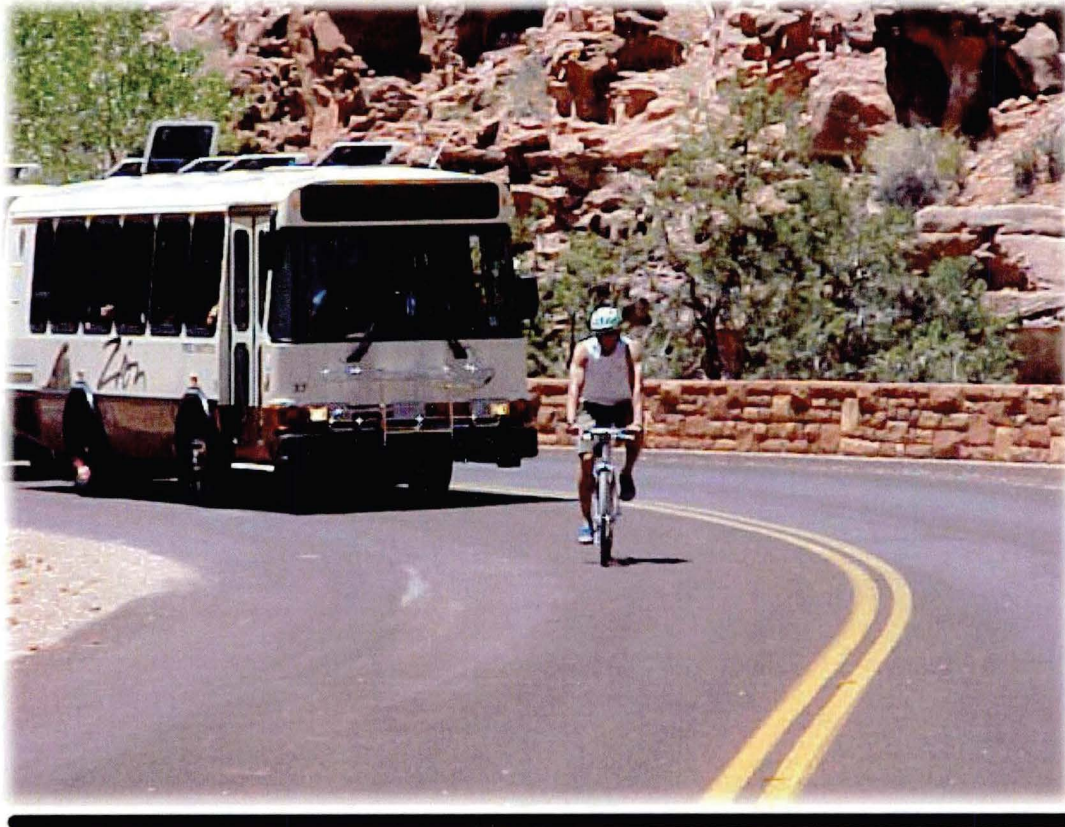


Sharing the Canyon



Accommodating Bicyclists on the Zion Canyon Scenic Drive



Sharing the Canyon: Accommodating Bicyclists on the Zion Canyon Scenic Drive

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ABSTRACT

This study takes an in-depth look at bicycling on Zion Canyon Scenic Drive in Zion National Park. The Scenic Drive is a narrow and winding road that is popular with bicyclists who must ride alongside the park's shuttle buses and other motorized vehicles. The purpose of the study is to assess current bicycling conditions and to present and evaluate ways to improve safety, congestion, and visitor experience on the road. Recommended approaches include dispersing information on how to safely interact with buses through signage and at entrance stations and local bike rental shops, creating a striped, on-road bicycle lane, constructing an off-road greenway on the valley floor, and imposing restrictions on bicycle use. This project was conducted over three months during the summer of 2007 by Jeff De Bellis as part of the National Park Transportation Scholars program.

INTRODUCTION

Located in the Colorado Plateau area of southwestern Utah, Zion National Park's dramatic scenery, rich mix of plants and animals, storied history, and wide array of activities lure over 2.5 million visitors each year (Figure 1). Before becoming a tourist destination, the area was home to Anasazi and Southern Paiute Native American groups and Mormon pioneers who have each left their marks on what is today Zion National Park. Over time, farming, ranching, and big game hunting have been replaced by hiking, climbing, camping, bicycling, canyoneering, photography, and sightseeing.

