of bike facility has limited usage and is confined to those areas where vehicular volumes and vehicle speeds are low.

URBAN BIKEWAY SYSTEM

The type of use expected of the facility is a pertinent factor to be considered when planning the bikeway system. The primary categories of use are recreational and commuting.

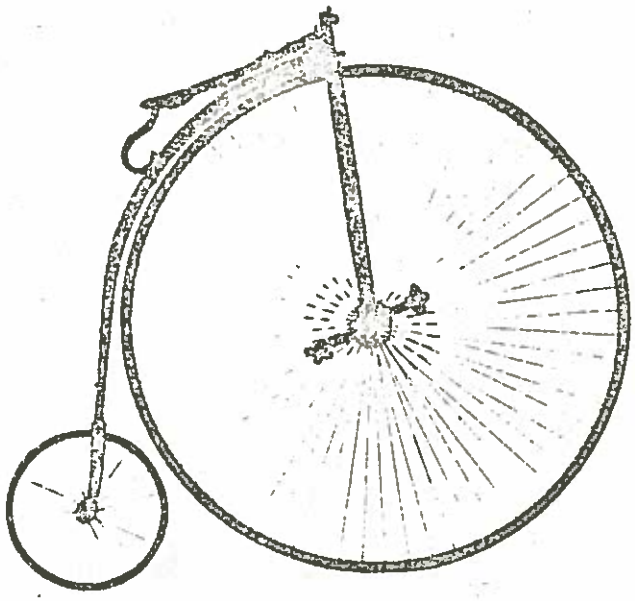
The intent of the designated routes should provide access to high density residential areas, colleges, urban parks, entertainment or recreational facilities, major commercial or shopping areas or employment centers. This system should provide for bicycle travel between small adjacent communities or within large urban/suburban areas where the bicyclists use these facilities not only for pleasure or errands but also for commuting to and from work.

In order to classify types of bikeways, the following assumptions of typical usage have been utilized:

1) Fifty percent of all bike trips are for recreational purposes and 50 percent are for commuting purposes.

2) Bicyclists on recreational trips will need the following percentages of the total bikeway mileage: Bicycle trails - 60 percent; Bicycle lanes - 10 percent; shared roadway - 30 percent.

3) Bicyclists on commuting trips will need the following percentages of the total bikeway mileage: Bicycle trails - 10 percent; Bicycle lanes - 60 percent; shared roadway - 30 percent.



BIKEWAY CRITERIA

The major considerations for a bikeway design are: length, location, acceptable grades, turning radii, and construction methods.

Length

There are no definite minimum or maximum lengths which can be prescribed for a usable bikeway. Experience in other states reveals that commuter routes will be used the most if distance from point of origin to destination is seven miles or less. For bicycle trips of five miles or less, the bicycle has the advantage over the automobile from both the standpoint of operating and time costs. In general, most bicycle trips are under five miles, thereby enhancing the economic viability of this mode of transportation for short trips.

Bicycle Trail Location

On roadways where the average daily vehicular traffic is over 4,000, a Bike Trail may be needed to separate and physically protect bicyclists from commercial or high-speed traffic (45 MPH or more).

When new highways are to be constructed which may also serve as bikeways, the inclusion of bicycle facilities in the origional construction plans, with acquisition of sufficient right-of-way, is much more efficient than adding a Bicycle Trail to an existing highway at a later date. Bikeways which are situated away from vehicular traffic provide cyclists with more safety and greater environmental benefits. Trails which meander at a level grade are the most pleasing for bicyclists.

Locations which may easily be adapted or developed into bicycle facilities are: telephone, powerline and gas pipeline rights-of-way; and riverbanks, embankments and flood control levees. Utility rights-of-way provide more than adequate horizontal and verticle clearances along a continuous line.

Usually the long and narrow rights-of-way follow origional contours. Riverbanks, embankments and flood control levees can provide usually long and gently curved scenic locations for Bicycle Trails than irregular riverbanks. Many embankments and most levees provide widths sufficient for the location of Bike Trails.

Bicyle Lane Location

Bicycle Lanes should be established on roadways where the vehicular traffic is too great for shared bicycle use and where the width of the road provides (or can be widened

to provide) space for such lanes. The daily vehicular traffic volume on roadways where lanes are necessary is on those which carry greater than 2,000 vehicles per day (the approximate upper limit for shared roadways). 8,000 vehicles per day is too high a volume on roadways with Bicycle Lanes where cyclists have little more than symbolic protection from motor vehicles. The speed limit for raodways with Bicycle Lanes should be no higher than 45 MPH. Recommended minimum roadway widths for additional Bicycle Lanes are as follows:

1) with parking permitted, both sides .....52'
2) with parking permitted, one side.....43'
3) with parking prohibited.....34'

Shared Roadway Location

Vehicular traffic volume and vehiclur speed are the prime considerations in establishing bikeways. Since a Shared Roadway provides the least protection for bicyclists, it is recommended that a higher type of bikeway facility be provided when the average daily vehicular traffic on a Shared Roadway exceeds 2,000. A Shared Roadway should be designated only where the speed limit is 35 MPH or below. Speed limits are particularly critical because the air disturbance created by a fast-moving motor vehicle can easily upset the balance of the bicyclist. Road width, like vehicular volume and speed is a crucial safety consideration.

The following are recommended minimum widths for Shared Roadways.

1) with parking, both sides.....44'
2) with parking, one side only .....34'
3) with parking prohibited.....24'

In extreme cases a Shared Roadway may be designated on a street or highway whose outside lane width is not less than 10'.

