Bicycling

Completion of this chapter should enable the reader to:

- Be familiar with important considerations in the selection of bicycling equipment
- Know how to select a proper-sized bicycle and make appropriate adjustments
- Demonstrate the basic maneuvers of starting, braking, steering, and shifting gears
- Know the rules of the road and execute them for maximum safety when cycling

HISTORY

The first bicycles, developed in the 1800s, were unlike today's machines. They did not move well and were almost impossible to stop. They were heavy, crude, and inefficient. When approaching a corner, the rider had to dismount and turn the bike around by hand because there was no way to steer it. Needless to say, these first bicycles were not used for transportation.

However, even those first cumbersome contraptions did have a simple advantage over walking: they used muscle power to move horizontally rather than vertically. When walking, energy is expended to fight gravity by moving the body up in order to move the legs out to take a step. This upward movement is wasted because it is not in the direction we wish to go.

When we stand up, muscles must be tensed and bones compressed to support body weight. This muscle tension expends energy even though no motion takes place. Walking triples the load on the legs. By sitting on a seat or board with two wheels attached to it, we save much of the expended vertical energy lost through standing muscle tension. Thus, the first bicyclists could sit on a seat and pedal the bike with their feet and glide along to their destination, using less energy than walking requires.

One of the first changes made to the bicycle was to increase the size (circumference) of the front wheel, a change that increased the distance the bike traveled with each pedal stroke. High wheelers, or "ordinaries" or "penny-farthings," as they were called, were in use from 1870 to 1885.

The development of the chain-driven-rear-wheel "safety bicycle," which first appeared in 1885, was the most important bicycle innovation. As the name implies, this type of bike is inherently safer because it does not have a huge front wheel. This design, still in use today, also removed the restriction of direct drive from pedals to wheels. Perhaps the most significant change to the bicycle since the introduction of the safety design was the addition of the derailleur in the 1930s. A derailleur enables one to select different gear ratios while pedaling, which permits the proper matching of pedal rate with changes in the terrain. For example, if the pitch of the road suddenly increases, one can shift the bike to a lower, easier gear. Before the development of the derailleur, most bikes had only one gear; today, racing bikes have 16 gears and mountain bikes have 24.

The bicycle of today (Fig. 7-1) is a remarkably lightweight, efficient, versatile, and economical machine. In many countries it is used as the primary mode of transportation.

Cycling as an Olympic event has changed a great deal over the years, for the most part because of changes in