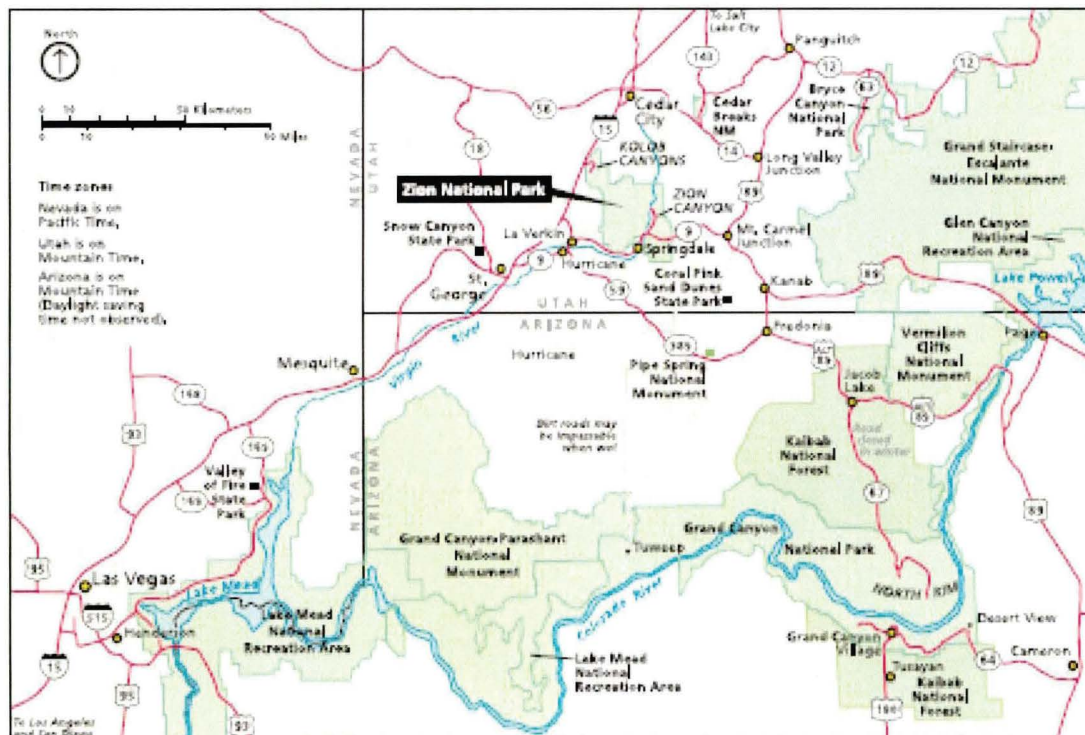


Figure 1: Location of Zion National Park

Though the park is 229 square miles, most visitors only see a small portion of the southern part of the park – Zion Canyon. Zion Canyon is bisected by the Virgin River, whose periodic flash floods have worked for centuries to carve out the narrow valley, leaving behind some of the largest sandstone cliffs in the world. The Zion Canyon Scenic Drive, which parallels the Virgin River, gives visitors access to the Zion Narrows, the Zion Lodge, and dozens of other popular spots in the park. By the 1990s, the canyon had become so popular that the number of cars using the Scenic Drive far exceeded the number of parking spaces available. In 2000 the park banned most motorized vehicles from the road during the months of April through October and began operating a shuttle bus system that carries passengers to trailheads and other points of interest along the Drive. Parks Transportation, Inc. (PTI) – the transit company operating the shuttle system – maintains two routes. The Zion Canyon Shuttle runs in the park, from the visitor center up the Scenic Drive to the Temple of Sinawava (Figure 2). The Zion Town Shuttle runs in Springdale, Zion’s gateway community. This route carries passengers along State Route 9 to the park entrance with stops at hotels, restaurants and other points of interest in the town. The lower volume of traffic has made the Scenic Drive more appealing to cyclists, who come in larger and larger numbers every year.