Grades

In investigating a proposed route or designating a new facility, the following criteria should be considered as a working guide for evaluating ascending grade conditions: 0% to 3% desirable, 3% to 5% maximum, 5% to 10% maximum acceptable for short grades. It should be noted that specific data related to the braking ability of bicycles is not available at this time. Because of our topography and climate, it is important that tests be made to ascertain the acceptable descending grade for wet-weather conditions.

Turning Radii

The turning radius of a bikeway should be established on the basis of its relationship to the design speed of the facility. Tests have been conducted to ascertain the smallest

'comfortable' radius that would be maintained at different speeds without braking. The reported relationship developed from test data is: R=1.75 V+1.4 where R is the turning radius (feet) and V is the velocity (MPH). Using this equation, with a bikeway speed designation of 10 mph, the, comfortable unbraked radius is 14. (No allowance was made in tests for grade or adverse weather conditions).

Bikeway Construction

Bikeways typically should be constructed to the same standards as light duty asphalt roads, or asphalt sidewalks, Bicycle Trails which are to be serviced by maintenance vehicles will need quality construction methods in order to insure adequate support for those vehicles. It is recommended that the following steps be used for the construction of a Bicycle Trail.

Once the bikeway has been located and staked, the first task will be the clearing of the path. This involves the removal of all debris, dead limbs, trees, stumps, and roots within two feet of the bikeway. For an eight foot bikeway this would affect an area twelve feet wide. It is also recommended that all hanging limbs and branches be pruned back to a height of at lease eight feet and preferably ten feet above the bikeway. Periodic inspection to remove any new growth should be made a part of the maintenance program for the bikeway.

The sub-base is ready for preparation when the clearing has removed the top soil leaving the lower stratus of soil exposed. Any large rocks or stones, if found, should be removed at this time. Then the sub-base should be graded to the desired specifications and compacted firmly.

In the event the bikeway must be cut into a hillside or traverse a section of wet ground, adequate drainage must be provided in order to keep the bikeway from washing out or to prevent the accumulation of water in low lying areas. To do this, drainage tiles must be used to remove water from under the bikeway. Failure to adequately drain a bikeway could result in frost heaving, erosion, and/or the cracking and buckeling of the surface thus resulting in the overall deterioration of the bikeway.

The purpose of the base is to adhere the bikeway surface to the ground and also distribute the loads of vehicles evenly. Good materials for this purpose can be found in aggregates, and crushed stong, etc. Finally, when the base has been laid and thoroughly compacted, the bikeway is ready to be surfaced.

Asphalt cement is by far the most widely used, accepted and recommended surfacing material today. The major reason for this is asphalt's strong and enduring qualities which make it highly desirable from a maintenance viewpoint, yet on the other hand, its workable qualities make it desirable and realitively inexpensive from a construction

viewpoint. Thus, it is recommended that asphalt be used for the surfacing of Bicycle Trails.

In the surfacing of bikeways, the asphalt should be inclined slightly to insure adequate water run-off. A slope between 1/4" and 3/8" per foot across the width of the bikeway is recommended.

Signs

There are two types of signs generally needed in the demarcation of a bikeway:

1) signs which are intended for the trail users, to either: (a) identify trails; (b) post regulations; (c) direct or guide the bikeway user; and/or (d) warn the rider.
2) signs which are primarily intended for motor vehicles to either; (a) warn motorists of cyclists or bikeways and/or (b) post regulations.

In either case, signs are necessary in order to identify the interaction between differing modes of transportation, and make each mode cognizant to the other, thus improving the safety for all rights of way concerned.

The following signs are authorized standards from the 1971, Manual on Uniform Traffic Control Devices, and are recommended for use on all classes of bikeways where found necessary or appropriate.

1) 'Bike Route'- used for marking an officially designated bicycle trail. The purpose of this sign is to guide the cyclist along any of the class bikeways mentioned in this report.

   Dimensions: 24" x 18"
   Shape: Rectangular
   Graphics: white bicycle symbol with 3" white letters "BIKE ROUTE" below on a green background, edge with a white border.

   When necessary, a supplementary sign with a directional arrow may be placed below the BIKE ROUTE sign.

   Dimensions: 24" x 6"
   Shape: Rectangular
   Graphics: white arrow on a green background edged with a white border.

2) 'Bikexing'- this sign is used to warn motorists in advance of a point where an officially designated bike route crosses a roadway.

Top Sign - Dimensions: 30" x 30"
Shape: Diamond
Graphics: Black bicycle on yellow background with a black border.

Bottom Sign: Dimensions: 24" x 18" - 6" letters
Shape: Horizontal rectangle
Graphics: Black "BIKEXING" upon yellow background.

Pavement Marking and Striping

In many situations, the signing of a bikeway may need to be supplemented with pavement markings in the form of stenciled signs and directional arrows. In fact, pavement messages are recommended for bikeways wherever the cyclist would be looking downward while being preoccupied with directional or pedaling efforts, such as uphill or turns.

Pavement markings can be intended for motorists, cyclists, and/or pedestrians. Whenever these messages are intended for motorists, they should be as large as the bikeway width will allow and in as few words or letters as deemed necessary. This is to insure that the intended messages will be easily recognized, and thus quickly read. If pavement messages are directed towards cyclists, or pedestrians, they may be reduced in size, but should retain their brevity.

The following pavement markings are recommended to supplement posted signs when necessary or found appropriate on any Bicycle Trail, Bicycle Lane, or Share Roadway.

"BIKEWAY" should be located at the beginning of any class bikeway.

"BIKE ONLY" should be located at an intersection to help demarcate the right-of-way between motorist, pedestrian and cyclist.

Directionsl arrows, "STOP, "SLOW", "YIELD", and "PEDXING" should also be used whenever necessary.