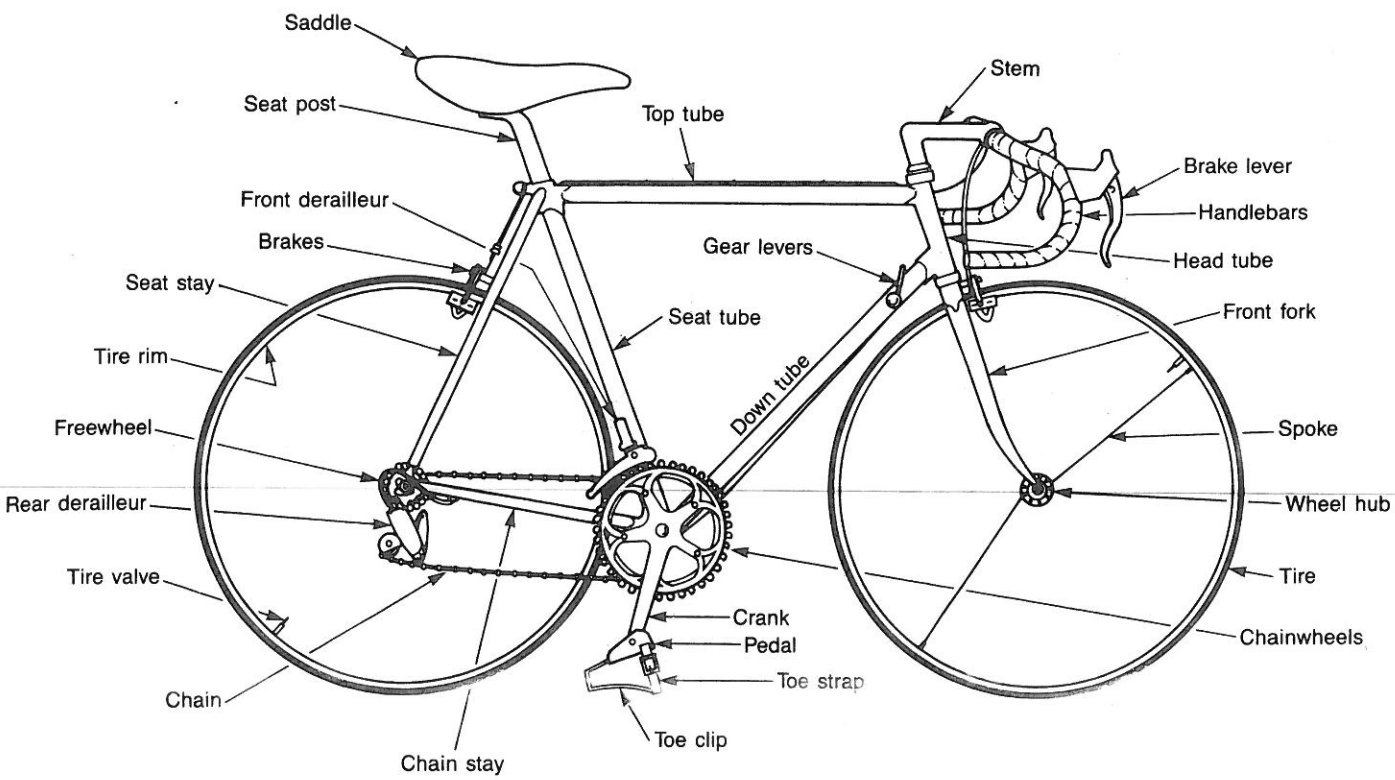

Fig. 7-1. Modern bicycle.

equipment. In the 1896 Olympics six cycling events, including a 12-hour race, were held. In the 1900 Olympics in Paris there was only one cycling event. In 1908 in London the first cycling events on a banked 500 m oval track were conducted. European nations—especially England, France, and the Netherlands—provided the best cyclists in the early Olympics. Until 1984 no U.S. cyclist had won a medal since 1908. With professional cycling increasing in popularity and attracting the finest Western European cyclists, the Eastern European countries and the Soviet Union began winning most of the medals after 1960. If the Soviet Union had not boycotted the 1984 Olympics, it would have probably brought a very strong cycling team to the Los Angeles games. However, the Soviet absence contributed to the success of the Americans, which came somewhat as a surprise.

The success of the U.S. cycling team at the 1984 Olympics, where it won several medals in both the sprint and road race events, provided a needed boost for American cycling. Also, the recent success of American riders Greg LeMond and Andy Hampsten on the European professional circuit has increased interest in the sport. In 1989 LeMond staged an incredible performance to win the 2000-mile Tour de France stage race by 8 seconds! In addition to this win LeMond also won the 1989 World Road Championship and the 1990 Tour de France. Lance Armstrong, the young cycling phenom from Plano, Texas, should serve to maintain America's interest in cycling as the careers of LeMond and Hampsten wane.

THE BICYCLIST

Posture

One of the most important considerations in choosing a bicycle is its fit. A bicycle that does not fit will be uncomfortable and will not handle correctly. Most people believe that the bicyclist sits on the seat, pushes with the legs, bends the back, and steers with the hands. In reality, the cyclist straddles the seat, spins the pedals, leans forward from the hips, and steers by leaning. The basic components of a correct cycling posture include bike size; saddle height, tilt, and fore-aft positioning; and handle bar height and stem length.

Bike size and saddle positioning

To check the basic frame size of the bicycle, straddle it and lift it until the top tube touches the crotch. If the bicycle is the proper size, there should be 1 to 2 inches (2.5 to 5.1 cm) of clearance between the tires and the ground. The saddle should be positioned so that it is just possible to place the heels on the pedals at the bottom position and pedal backward without rocking the hips. A final check for saddle height is the angle between the

upper and lower leg when the leg is fully extended and fixed to the pedal; the angle should be between 20 and 30 degrees.

After adjusting the saddle height, one needs to adjust saddle tilt and fore-aft positioning because they are important factors for attaining a proper bike posture. Saddle tilt is an easy adjustment; all you have to do is make sure the saddle is level from the tip to the back. To check the tilt, place a level across the top of the saddle and adjust accordingly by loosening the nut that affixes the saddle to the seat post (Fig. 7-2). If the saddle is tilted backward (with the tip higher than the back of the saddle), you may experience discomfort and numbness in the crotch while riding. If the saddle is tilted forward (with the tip lower than the back), you will slide off the front of the saddle while pedaling, which greatly increases neck, shoulder, and upper-arm fatigue.

Unlike the saddle tilt adjustment, fore-aft positioning is a bit tricky. First you have to adjust your cycling shoes precisely, a procedure that is extremely personalized, although there are two rules of thumb that serve as a good starting point: Position the cleat so that the ball of your foot lies directly over the pedal axle and make sure your foot is pointing straight ahead, in the so-called neutral position (Fig. 7-3). Most people do not need to have their shoes pointed inward (pigeon-toed) or outward (duck-foot), positions that often increase the risk of knee injury.