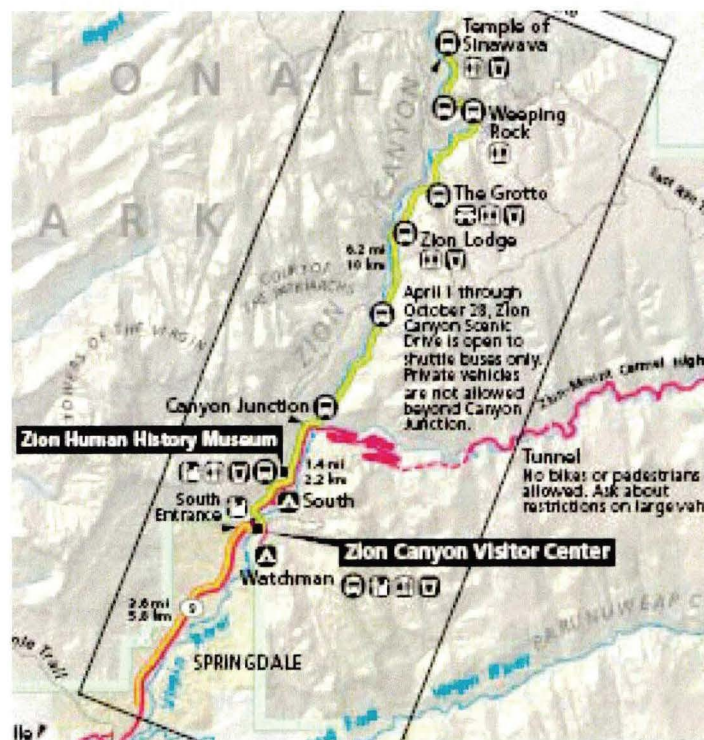


Figure 2: Zion Park Shuttle route map

Despite the low volume of traffic, bicycles and shuttle buses are not always compatible on the narrow and winding Scenic Drive. Though there have never been any major accidents between bicycles and buses, there have been a handful of incidents where bicycles were either forced off the pavement and into roadside ditches or grazed by a passing bus. Passing bicycles is especially dangerous because the buses have attached

rear trailers, so that if a driver has to swerve to avoid an oncoming vehicle, the trailer will amplify any movement made by the front part of the bus. In 2004, these incidents prompted PTI to create a new policy disallowing shuttles from passing moving bicyclists. If a rider wants a bus to pass them, they must pull over to the side of the road and stop. The policy has worked well from a safety standpoint – since its implementation there have been no reported incidents between cyclists and buses.

Even with the new policy, there are three types of problems resulting from both groups' use of the road. The first of these is congestion. Many cyclists are either unaware of the policy, do not wish to pull over to let a bus pass, or do not have room to pull over on certain sections where the road is especially narrow because it is flanked by either a steep drop off or a sandstone wall. This can result in a bus being stuck behind a cyclist for up to a few minutes at a time. Since the buses have a certain amount of flextime built into their schedules to accommodate for various delays, it does not generally throw off schedules. More than anything, it is an annoyance to shuttle drivers and passengers. The second set of issues is safety related. Though the park's shuttles cannot pass cyclists, other vehicles, including large tour buses and delivery trucks, can. Also, rather than pull over to let shuttles pass and thereby lose momentum on the steep road, many riders move over to the oncoming lane and continue riding while the bus goes by. This is especially dangerous given the large number of blind curves on the Scenic Drive. The third area of concern is visitor experience. Cyclists have the choice of either pulling off the side of the road and losing momentum or being closely followed by a bus (Figure 3).



Figure 3: Bicyclists on the Zion Canyon Scenic Drive

The purpose of this study is to assess cycling conditions on the Zion Canyon Scenic Drive, gather data on the number and types of cyclists using the road, and propose ways to improve safety and visitor experience while alleviating congestion. This was done through a combination of interviews, bicycle counts, literature review, and other methods. Bicycling in the canyon is a complex issue with no clear solution. It requires a multi-faceted approach and a willingness to look down the road from multiple perspectives.

METHODOLOGY

Bicycle Compatibility Indexes

A project such as this with multiple objectives requires multiple methods. The first of these is the use of a bicycle compatibility index to determine how well suited the canyon road is for cycling. The bicycle compatibility index (BCI), sponsored by the Federal Highway Administration (FHWA), is used by metropolitan areas to evaluate urban and suburban streets for bicycle friendliness based on variables such as traffic volume, traffic speed, and shoulder width¹. Since the BCI was developed for use with city streets, it would not give an accurate representation of the canyon road, which has little in common with its urban and suburban counterparts.

There are two other bicycle compatibility indexes designed for use with rural roads that are more appropriate for evaluating the Scenic Drive. The first, the rural bicycle compatibility index (RBCI), was developed using rural roads in Nebraska². Nebraska's RBCI is the prototype for a national RBCI currently being developed by the FHWA. The RBCI uses two variables – shoulder width and volume of heavy vehicle traffic traveling in the same direction of the cyclist. Each road segment receives a certain number of points based on these variables and a corresponding grade (Figure 4). The second, the compatibility of roads for cyclists index (CRC), was developed by researchers in Quebec to evaluate the bicycle compatibility of roads in rural and urban fringe areas in the province³. The CRC has more variables – it includes presence of a striped shoulder, cycling space, car speed, residential, commercial, and industrial entrances, ditches, car traffic flow, heavy truck traffic flow, roadside obstacles, visibility, and major junctions. A certain number of points are added or subtracted based on each criterion. A perfect score – the most bicycle friendly road segment – is 100. Though these indexes were designed mainly for roads in Nebraska and Quebec, respectively, they are a good basis for evaluating other rural roads. The Zion Canyon Scenic Drive is different from most rural roads in some respects, but the indexes can give a general idea of the road's bicycle compatibility.