Lane striping will be necessary if not required for the demarcation of the right-of-ways for Bicycle Lanes. Lane striping can also be used in Bike Trails to delineate the edge of the path. Also, lane striping may help channelize bike flows and or identify bike lanes and their widths. Finally, lane striping can be used at intersections to demarcate the space alloted for a bikeway crossing. Crossroad lane stripping is recommended to

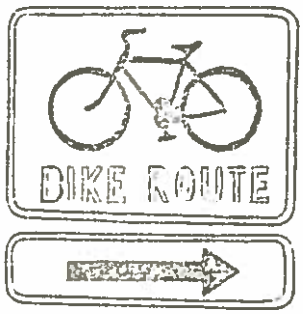
be 12" painted or thermoplastic white squares placed 12" apart on the length of the bikeway crossing.

Bikeway Demarcation and Sign Placement

Unnecessary, unattractive, and cluttered signs can contribute or be a form of visual pollution. Just the same, signs which are needed and are not provided for could result in poor judgement and slow reactions on the part of motorists, cyclists and/or pedestrians alike. The need for uniform placement and the proper type of signing can not be over emphasized.

The signing of a bikeway may vary according to its class type as well as its length and/or number of changing conditions along the path. For instance, Bicycle Lanes or Shared Roadways existing signs along their shared rights-of-way. However, signs in forming the motorist of this officially designated bikeway are recommended. As for a Trail it must rely entirely upon the placement of signs specifically designated for its use. Signs informing cyclists of directional changes, intersections with either motorist or pedestrian, beginning or ending of the bikeway (Class change), destination point, and/or guide signing are recommended to be provided on Bike Trails and also on Bike Lanes and Shared Roadways where deemed necessary.

Signs are also needed to warn motorists of bikeways and their intersections, and should be positioned at least 100 feet (in urban areas) preceeding a bikeway intersection.



BIKEWAY FUNDING

One of the facts often forgotten in the evaluation of the history of the bicycle is that pressure from the bicycle lobbies caused many of America's undriveable, almost impassable roads to be paved for the first time. Bicyclists were also active and instrumental in the implementation of an entire road network within various states and cities. It is ironic that the instrument which paved the way for decent driving conditions of the automobile should find itself in a position of now looking for scraps from roadway construction funds.

The bicycle's recent rise in importance as an alternate mode of commuter transportation requires that additional attention be focused by Government on the level of funding for facilities.

There are a number of Federal and State Funds which can be used on a matching basis to help expand the amount of money which the localities can possibly use for Bikeway Construction. Since the programs are varied in both eligibility and potential matching amounts, no specific dollar amount can be quickly predicted, but instead will be dependent totally on system design and priority of development.

Environmental concerns such as fuel conservation, noise pollution and air pollution enhance the feasibility of establishing bikeways in the Commonwealth of Virginia. Federal directives related to the development of bikeways are also being promulgated by the Environmental Protection Agency.

Responses from municipal and county officials, the existing deficiency in satisfying the forecasted demand mileage for bikeways, an increasing number of bicycle users and bicycle sales, a possible reduction of bicycle-motor vehicle accidents and environmental considerations all substantiate the feasibility of proceeding with the development of bikeways in the Commonwealth of Virginia. All of these factors must be considered as bikeway planning begins at the local level. Further, extreme care in bikeway planning must be taken to balance the use of the facility with the construction cost and to minimize maintenance costs and responsibilities.

COST OF BIKEWAYS

A number of varying factors are involved in the cost of establishing bikeways. The average cost per mile of one section may deviate significantly from the average cost of another section, as shown in the table below.

UNIT BIKEWAY CONSTRUCTION COSTS IN VARIOUS STATES

Type of Bikeway Facility	Source	Comments	Cost Per Mile (Excludes R/W)
Bicycle Trail	Oregon	Including some grade separation structures	$38,350-52,500
	Oregon	Excluding grade separation structures	$23,300
	Arlington Co., Virginia		$8,000-$14,000
Bicycle Lanes	Oregon	With only signing & striping required	$ 600
	Oregon	Including barriers	$9,000
Shared Roadway	Portland, Oregon		$ 260
	Arizona		$1,010
	Portsmouth, VA		$ 400
	Florida Study		$10,560-$14,080
Construction of Pavement Structure Only	Maryland Study		$26,400

The Department has developed design standards for typical bicycle trails, lanes and shared roadways, with the cost estimates on a per-mile basis using 1972 construction prices. These cost estimates are summarized in the table on the following page.

VIRGINIA DEPARTMENT OF HIGHWAYS AND TRANSPORTATION
UNIT COST ESTIMATES FOR
TYPICAL BICYCLE TRAILS, LANES AND SHARED ROADWAYS

Description	Cost Per Mile
Bicycle Trail Two-Way (Separate from Roadway)	$38,250
Bicycle Trail Two-Way (Adjacent to Roadway)	$38,250
Bicycle Lanes (Between Parking Lane and Travel Lane)	$ 2,280
Bicycle Lanes (Between Travel Lane and Edge of Road)	$ 1,420
Bicycle Lanes (Elevated Above Roadway with Curb and Gutter and Drainage Structures)	$72,350
Bicycle Lanes (Overlayed on Roadway Shoulder)	$12,180
Shared Roadway	$ 950

The average cost for bicycle lanes is estimated to be $10,000 per mile. The cost for a bridge structure with a ten-foot horizontal clearnance is $485 per linear foot. It is emphasized that these estimates are to be used only as a guide. The current economic situation in this country has so disrupted construction and maintenance operations that any cost estimates must be considered highly variable.