After setting up your cleats, you can then adjust the fore-aft position of your saddle. The first part of this adjustment is to find the area on the inside of your knee where the thigh bone and lower leg meet. You should be able to feel a small indentation in this area—the joint line of the knee—when your leg is fully extended (Fig. 7-4). Mark this indentation with a big *X*. Next, sit on your saddle and place your feet on the pedals, rotating them to the 9 and 3 o'clock positions; the foot of the marked leg should

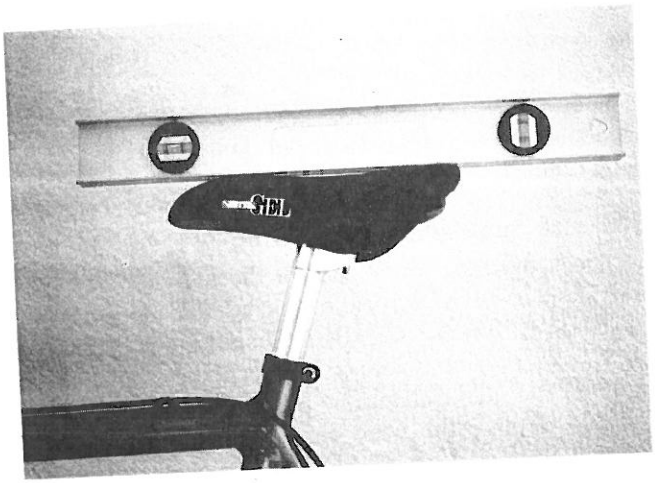

Fig. 7-2. Proper saddle tilt.

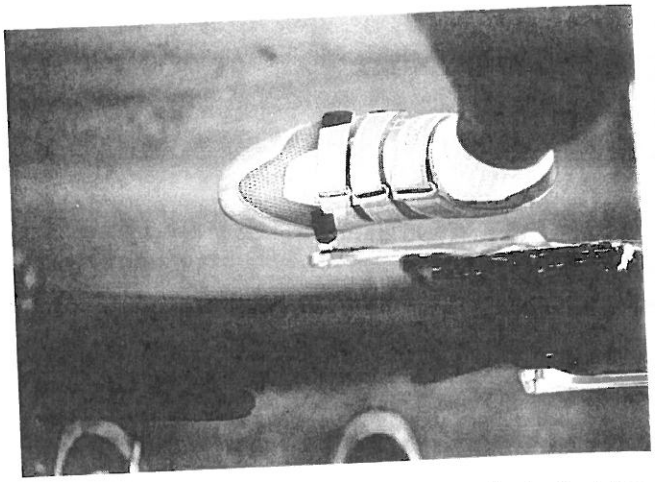

Fig. 7-3. Positioning of the cleat. Notice the ball of the foot is directly over the pedal spindle when the pedal is in the 3 o'clock position and is pointed nearly straight ahead.

be at 9 o'clock. (It helps to lean against a wall, door jam, or friend for this procedure.) Once accomplished, drop a plumb line from the mark on your leg to the pedal. The line will bisect the pedal axle if your fore-aft positioning is correct. If not, move your saddle forward or backward by loosening the nut that affixes the saddle to the seat post.

The final aspects of attaining proper bike posture are setting handle bar height and choosing stem length. A good rule of thumb for handle bar height is that the bars should be about 1 inch (25 cm) lower than the tip of your saddle. To check stem length, sit on the saddle, reach forward, and place your hands on the hooks or drops of a road handle bar or the handle bar grips of a mountain bike. (Again, it helps to lean on a wall, door jam, or

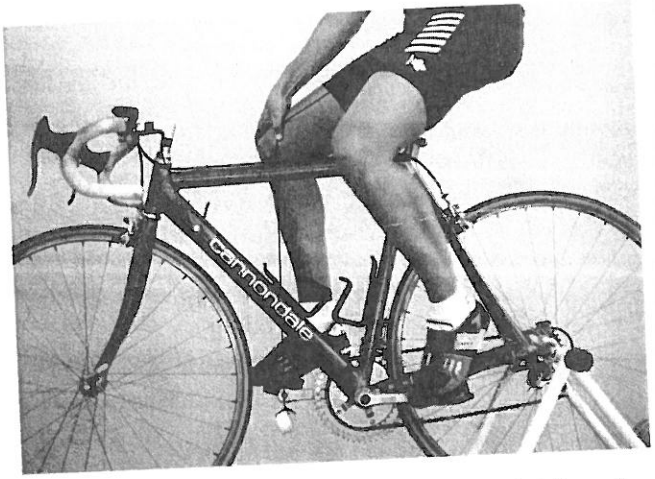

Fig. 7-4. A plumb line dropped from the joint line of the knee past the crank arm when the pedals are at 3 and 9 o'clock position bisects the pedal spindle.

friend.) If the handle bars obscure your view of the front hub while you are so positioned, the stem length is correct. If not, you will need a longer or shorter stem. It is a good idea to check stem length when you purchase a bike; most shops will replace the stem free at this time.