The Scenic Drive was divided into fifteen segments, each approximately .4 miles long, for evaluation. These segments correspond to the segments into which the road was divided on a map created when the road was reconditioned in 2004. Each road segment was evaluated twice, once for the side of the road traveling up canyon and again for the side of the road traveling down canyon. Using the RBCI, bicycle compatibility varies little by segment or direction. Every segment received a score of approximately 2.5 in each direction (Figure 5). This corresponds with a bicycle compatibility grade of "C: moderately high." Using the CRC, there is more variation in the road's bicycle compatibility (Figure 6). The most compatible stretches of road are segments B and C coming down canyon, which scored 57 and 52, respectively, and segment D going up

canyon, which scored a 52. Road segments B, C, and D make up a stretch of road going from about .4 miles past Canyon Junction to the Court of the Patriarchs bus stop. All of the other road segments, in each direction, received a score between 30 and 50. These bicycle compatibility indexes can be used to evaluate the effect of any future modifications to the road on its bicycle compatibility.

LOS	BCI Range	Compatibility Level ¹
A	≤ 1.50	Extremely High
B	1.51 - 2.30	Very High
C	2.31 - 3.40	Moderately High
D	3.41 - 4.40	Moderately Low
E	4.41 - 5.30	Very Low
F	> 5.30	Extremely Low

Figure 4: Bicycle level of service (LOS) Grading system for RBCI

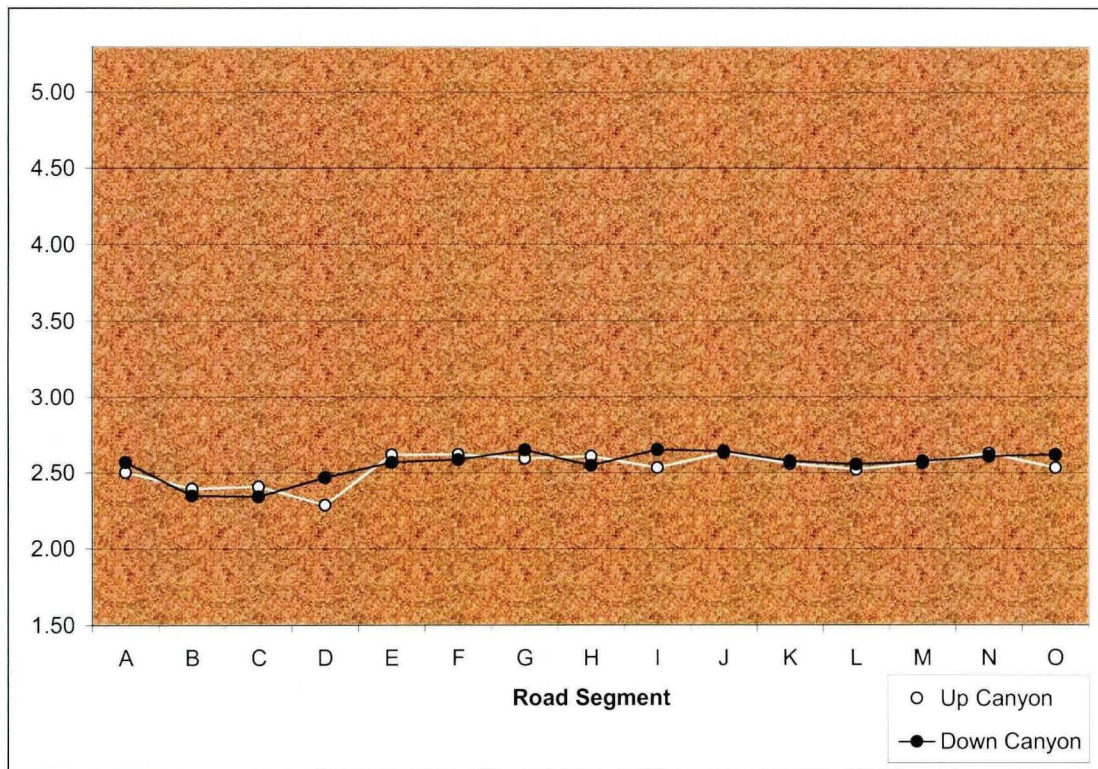


Figure 5: Rural bicycle compatibility index (RBCI) of the Zion Canyon Scenic Drive