STATUS OF EXISTING PROGRAMS

Officials in federal and state agencies were contacted to determine the availability of any monetary resources in their existing programs which might be utilized to plan, design, construct or maintain bikeways in Virginia, and thereby diminish the necessity of establishing new bikeway funding programs. The results of this survey are briefly summarized in the following table.

STATUS OF EXISTING PROGRAMS

AGENGY	OBJECTIVES
Virginia Department of Conservation and Economic Development	
Division of Forestry	To encourage multiple use of forest resources
Division of Parks	To establish outdoor recreational use of natural resources
Virginia Commission of Outdoor Recreation	The creating and putting into effect a long-range plan for acquisition and development of a comprehensive system of outdoor recreation facilities
Virginia Department of Highways and Transportation	Existing Bikeway Program
Appalachian Regional Commission	Appalachian Development Highway System and Appalachian Local Access Roads
U.S. Department of Housing and Urban Development, Community Development	Urban Renewal Projects

STATUS OF EXISTING PROGRAMS
(Continued)

AGENCY	OBJECTIVES
U.S. Department of Interior	
Bureau of Outdoor Recreation	Outdoor Recreation-Acquisition and Development; Outdoor Recreation - State Planning and Financial Assistance
National Park Service	Historic Preservation Grants-in-Aid Program; To develop bikeways in National Historical Parks.
U.S. Department of Agriculture, Soil Conservation Service	Watershed Protection and Flood Prevention Program
U.S. Department of Transportation	
Federal Highway Administration	Federal-Aid Highways Emergency Relief; Federal-Aid Highway Act of 1973
National Highway Traffic Administration	State & Community Highway Safety
T.O.P.I.C.S. (Traffic Operations Program to Improve Capacity and Safety)	Increase capacity or safety existing facility; construction of signalization and signing systems, overpasses and separation of Transportation Modes
Tennessee Valley Authority	Water Resources Development
Environmental Protection Agency	Air Pollution Control Program Grants

STATUS OF EXISTING PROGRAMS
(Continued)

AGENCY	OBJECTIVES
Department of Housing and Urban Development	
Open Space Program	Public Open Space Facilities; Available amount allocated on Block Grant Basis
Demonstration Cities	Dependent on Priorities and Program set by Model Neighborhood; Available amount allocated on Block Grant Basis to Municipality as agent for Model Cities Agency

In most of the programs, bikeways must be constructed in conjunction with other capital improvements. The U.S. Department of Transportation is the only agency which has authorized the additional use of current funds to construct bikeways.

FUNDING ALTERNATIVES

Highway Funds

The diversion of highway funds represents one method to finance the development of bikeways in the Commonwealth of Virginia. Five states (California, Maryland, Michigan, Oregon and Washington) have enacted legislation using highway funds to finance bikeways, however, the Virginia General Assembly quashed a bill in January, designed to divert up to 1% of highways funds to bikeway development at the urging of the Virginia Department of Highways and Transportation.

Bikeways are incorporated into highway projects when officially requested by local governments; when they are part of an approved bikeway plan; and when the costs of the bikeways are absorbed into the total project cost. Local participation in funding is encouraged by incorporating bikeways in this manner, thus resulting in realistic development of construction projects which represent local investment and the interest of elected officials. Local participation amounts to 15 percent of total cost in cities and towns over 3,500 population. In a county's secondary road system, bikeways can be provided with local funding of 100 percent of the additional right-of-way costs. Primary projects are funded by the Department.

The Federal-Aid Highway Act of 1973 permitted states to divert not more than $2,000,000 per fiscal year in Federal-Aid Highway Funds for independent bikeways or walkways.

General Fund Revenues

General fund revenues represent a reasonable financial alternative for the development of bikeways. Even though general fund revenues have not been utilized to fund bikeways, they have been used by various agencies and local units of government to finance the development of various transportation facilities and programs in the Commonwealth.

With this broad dispersion of expenditures among various agencies, it is appropriate to consider using general funds to assist in the development of bicycle facilities which would be beneficial to citizens residing in all regions of the Commonwealth.

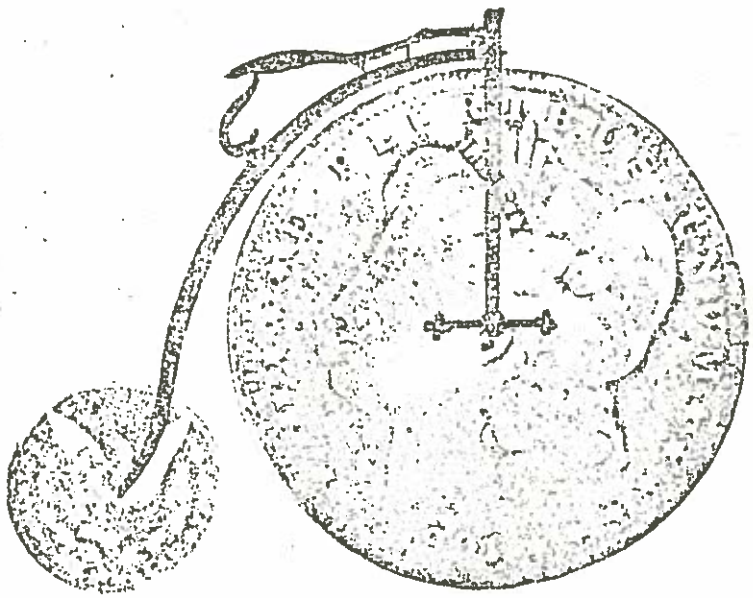
Two major sources of revenue for the state's general fund are the income tax on individuals and the sales and use tax. Estimated net revenues collected from the sale of bicycles have increased significantly since the implementation of the retail sales and use tax on September 1, 1966.