Clothing

A great deal of specialized clothing is available today, designed and manufactured with racing and long-distance bicycling in mind. Cycling shorts are made from stretchable Lycra and are chamois lined to prevent saddle chafe and sores. Some are anatomically designed; that is, they are curved to fit the cyclist in the seated position.

Cycling jerseys are made with special fabrics that wick moisture from the skin. This keeps a bicyclist cooler in the summer and warmer in the winter. In addition, they have long zippers in the front for added ventilation and pockets in the back for carrying identification, spare tire tubes (flats are common), and energy snacks.

A bottle is fitted to the frame and its contents are used to replace body fluids. Fingerless gloves, worn by many bicyclists, can be used to rub bits of glass off tires and protect the palms of the hands should a fall occur.

Special cycling shoes are also worn. These shoes have hard soles that distribute the forces generated from pedaling over a larger area of the foot, a characteristic that reduces foot discomfort and fatigue. Cycling shoes also have cleats of various forms (the form depending on the type of pedal you have). Cleats allow for a better interface between the foot and the pedal, which increases pedaling efficiency for all types of riding.

Lightweight bicycling helmets are available in most bicycle shops. The newer ones, made of Styrofoam with a thin plastic coating, are well ventilated and very light, weighing only about 8 ounces.

Whereas cycling shorts and jerseys are relatively unimportant to the short-distance rider, all cyclists should wear a helmet. Almost all deaths and most serious injuries incurred in cycling accidents are caused by head injuries. Where there is the chance of the head striking an immovable object—as in football, hockey, auto racing, and other contact sports—protective headgear can save a life (Fig. 7-5).

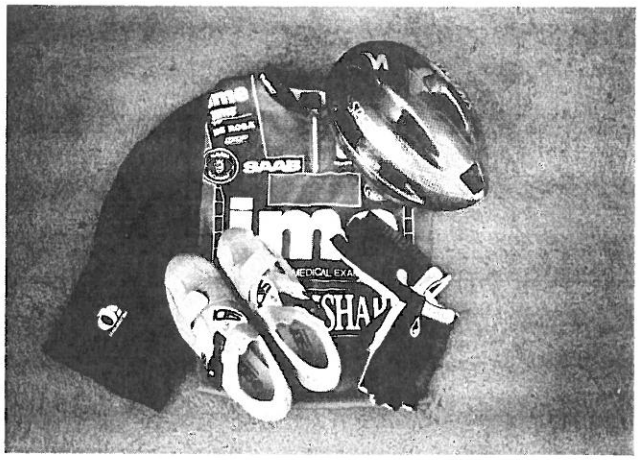

Fig. 7-5. Bicycling clothing.

Saddle selection

Because the rider does not sit on the seat but straddles it, the saddle (seat) is a prop for the pelvic bones. It is important that chafing be avoided, because the legs will be in constant motion. Therefore, the best saddle is smooth, flexible, and just wide enough for good support but not wide enough to chafe.

Most saddles today are made of flexible plastic covered with foam and leather and are quite comfortable. Women will probably find a saddle designed for wider pelvic bones to be more comfortable than a conventional saddle. The less expensive vinyl-covered saddles are often too hard, and they do not absorb moisture. A mattress saddle with springs is only satisfactory for riding short distances in an upright position. It may feel better at first, but the longer the ride, the more uncomfortable it gets.

Pedaling technique

The mark of a good bicyclist is the smooth, steady way in which she or he pedals the bike. The foot must be placed on the pedal so it can push the pedal as far around the circle as possible. To do this, you use the foot as a lever with the ankle as fulcrum while pedaling on the ball of the foot. At the bottom of the circle, the heel is up and the toe is down. At the top of the circle, the heel is down and the toe is up, thus pulling the pedal back. This is called "ankling." Smooth ankling is achieved only by using cycling shoes equipped for clipped or clipless pedals, but this technique should be practiced even if tennis shoes or rubber pedals are used.

The feet should rotate the pedals at a rhythmic, constant pace (cadence), twice as fast as walking. A slow cadence is 60 revolutions per minute; 80 is normal; and 90 to 100 is racing pace.

Care of equipment

Before starting a ride of any distance, be sure to give the bicycle a quick safety check. Grip the brake levers and make sure that the brakes work. Look for worn brake blocks and loose cables. Make sure the handlebars, seat, and wheels are not loose and see that the wheels are true—that is, they do not wobble from side to side when you spin them (they do not rub the brake pads). Check the tires for the proper pressure and for worn or cut places. Under-inflated tires greatly increase rolling resistance and

increase the chance of damaging the rims. Lubricate the chain if necessary. Make sure to have a spare tube, tire irons, and a pump. Taking a few moments before a ride could save a long walk home, but more importantly, it could prevent an accident.