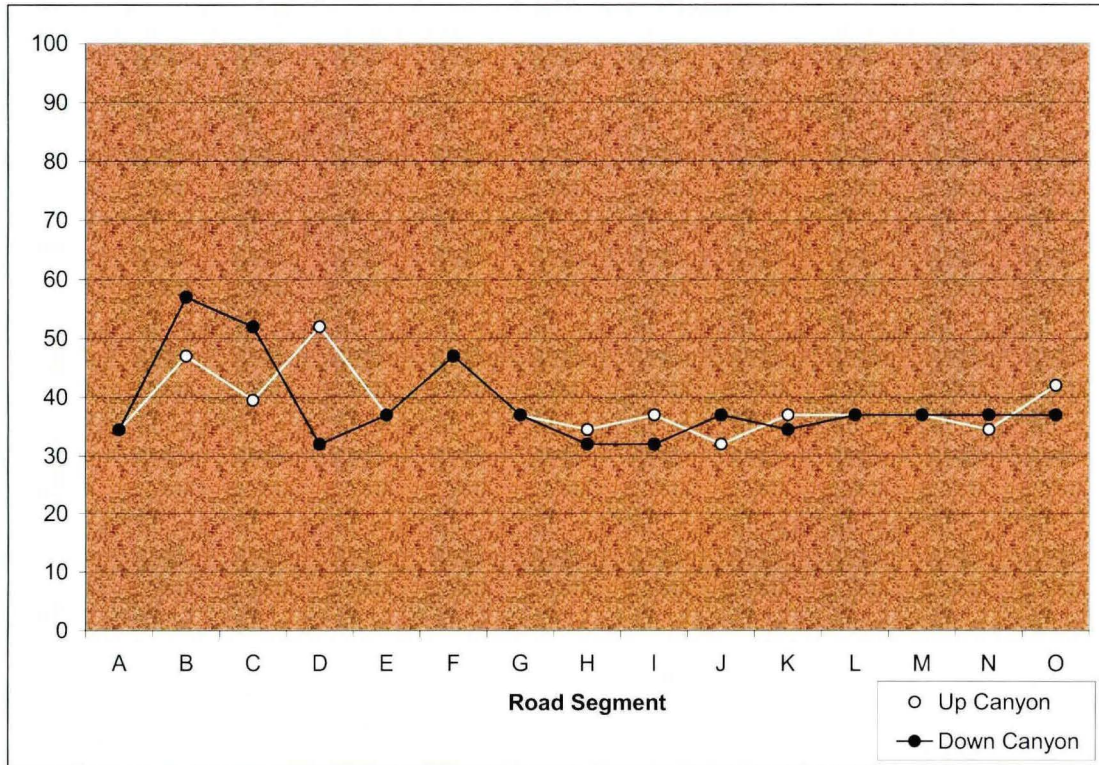


Figure 6: Compatibility of road for cyclists (CRC) of the Zion Canyon Scenic Drive

Bicycle Counts

Bicycle counts were conducted to get an idea of how many cyclists use the Scenic Drive, how use varies by time and location, and some of the characteristics of cyclists. Three types of counts were conducted. The first type of count revealed how many times buses and bikes interact on the Scenic Drive. On Saturday, August 4, 2007, shuttle drivers counted each time they passed a bicycle traveling in their direction. Over the course of the day, buses passed a total of 236 bicycles. In many instances it is likely that the same bicyclist was passed by multiple shuttles and therefore counted multiple times. This is intentional because the count was designed to determine how many times cyclists were passed throughout the course of the day – not how many cyclists use the road. The majority of the cyclists pulled over when the buses approached, allowing them to pass. Others continued to ride in front of the buses up to five or six minutes before allowing them to pass.

A separate data collection effort counted how many times the shuttles' bicycle racks were used during the course of a single day. Every shuttle bus is equipped with a front-end bicycle rack designed to hold two bicycles. It is sometimes possible to wedge a third bicycle in the middle. Because of the steepness of the road, many cyclists will load their bikes onto the bus racks, ride the shuttle to the top, and then pedal down. This count took place on Saturday, July 7, 2007. On this day, a total of 35 bicycles were loaded onto the bike racks. Eight of these were on the Zion Town Shuttle and 27 were loaded onto the Zion Canyon Shuttle.

The third type of bike count gathered more specific information about visitors pedaling in the canyon. This data collection effort took place over four days – June 28 and July 12, 2007 (Thursdays) and June 30 and July 14, 2007 (Saturdays). These days were chosen in order to compare weekday and weekend cycling patterns. On each day counters were stationed at two locations – the Court of the Patriarchs trailhead and Big Bend viewing area – one in the lower section of the canyon and one in the upper section. Counts took place at three times – 10 am, 2 pm, and 7 pm – each one for an hour. The 10 am and 7 pm times were chosen based on anecdotal evidence that this is when the most cyclists are out. Because of the 100° plus midday weather at this time of year, the morning and evening temperatures are better suited for bicycling. The 2 pm time block was chosen to get an idea of how many cyclists are braving the desert sun to pedal the canyon in the afternoon. The 2 pm hour is the park's busiest in terms of the number of people riding the canyon shuttle. Along with time, day, and location, the count factored in age, skill level, cycling group size, and direction of travel.