The use of general funds to finance the development of bikeways merits serious consideration in view of the sales tax payments by purchasers of bicycles, the increasing popularity of bicycling and the current practice of using general funds to finance certain other transportation programs.

Revenue Sharing Funds

Federal revenue sharing funds as established by the State and Local Fiscal Assistance Act of 1972, more commonly known simply as Revenue Sharing, might be used by state or local units of government to design, construct or maintain bikeways.

The Act covers seven entitlement periods running from January, 1972, through December 1976. After expiration in 1976 revenue sharing funds will not be available to supplement the state's general fund unless the Act is extended by new federal legislation.



BICYCLE THEFT DETERENTS

Parking

Coupled with the current increase in cycling, is the increase in the popularity of of bicycle theft. This may be attributed primarily to poor or often non-existent bicycle parking facilities. Also to blame are the usually inadequate locks and chains cyclists often carry around to secure their bikes. These chains are often not large enough to lock both front and rear wheels, as well as the bicycle frame, to a fixed and secure object. Most chains and locks simply are just not adequate to effectively stop or even detain an experienced bicycle thief.

Bicycle theft is an extremely attractive business, because it is quick and simple, not to mention the high resale value of any multi-speed bicycle especially in light of the present demand. It takes only minutes with a good pair of bolt cutters to snap through most locks and chains sold today for the protection of bicycles.

The parking facility most often used is the typical metal bike rack which supports the bicycles by the wheels and not by the frame. This is an undesirable feature for parking of $125 to $150 10-speed bicycles, whose thin wheels may be easily warped or bent when parked in wheel support racks. In unsightly, if not dangerous fashions, bicycles are therefore parked in a variety of manners and locations. They are found tied to trees, fences, light posts, parking meters, etc.

A bicycle rack has recently been manufactured which support bicycles by their frames while at the same time securing the wheels (i.e. Rally Enterprises, Inc.) The manufacturer claims they have "never lost a bike." These racks may also be ordered with coin operated mechanisms to defray their costs. Another theft proof inovation is the bicycle locker (sold by Bike Lockers, Ltd.) This solution to problems of bicycle thefts and vandalism is total enclosure. The locker conceals the bicycle therefore taking away the temptation of a rip-off (even if one could break in there is a possibility the locker could even be vacant). This manufacturer states that in all present installations, they also have never experienced bicycle thefts, therefore making both the frame and the lockers 100% theft free. A single auto parking space will provide enough space for up to 8 bicycle locker units back-to-back. These units are available with key locks for monthly rentals or with coin operated mechanisms for 24 hour rentals.

Bicycle Registration and Licensing

While there are many examples of the effectiveness of registration programs in theft control, perhaps the best example can be found in Vancouver, British Columbia. From

1964 to 1970 the recovery rate of stolen bicycles was at an all-time low of approximately 14%. After the establishment of the bicycle registration program in 1971, approximately 33,000 bicycle license applications had been received in the first 4 months. During this same 4 month period, recovery of stolen bikes showed a steady increase from 11.5% in the first month to 51% in the second month, 71.4% in the third month to a rate of 74.1% by the end of the fourth month. This increase is due mainly to the new licensing system and is expected to improve with each succeeding year as more bicycles are registered.

The city of Denver has been licensing bicycles since 1935. During the past 2 years, their recovery rate of registered bicycles has been about 53% as compared to a 27% recovery rate for unlicensed bicycles.

Both Detroit and Chicago experienced bicycle recovery rates that were approximately 20% higher for bicycles which were registered. Citizens seem to be unaware of the advantages which an effective bicycle registration and licensing system would provide.

The major advantage in having a full scale bicycle registration and licensing program available in the area is to curb thefts and facilitate the return to the rightful owners of lost and stolen bicycles coming into the possession of the police departments.

The Salem Police Department has been engraving bicycle owners social security numbers into their bicycles and retaining records with the owner's name, social security number, and bicycle serial number. There is no fee involved and the registration is not mandatory. The police departments of Vinton and Roanoke County have agreed to intiate Salem's registration program in their jurisdictions. The Roanoke City Police Department has agreed to lend engravers to bicycle owners and bicyclists may file their social security numbers and bicycle serial numbers with the department.

Fees could be charged for registration to defray the costs of the program as well as to generate funds. License decals with numerical coding would be issued to cyclists who had registered. It is recommended from past experience by the Vancouver Chief Constable, that a fee of $1.50 per registration and $1.00 for transfer of ownership would make a registration program self-supporting and fund-generating.

An accelerated effort to make a registration and licensing program which is well promoted to the cycling population will do much to discourage theft as well as helping in an organized effective method of protection. Early Spring is suggested as an appropriate time to launch such a campaign when warmer weather stimulates the yearly surge of interest in cycling.

BIKEWAY ROUTE PLAN

The Roanoke Valley Bikeway as proposed is comprised of two basic route systems. One is a transportation system and the other is a recreational route. Utilizing the assumtions of typical usage, fifty percent of all bike trips as recreational while the other fifty percent as transportational trips, the need to provide facilities for both types of bicycle usage is therefore evident.

Commuter Routes

There are five major areas served by the proposed network of transportational bicycle routes. Crossroads Mall and Williamson Road north of Roanoke City are linked to downtown Roanoke by utilizing roadways parallel to Williamson Road where traffic is less of a problem. Tanglewood Mall, Virginia Western Community College, and Towers Shopping Center in southwest Roanoke are linked to downtown Roanoke via Ogden Road, Winding Way Road, Colonial Avenue, Brandon Avenue and Jefferson Street. Also this area could be linked with the Riverjack area of Salem by providing a biketrail along State Route 419. The Oak Grove Shopping Area on Route 419 may be served by a route utilizing Bower Road, Grandin Road Extension, Grandin Road, Memorial Avenue and Wiley Drive (now designated a bikeway by the City of Roanoke).