Tires

Tires fail more frequently than any other part of a bicycle. Knowing how to change tires and fix flats will save a lot of time and money.

There are two kinds of bicycle tires. The most common type—"wired-on," or clinchers—are so named because of the wire bead that seals the tires to the rim. The other kind, used almost exclusively by racers, are "tubulars," which are glued on to the wheel rim.

Changing wired-on tires is not difficult, and with a little practice one can become proficient. If a spare tube, some tire irons, and a pump are carried, a flat tire should never cause a delay of more than a few minutes.

Tubes within the tires also come in two types (actually, it is the valves that are different), so it is important that the tire pump carried fits the type of valve on the bike. Schrader valves are large and thick, like automobile valves. Presta valves are narrow and require the little button on the valve tip to be unscrewed to use them. Each takes a different hand pump to fill with air.

Types of bicycles

There are many different types of bicycles, each designed for a different purpose. *Racing bikes* feature drop handlebars and short wheelbases and are lightweight (Fig. 7-6). *Touring bikes* are equipped for carrying loads: They have heavy-duty wheels, luggage rack attachments, and "granny gears" for climbing steep hills. *Mountain bikes* have wide, knobby tires and rugged construction; they were originally designed for use on dirt roads and trails, but their upright posture and ease of use have made them popular in cities as well (Fig. 7-7). *Commuter bikes* are average "around-town" vehicles that come in all shapes and sizes. Often equipped with fenders and reflectors, they provide reliable transportation and recreation.

BASIC MANEUVERS

Starting

Grasp the top of the handlebars and swing a leg over the seat to straddle the bicycle. Backpedal until one pedal is forward and high. Place the ball of the foot on the high pedal and kick off with the other foot. This will start the bicycle moving. Place the other foot on its pedal and ease the crotch backward up onto the saddle.

Stopping

Apply the brakes to slow down. Put the pedals in the high and low positions, transfer your weight to the low pedal, and slide forward and off the seat. Remove the foot from the high pedal and reach for the ground while slowing to a stop. Just before the stop, turn the front wheel away from the free foot to tip the bicycle. If timed correctly, the bicyclist will stop and lean onto the free foot just as it touches the ground. Backpedal to the starting position.

Steering

Steering is accomplished more by leaning than by turning the handlebars. This effect can best be tested by walking along, pushing the bike forward, and holding onto only the saddle. A slight tip to the left or right will naturally turn the front wheel in the same direction. This action occurs when the bicyclist is in the saddle. The hands and arms on the handlebars primarily support the body's upper torso.

Fig. 7-6. Road racing bike.

Fig. 7-7. Fully suspended mountain bike.

Gear shifting

The premise of variable bicycle gear ratios on 10-speed bikes is that the bicyclist is most efficient when pedaling at a constant rate in revolutions per minute. (One revolution is two complementary strokes, one from the left leg and one from the right.) Inasmuch as the bicyclist faces variable conditions during the ride, it would be impossible to keep a constant pace with only one gear. For example, the average bicyclist would be unable to keep the same pace going uphill as on the flat. Other variable conditions include wind and weight carried. Shifting gears allows the optimum in mechanical efficiency.

Shifting gears on a bicycle has become very easy—almost foolproof—since the advent of index, or "click," shifting in the mid-1980s. To shift, you simply move the gear lever—be it incorporated in the brake lever (see Fig. 7-6), on the down tube, or on the handle bars (thumb shifters) (see Fig. 7-7)—until a click is heard. If the derailleur cables are properly tensioned and the frame is aligned, the bike will now be in a new gear. It is as easy as that. Sometimes it helps to reduce pedaling force so as to facilitate the shift, but this is usually unnecessary except in extreme situations, such as shifting while riding at a low pedal frequency on a steep incline. In general, it is best to anticipate the shift, that is, shift before the pedal cadence drops dramatically. It is wise to practice shifting on a flat, lightly traveled road so you can shift smoothly and safely in all situations.

Braking

Use both brakes to stop safely by applying pressure first to the rear brake and then to the front brake. Gradually brake harder until coming to a stop or until the rear wheel starts to skid. If this happens, let up on both brake levers until the wheels start to turn again.

Never use only the rear brake in traffic. It cannot provide enough deceleration to stop in the event of trouble. Also never brake hard with only the front brake, as you may be thrown forward over the handlebars. Be careful when riding in rain. The brakes will not work until the brake blocks wipe the rims dry. Riding on steel rims in wet weather is much more dangerous than riding on alloy rims. In any case, remember to leave extra distance for stopping.