There is more bicycle traffic on the lower portion of the Scenic Drive than on the upper portion (Figure 7). On weekdays, 36% more cyclists ride past the Court of the Patriarchs than Big Bend. On Saturdays, 38% more cyclists ride past the Court of the Patriarchs than Big Bend. Saturdays see more cyclists in the canyon than weekdays. There is a 13% increase in the number of riders passing the Court from weekday to Saturday and a 10% increase in riders passing Big Bend. Bicycle activity varies with time of day as well. Of the three hours surveyed, 10 am was the busiest for both locations, on all count days. On weekdays, 7 pm is the next busiest hour at both locations, followed by 2 pm. On Saturdays, 2 pm is busier than 7 pm.

During the counts, the number of cyclists riding together ranged from single riders to groups of 6. The average group size is 2. Cyclists tend to travel in slightly larger groups on weekdays – 2.1 as opposed to 1.9 on Saturdays. These figures do not include large tour groups that often use the road. These groups can have as many as 30 riders. Counters also differentiated between adult and child cyclists (Table 1). Since the exact age of the riders is not known, this is subjective. Children are considered to be anyone appearing below 18 years of age. According to the results, children are more prevalent on Saturdays and earlier in the day.

Since many cyclists ride the shuttle to the end of canyon and only pedal down, there are more cyclists traveling down canyon than up canyon (Table 2). This aspect of the count determined the percentage of riders traveling in each direction past the count locations.

The final statistic that the bicycle counts collected is skill level (Table 3). The beauty of the Scenic Drive attracts all types of cyclists – from families with small children just learning to ride to serious cyclists. During the data collection effort, counters divided cyclists into three groups – sport, moderate, and leisure. Skill level was assessed subjectively based on speed, dress, bicycle, and general appearance. Riders on road bikes wearing cycling garb and traveling at higher speeds fell into the sport category. Riders on mountain or hybrid bikes wearing casual clothing fell into the leisure category. Anyone who appeared to fall somewhere between these categories was classified as moderate. Skill level was assessed based on the entire group of cyclists riding together rather than each individual rider. The skill level of the group is rated based on the skill level of the least skilled rider, so that a group containing both sport and leisure riders is considered

leisure. Any group including small children is classified as leisure as well. The raw data from these counts is included as Appendix A.