The City of Salem and the City of Roanoke could be linked by the existing bike route in Salem and by use of Main Street in Salem, to Melrose Avenue, and Tenth Street in Roanoke enabling cyclists to commute from one city to the other or any point from one city to the other or any point in between. The Town of Vinton could be serviced by a route along Wise Avenue. Vinton is also a aprt of the Recreational Trail which eventually ties in with the Blue Ridge Parkway east of the town.

Recreational Route

This proposed bike route begins in the Haven Game Management Area north of Salem, making use of Salem's existing bikeway joining the Roanoke River at Riverside Drive. The route follows the Roanoke River east along Riverside Drive until it crosses the Route 419 Route 11 intersection where the trail may be constructed on a levee alongside the river. After crossing Route 11 again the trail is planned to pass behind Blue Ridge Industrial Park. This trail follows the river until it reaches Lick Run where the route may make use of existing streets eventually joining Wiley Drive. From Wiley Drive the route follows Piedmont Street to Riverland Road. Here a bridge for bicycles and pedestrains may be constructed across the river to take the cyclists away from the heavy traffic on Riverland Road. There is a flood control levee upon which the trail may be constructed. The trail would then cross the river at the Underhill Avenue bridge in southeast Roanoke where it would branch north to Wise Avenue and south on Bennington Street. From Wise Avenue the proposed route goes into Vinton where it may utilize several side streets to avoid traffic and finally onto Mountain View Road where it

joins the Blue Ridge Parkway. From Bennington Street the route progresses south to Rutrough Road and then joins the Blue Ridge Parkway. This route would qualify for status as a National Scenic Trail for funding since it links the Haven Game Refuge with the Blue Ridge Parkway.

RECOMMENDATIONS

There is a growing need for an efficient and low-cost transportation system in the valley. The bicycle offers such a means of transportation while benefiting the community socially, economically, and environmentally.

In order for this bikeway to become a reality it will require a coordinated effort among the valley governments. It is also recommended that the following measures be taken in order to provide immediate and long-range facilities for the bicycle.

1) Adopt this bikeway plan for its immediate construction and utilization.

2) Direct that bikeways be located wherever feasible, to better serve the public.

3) Adopt a provision, that for all future construction on roads, or their repair and realignment; consideration should be given to bicycles, and if found feasible, bikeways should be added into the design.

4) Direct that bikeways be constructed with high quality to reduce maintenance costs.

5) Direct that adequate funds are appropriated for the policing and maintenance of these bikeways.

6) Adopt and enforce safety rules and regulations.

7) Establish programs for educating pedestrians, cyclists, and motorists, of the rules and regulations governing each in relationship to bikeways.

8) Restruct parking along bicycle routes--except meter parking--during daylight hours (7 a.m. to 7 p.m.).

9) Provide adequate bicycle facilities for parking and left prevention for installation areawide: parking lots and garages, schools, colleges, shopping centers, bus and train stations.

10) Designate the Bicentenial Bicycle Route through Virginia a statewide bikeway.