RULES OF THE ROAD

The rules of the road for bicyclists are the same as for automobile drivers. Automobile drivers cooperate with each other within the rules of the road, and motorists usually cooperate with bicyclists who obey these rules. Conflict arises when bicyclists or motorists, through ignorance or design, act unreasonably on the roadway.

Where to ride on the roadway

Bicyclists have a right to a safe corridor along the road. Care must be taken, however, not to interfere with other users of the road. Courtesy toward others will pay in increased respect and safety. Bicycles are vehicles, and the following are recommended rules governing the place of bicycles on the roadway. Unfortunately, some people do not recognize bicycles as legitimate vehicles. This belief often results in actions inconsistent with standard traffic engineering practice and commonsense rules of behavior in traffic situations.

When riding on a road of standard width, the bicyclist should ride inside the traffic lane at the right-hand side of the road. Cars will usually have ample room to pass within or nearly within this lane. On roads that are too narrow to permit safe passing either within the lane or over the centerline, the bicyclist should ride in the center of the right lane. If riding as fast as or faster than the other traffic, use the lane as if operating a car. Do not weave in and around parked cars.

Never ride on the left side of the street, facing traffic. Very few bicyclists are hit by overtaking cars. Instead, the greatest number of car-bicycle collisions are caused by wrong-way riding. When approaching a motorist from an unexpected spot, the bicyclist could be hit without being seen. Riding on the wrong side of the road also causes bicycle-bicycle collisions. Bicyclists usually occupy the right portion of the roadway; but going in the wrong direction, there exists a risk of a head-on collision with another bicyclist.

It is important not to ride in the motorist's blind spot, especially when approaching intersections or driveways, where a motorist might make a right turn. Overtake on the right only when the cars are stopped or are barely moving. Never overtake on the right where it is possible for the motorist to make a right turn, and never overtake on the right when the road is too narrow to do so safely.

Right turns

Make a right turn in the same manner as a car does: from the farthest right of the roadway.

Some roads have right-turn-only lanes. When riding in the right-hand portion of a right-turn-only lane, the bicyclist must turn right (Fig. 7-8, *B*). If the bicyclist attempts to go straight through, he or she could be hit by a motorist legally turning right. When a bicyclist encounters a right-turn-only lane but does not wish to follow it, the alternative is to merge to the left and ride on the righthand edge of the next straight-through lane (Fig. 7-8, *A*). Merge left by looking over your left shoulder before changing the path of travel. Change lanes only

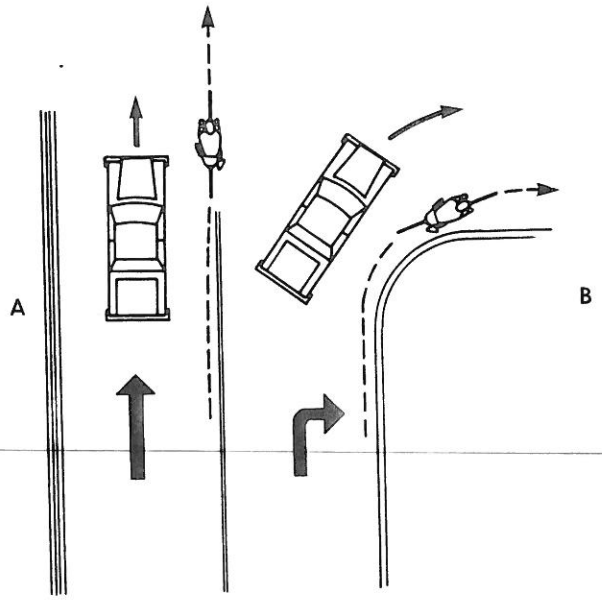

Fig. 7-8. Right turns. See text for details.

when overtaking traffic has cleared or slowed to allow you to move over.

Left turns

Never attempt a left turn from the right side of the street. The bicyclist stands a good chance of being hit by an overtaking car by making a left turn in front of it.

To make a safe left turn, the bicyclist must follow the same procedure as an automobile driver. The first step is to merge left. Look back over your shoulder for overtaking cars. It may help to signal, but the look is mandatory. Never signal without looking. A signal is a matter of courtesy; the look is a matter of life and death. After looking over the left shoulder for overtaking cars, move into the left lane if the way is clear. When occupying a left-turn-only lane, ride at the *right* edge of the lane (Fig. 7-9, *A*). This will allow motorists to also occupy the lane and turn simultaneously when the way ahead is clear. If the lane is not a left-turn-only lane, stay as close to the centerline of the road as possible (Fig. 7-9, *B*). This will allow motorists who wish to go straight through to pass on the right while the bicyclist is waiting for the oncoming traffic to clear.