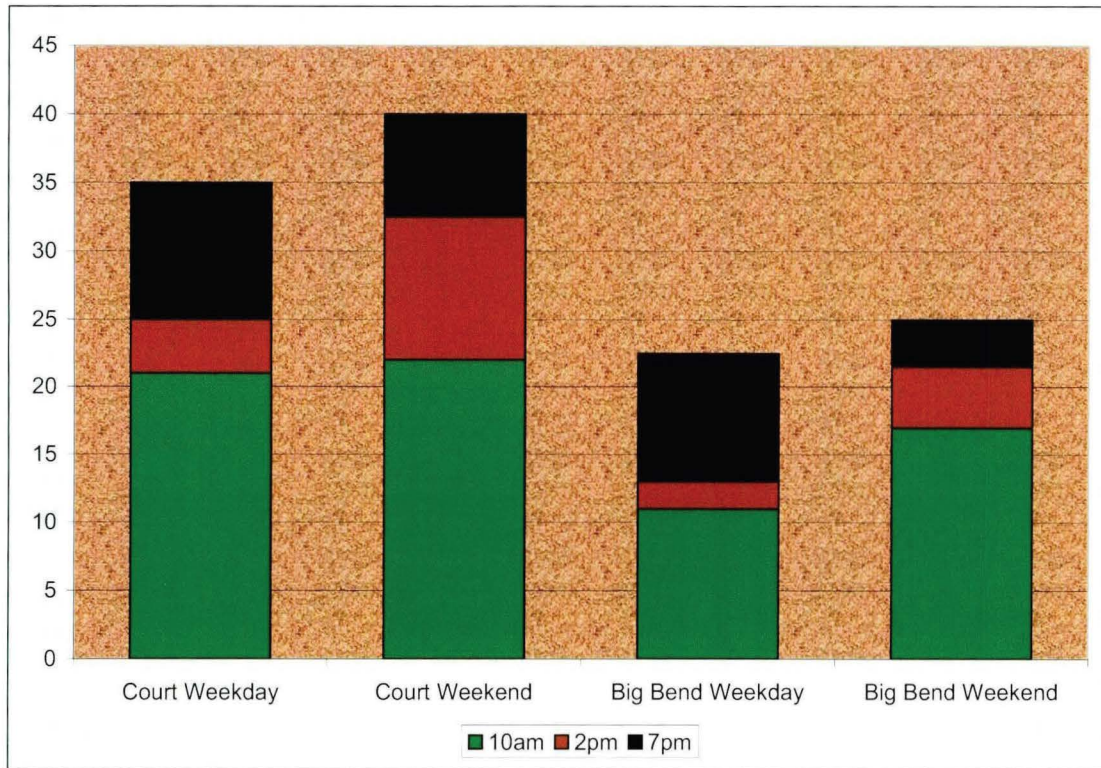


Figure 7: Number of cyclists by location, day of week, and time of day

Note: Each column represents two days averaged together

	10am	2pm	7pm
Weekday	30%	25%	5%
Saturday	38%	27%	18%

Table 1: Percentage of bicyclists who are children

	Weekday	Saturday	Overall
Up Canyon	23%	33%	29%
Down Canyon	77%	67%	71%

Table 2: Bicycle direction of travel

	10am	2pm	7pm
Weekday	31%	9%	72%
Saturday	19%	20%	5%

Table 3: Percent of sport cyclists

Based on these figures a rough estimate of how many cyclists using the Scenic Drive each day can be computed. From counting the bikes loaded onto racks, it was estimated that 27 cyclists ride only down canyon. The hourly counts show that two-thirds of the cyclists passed the counter in the down canyon direction. Assuming that every cyclist riding up canyon also rode down canyon and was therefore counted twice, about half of the cyclists ride up and down canyon while the other half take the shuttle up and pedal down. This way, this study estimates that about 54 cyclists use the road on an average Saturday. Based on the third type of count, the shuttles pass 236 bicycles over the course of the day. This means that each cyclist is passed 4.4 times.

CONSTITUENCIES

Three groups are affected by the issue at hand and its possible solutions – Zion National Park, PTI, and park visitors. The park itself is affected by the issue because the problem is within the park itself and most of the solutions – as outlined below – require some cost to the park. The cost may be monetary, such as the price to put up new signage, it may be environmental, such as the physical alteration of the landscape necessary to build a new bike path, or it may be the costs of time and labor needed to educate cyclists on the rules of the road. During the course of this study, park staff were consulted extensively in order to understand the scope of the problem and the feasibility and repercussions of possible solutions. Staff consulted include the park's GIS Specialist, Environmental Protection Specialist, Archaeologist, Roads and Trails Foreman, and the Chiefs of Concessions Management and Resource Management and Research.

The second group affected is PTI. Since PTI manages the shuttles that operate along the Scenic Drive, anything that takes place on the road has an affect on PTI's operations. PTI has taken on a major role in addressing the conflict between bicycles and motorized vehicles. Shuttle bus drivers are the eyes and the ears on the Scenic Drive and are the best resource available about what goes on along the road. Drivers, dispatchers, and supervisors were all contacted to solicit their opinions. Some of them have lived and worked in the canyon for many years and have a good deal of insight about the issue. Amongst drivers, however, opinions vary as to the severity of the problem and what the best solution is.

The third, and arguably most important group affected is visitors themselves – particularly those visitors riding bikes in the park. Though park staff, PTI staff, and members of the community who often bicycle on the Scenic Drive were spoken with, this is one area that can be expanded on in a future study. Aside from locals, there was minimal interaction with visitors bicycling in the park because they are difficult to catch before or after their ride. Conducting a formal survey would have taken more time to receive approval than was available for this project. In order to move forward in addressing this issue, the thoughts and opinions of visitors will need to be better addressed.

RECOMMENDATIONS

This section of the study presents and evaluates four alternatives for better accommodating bicycle traffic on the Scenic Drive – an information campaign, implementing restrictions on bicycle use, addition of a striped, on-road bicycle lane, and construction of an off-road multi-use path. There is also a fifth alternative, no action. The

alternatives are evaluated based on three criteria – how well they reduce congestion, whether or not they make the road safer for all users, and their effect on visitor experience.

Information Campaign

An information campaign would make cyclists aware of the current policy – that shuttles will not pass moving cyclists. If more cyclists know the policy, they will be more likely to pull over and allow shuttles to pass. The more times they hear this and see it in print, the better chance they will retain the information. When a shuttle is approaching, ideally, they will automatically remember to pull over. This alternative is a continuation of the path that the park is currently taking to balance the needs of motorized and non-motorized vehicles on the Scenic Drive. Since the policy was implemented in 2004, the park and PTI have taken steps to spread the word about the policy. There are signs on both the Scenic Drive and many of the bicycle racks in the park. Unfortunately, these signs are small and easy to miss. The policy is also mentioned on the automated recording that plays on the shuttle buses traveling up the canyon. But this only reaches those cyclists who ride the bus up canyon and pedal down. When the policy first began, fee collectors gave out informational handouts to visitors with bicycles. As time passed, this practice fell by the wayside. Employees at the two local bike rental shops also inform renters about the park’s policy.