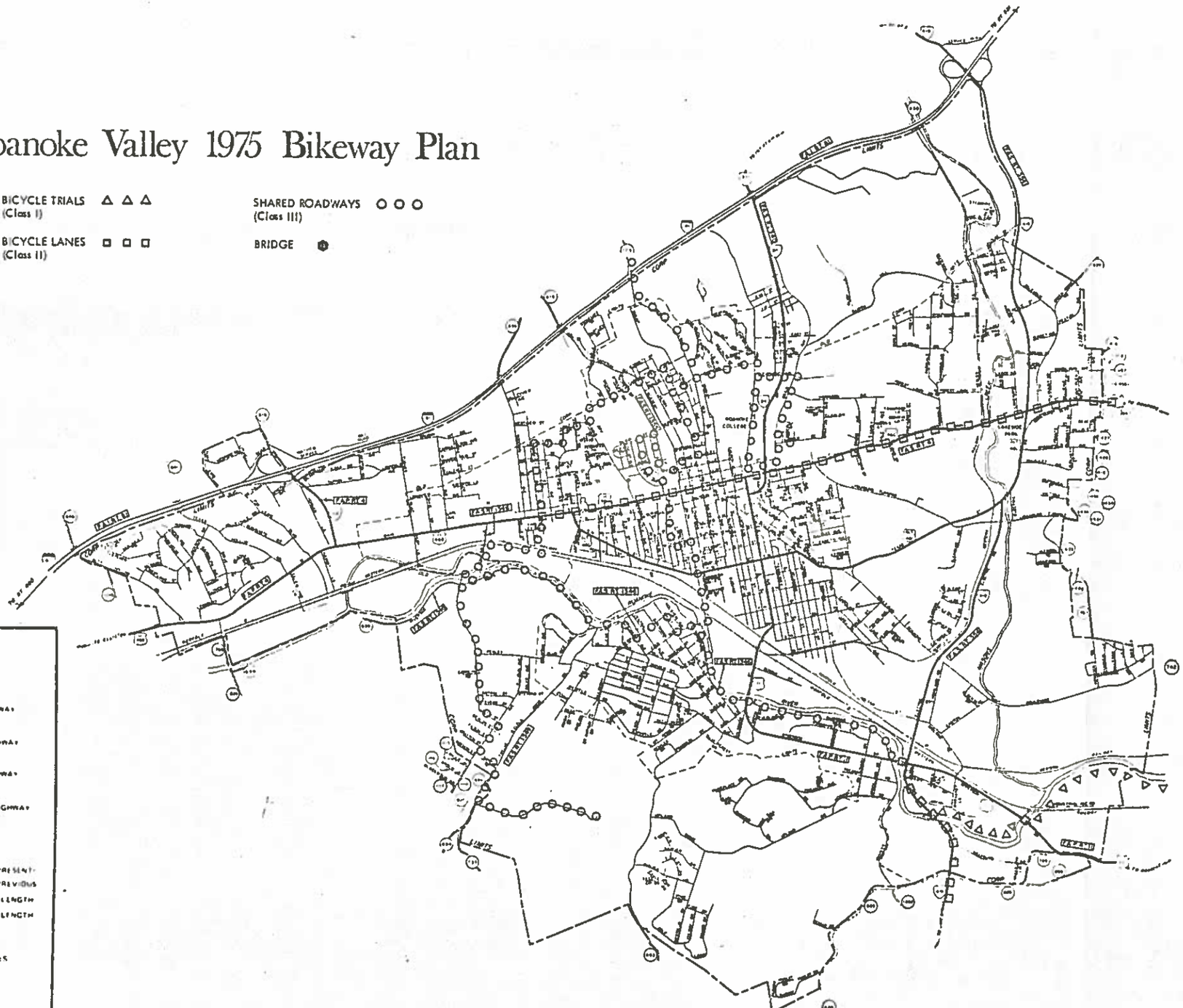
Roanoke Valley 1975 Bikeway Plan

BICYCLE TRIALS (Class I) △ △ △

BICYCLE LANES (Class II) □ □ □

SHARED ROADWAYS (Class III) ○ ○ ○

BRIDGE ●



LEGEND

Compass Plan Comp.

- 95 — INTERSTATE HIGHWAY
- 1 — US PRIMARY HIGHWAY
- 2 — VA PRIMARY HIGHWAY
- 600 — VA SECONDARY HIGHWAY
- MUNICIPAL STREET
- STATE LINE
- COUNTY LINE
- CORPORATE LIMIT LINE PRESENT
- CORPORATE LIMIT LINE PREVIOUS
- BRIDGE 20 AND OVER IN LENGTH
- BRIDGE 20 AND OVER IN LENGTH
- GRADE SEPARATION