After completing a left turn, you should turn into the right lane of the new street. But before doing this, check for traffic in that lane. Remember to check for oncoming traffic that may make a right turn on red and enter the inside lane just as the bicyclist does.

Sometimes on multilane streets the traffic is so heavy that it is not possible to make a left-hand turn in the manner described. If this happens, it is best to use pedestrian rules, ride to the far corner of the intersection, and turn the bicycle in the proper direction and wait for the light to change. At an intersection without a signal, wait for the traffic to clear in all directions.

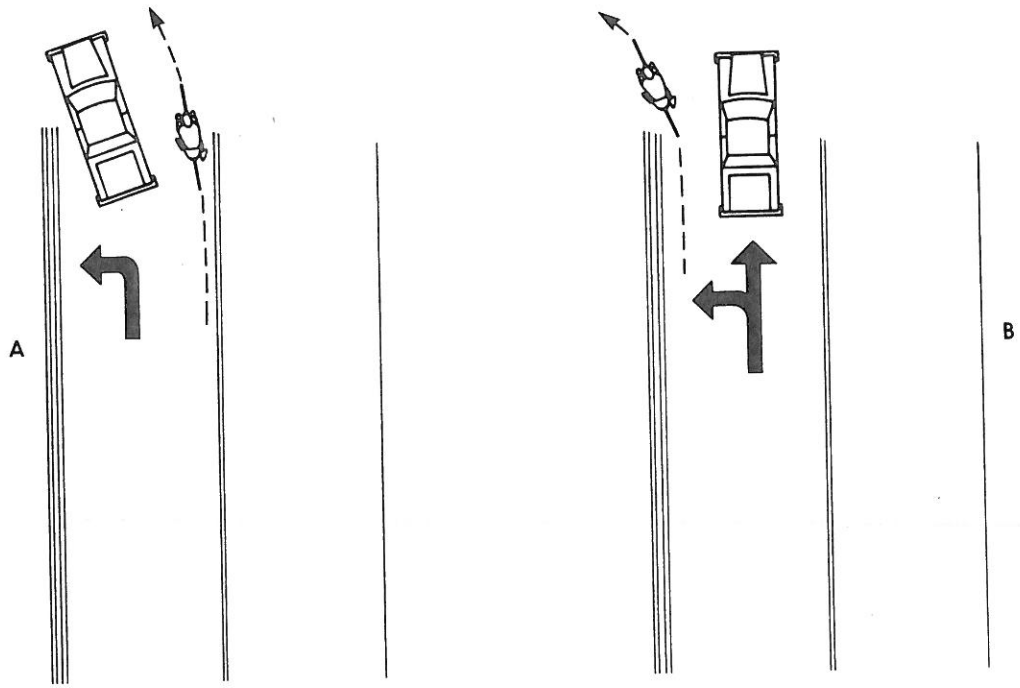

Fig. 7-9. Left turns. See text for details.

SAFETY

Statistics show that in the majority of bicycle accidents the rider simply falls off the bicycle for some reason. The remainder of accidents are collisions with automobiles, fixed objects, and other bicyclists. This implies that the greatest cause of accidental injury is inept bicyclists.

First, it is important to know how to ride a bicycle. The bicyclist should adopt riding procedures that are reasonable and proper, always be observant, recognize potential problems, and be able to cope in emergency situations. Second, it is important to operate a bicycle as a vehicle. This provides operating procedures that are predictable and expected by drivers of automobiles and by other bicyclists. Because of unexpected turning and crossing maneuvers into streets from bike paths and sidewalks, it is much safer to ride a bicycle in the street than in these off-street facilities.

Studies have shown that experienced, active bicyclists, such as those who belong to organized clubs, have one-sixth to one-seventh the accident rate of other bicyclists. It appears that—in the case of bicycling, at least—a little learning is truly a dangerous thing.

BICYCLING ACTIVITIES

Safe and proper bicycling offers a lifetime of enjoyment and fitness. Social and other benefits are also possible by joining a local bicycle club. Bicycle club members can supply a wealth of knowledge and are happy to help newcomers become more knowledgeable and more skillful bicyclists. Usually club members are aware of the latest equipment. On club rides the novice can rapidly learn what others spent years finding out: where the best rides are, bicycling techniques that make riding easier, and favorite lunch stops.