RAILROAD CROSSING STRUCTURES

- RAILROAD TRACK
- UNDERPASS
- OVERPASS
- FEDERAL AID INTERSTATE SYSTEM

City of

SALEM

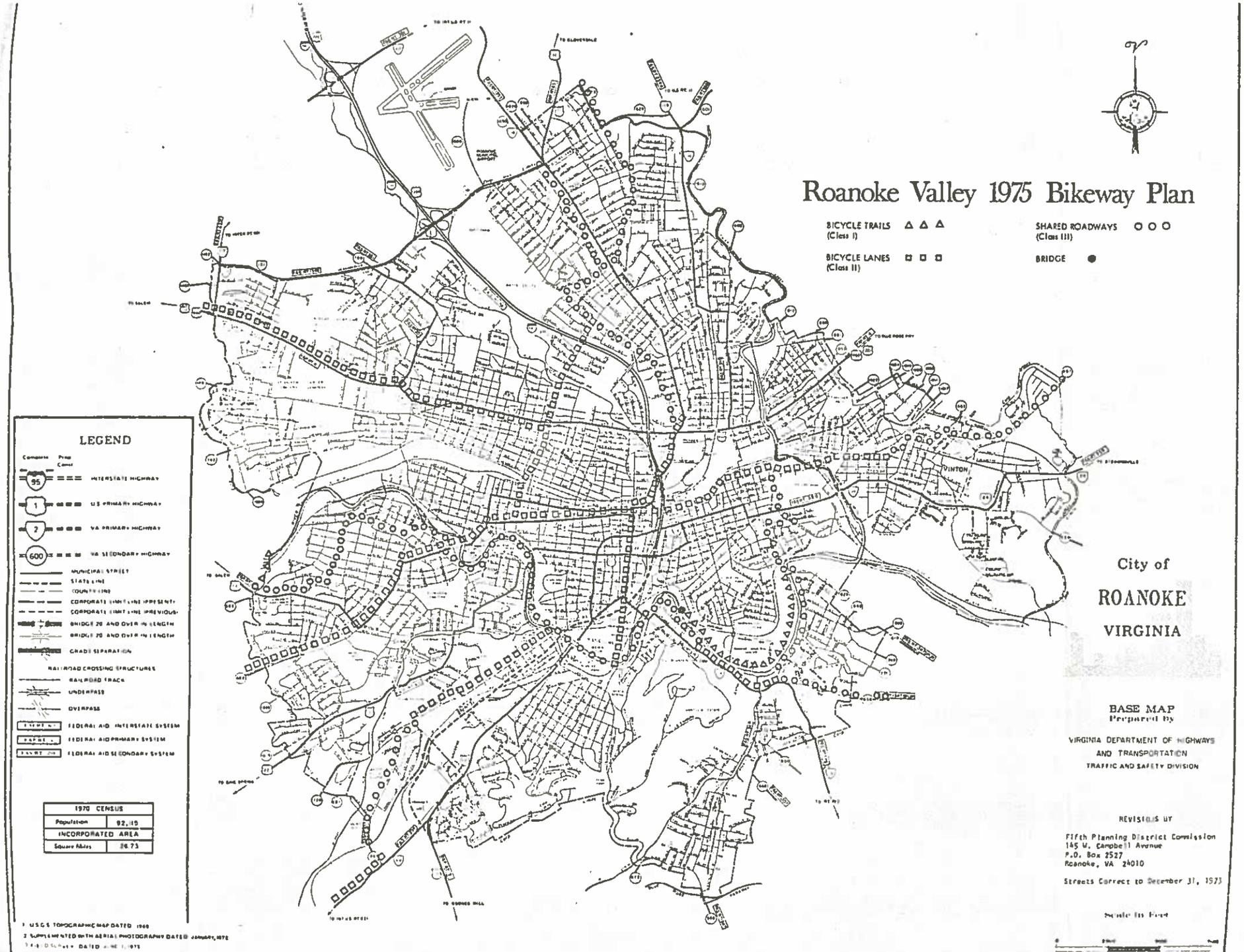
VIRGINIA

Prepared by

VIRGINIA DEPARTMENT OF HIGHWAYS

AND TRANSPORTATION

TRAFFIC AND SAFETY DIVISION


Roanoke Valley 1975 Bikeway Plan
BICYCLE TRAILS (Class I)
BICYCLE LANES (Class II)
SHARED ROADWAYS (Class III)
BRIDGE
LEGEND
INTERSTATE HIGHWAY
U.S. PRIMARY HIGHWAY
VA. PRIMARY HIGHWAY
VA. SECONDARY HIGHWAY
MUNICIPAL STREET
STATE LINE
COUNTY LINE
CORPORATE LIMIT LINE (PRESENT)
CORPORATE LIMIT LINE (PREVIOUS)
BRIDGE 20 AND OVER IN LENGTH
BRIDGE 20 AND OVER IN LENGTH
GRADE SEPARATION
RAILROAD CROSSING STRUCTURES
RAILROAD TRACK
UNDERPASS
OVERPASS
FEDERAL AID INTERSTATE SYSTEM
FEDERAL AID PRIMARY SYSTEM
FEDERAL AID SECONDARY SYSTEM
1970 CENSUS
Population 92,115
INCORPORATED AREA
Square Miles 36.73
VINTON
City of
ROANOKE
VIRGINIA
BASE MAP
Prepared By
VIRGINIA DEPARTMENT OF HIGHWAYS
AND TRANSPORTATION
TRAFFIC AND SAFETY DIVISION
REVISIONS BY
Fifth Planning District Commission
145 W. Campbell Avenue
P.O. Box 2527
Roanoke, VA 24010
Streets Correct to December 31, 1973
1 U.S.G.S. TOPOGRAPHIC MAP DATED 1968
2 SUPPLEMENTED WITH AERIAL PHOTOGRAPHY DATED JANUARY, 1975

ROANOKE URBAN AREA

FIFTH PLANNING DISTRICT COMMISSION

APPENDIX A

ARGUMENTS FOR BIKEWAYS

1) In 1973, more than 15 million bicycles were manufactured in and imported into the United States. This exceeds the production and importation of automobiles by 3.1 million for the year. 1974 bicycle retail sales are expected to exceed 1973.

2) In 1974, it is estimated that 45% of the bicycles bought, will be bought by adults.

3) Bicycles provide low cost recreation and transportation anyone can afford and maintenance costs are minimal.

4) Bicycles provide random, personal, rapid transit for distances up to five miles most months of the year.

5) Bicycles are free of noise and air pollution.

6) Bicycles require minimum space, both while being ridden and parked.

7) Bicycles don't contribute to an energy crisis by not using any of the scarce energy sources--oil, gas, or electricity.

8) Bicycles provide needed exercise in addition to its recreational and transportational utility.

9) Better and safer bicycle riding facilities will help reduce bicycle fatalities.

10) Safer and more direct bikeway routes will encourage many more people to ride their bikes to save fuel, reduce pollution, and relieve traffic congestion.

APPENDIX B

IT'S THE LAW.....

The following statutes govern bicycles and bikeways in Virginia:

1) Counties, cities and towns may establish bicycle paths and regulate their use.

2) Conducting and promoting endurance contests using bicycles is prohibited; however, bona fide athletic contests such as cross-country races over a limited number of miles are permitted.

3) Any person riding a bicycle on a roadway is subject to the same regulations as the driver of a vehicle, unless the context clearly indicates otherwise.

4) Riding bicycles is prohibited on interstate and controlled access highways where marked.

5) Riding bicycles on sidewalks is prohibited, except in Arlington and Henrico Counties. In other areas, children under 15 may ride on certain designated sidewalks, and in Virginia Beach, Vienna and Fairfax County, persons of any age may ride on certain designated sidewalks.

6) Cyclists must ride as near to the right side of a road as possible; they may not ride two abreast, and wherever a usable bicycle path exists adjacent to a roadway, they must use the path.

7) Any cyclist carrying a package must keep at least one hand on the handlebars.

8) No cyclist may attach himself or his bicycle to a vehicle on a roadway.

9) Every bicycle used between sunset and sunrise must be equipped with a lamp on front and a red reflector and/or red light on the back.

10) Every bicycle must have brakes that, when operated, will skid on dry, level pavement.

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"It should become a mark of distinction that an individual consumes less than he can afford - drives a smaller car, rides a bike, or uses public transit, lives in a smaller home which he does not overheat in winter or overcool in summer, carefully controls his diet, and otherwise exercises self-restraint in the consumption of material things. And it should become a badge of shame that an individual leaves his electric lights blazing on a bright summer day, roars down the highway at 80 miles per hour in a two-ton automobile, or otherwise is profligate in the use of limited natural resources." (Charles F. Luce, Chairman, Consolidated Edison Company of New York)