There are two types of bicycle clubs: touring and racing (Figs. 7-10 and 7-11). Check with a local bicycle shop to find out about club activities. The novice is wise to

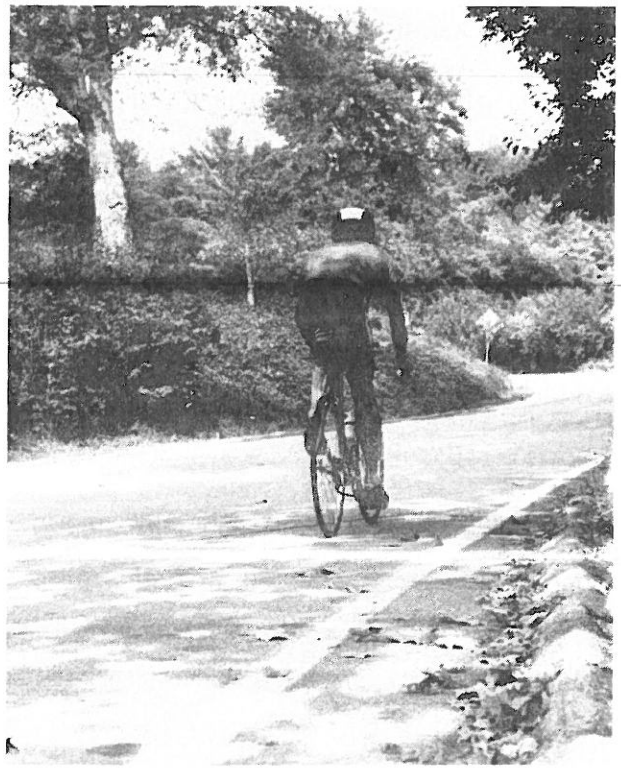

Fig. 7-10. Bicycle touring.

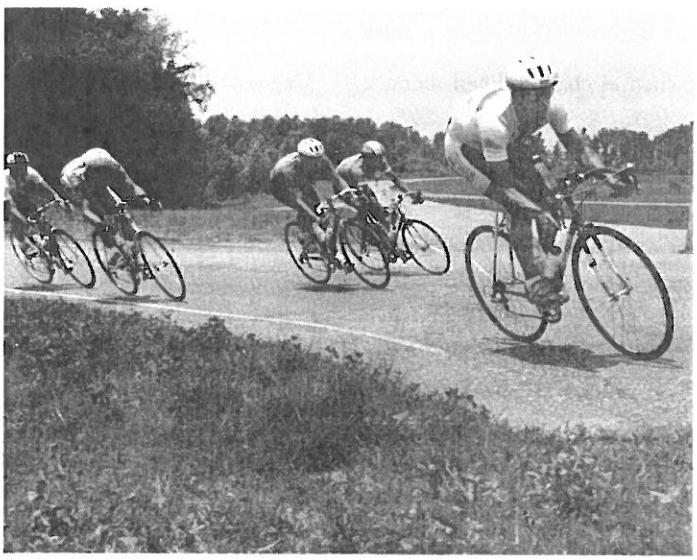

Fig. 7-11. Bicycle racing.

investigate joining a touring club. Touring clubs usually have three levels of rides: short, medium, and long, or easy, moderate, and strenuous. Initially pick an easy ride and go with the club. The bicyclist should be self-sufficient by carrying water, a pump, a spare tube, and tire irons.

TEACHING CONSIDERATIONS

1. Define the purpose of the instruction in terms of bicycle touring, racing, or a combination of both.
2. Check equipment for safety and fit.
3. Teach bicycle safety and etiquette. For cyclists who do not have a license to drive a car, spend some time practicing the rules of the road. Use videotapes of different driving conditions, if necessary. Take students out on the road with no traffic to practice until hand signals and understanding of the rules of the road become automatic.
4. Combine more lecture-type material with opportunities for activity.
5. Provide opportunities to cycle in a touring or racing situation. Where possible, conduct these activities in the environment to be used by the student. Choose less heavily traveled areas to begin practice and then move to more heavily traveled areas.
6. Design an obstacle course in a parking lot for improving bike handling skills.
7. Hold a 5-mile time trial, starting individual cyclists at 30-second intervals.
8. When planning initial trips, organize a buddy system.
9. Do not take large groups of cyclists into heavy traffic.
10. Have students play "bumper-bike" on a grassy field. The students ride *slowly* and bump into each other on a grassy field, which teaches them how to handle bikes in tight situations.

GLOSSARY

bicycle clothing Special clothing, such as chamois-lined shorts, that prevent saddle chafe and sores.

braking Bringing the bicycle to a stop by using both brakes properly.

gear shifting (derailleur) Varying the gear ratios on 10-speed bikes; the bicyclist is most efficient when pedaling at a constant rate of revolutions per minute.

helmet Lightweight headgear designed for bicycle riding.

rules of the road Rules that apply to both cyclists and automobile drivers.

saddle A smooth leather seat just wide enough for good support and not so wide as to chafe.

safety check Checking that the parts of the bicycle are in good working order before a ride.

steering Guiding the bicycle more by leaning than turning the handlebars.

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