Despite the efforts the park has already taken in this direction, there are still many cyclists that do not know to pull over. In conjunction with this study, the park has designed and approved new signage for the Scenic Drive. One sign will appear at the end of the Pa’Rus Trail, where it intersects with the Scenic Drive (Figure 8). Many cyclists ride along the Pa’Rus Trail and then continue along the Scenic Drive, making this an ideal location for signage. A second sign appears just before the slide area, an approximately 1 mile stretch of road that is particularly narrow and does not allow much room for cyclists to pull over (Figure 9). These signs are larger, easier to read, and more strategically placed than existing signage. The style also blends well with other signs on the road.



Figure 8: Sign to be placed at end of the Pa'Rus Trail



Figure 9: Sign to be placed before the slide area on the scenic drive

Along with new signage, the park can renew and expand their effort to hand out informational cards to visitors entering the park with bikes. These cards carry a similar message as the signs. In addition to park entrance stations, these cards would be handed out at the visitor center, by shuttle drivers to anyone loading a bike onto their bus, and at the two local bike rental shops. The owner of one local bike shop stated that he would be willing to hand out such cards. A more drastic tactic is to have cyclists sign a waiver saying that they understand the bicycle policy and will abide by it. The last recommended avenue for an information campaign is posting a larger notice in the park newspaper, which is handed out at entrance stations.

If successful, an education campaign getting bicycles to pull over would address all three issues related to the conflict between motorized and non-motorized vehicles – safety, congestion, and visitor experience. It would improve safety in that it would encourage cyclists to pull off to the right rather than continue riding in the left lane while a bus passes. Since shuttles would not spend as much time stuck behind bicycles, it would improve congestion. For the same reason, it would improve the experience of those visitors riding the shuttles. The downside to this approach is that it does nothing to improve the visitor experience of bicyclists. Ditches and steep slopes make it difficult to pull over in many places and cyclists riding up canyon would lose momentum.

Restrictions

The second alternative is imposing restrictions on bicycle use on the Scenic Drive. The most draconian approach would be to ban bicycles from the road altogether. A

milder approach would be to require cyclists to obtain a permit to bike on the road and only issue a certain number of permits each day. The park could put a cap on the number of people riding on the Scenic Drive in the same way they put a cap on the number of visitors allowed to enter canyons and other backcountry sites. Glacier National Park had similar bicycle conflicts on its narrow, winding, and mountainous Going-to-the-Sun Road. A number of accidents on the road spurred the park to limit bicycle use to certain directions and certain times of day, when fewer cars are on the road. From a safety standpoint, the restrictions have worked well in Glacier. The number of accidents has dropped off. Bicyclists are divided on the issue however. According to one ranger at Glacier, many cyclists understand the need for restrictions but the park receives a number of complaints from those who do not. Since Zion's Scenic Drive is limited mainly to shuttles buses during the operating season, traffic volume on the road is fairly consistent throughout the day. There is no time that is better to ride than another – except to avoid the midday heat. There is also the cost and responsibility of enforcing any restrictions. According to Glacier's experience, these restrictions work well from safety and congestion reduction standpoints. The major setback is in the realm of visitor experience. Any type of restriction limits bicyclists' access to a road that they feel they have a right to enjoy.

On-Road Bicycle Lane

Alternatively, a bicycle lane would greatly improve the experience of bicyclists using the road. A striped, on-road bicycle lane would separate traffic, giving bicyclists a separate riding space. The American Association of State Highway and Transportation Officials' *Guide for the Development of Bicycle Facilities* recommends a minimum width of four feet⁴. Since bicycle lanes are best suited to one-way traffic, in most cases there would be one on each side of the road. But since most of the bicycles going down canyon travel at about the same speed as shuttles, the majority of conflicts occur in the up canyon direction. Rather than add an extra 8 feet to the road, the park may wish to put a lane in only in the up canyon direction. For most of the Scenic Drive, a 4 foot lane would still need to be carved out of the hillside. Based on rough measurements, a 1 mile stretch of road ending at the Court of the Patriarchs is the widest and may be able to accommodate a bicycle lane. After subtracting 11.5 feet for each traffic lane – the minimum width on the Scenic Drive – there is still just over five feet of shoulder left. Beyond that, the road would need to be widened. In some of the broader, flatter sections of the canyon in the vicinity of Zion Lodge, widening the road would be relatively simple. But in other places, where the topography either drops off toward the river or climbs abruptly, widening the road would require major environmental modification. A topographic map of Zion Canyon and the Scenic Drive is included as Appendix B. If the park did choose to build a bike lane in only one direction, it would need to be very well marked that it is intended only for bicyclists traveling up canyon. If it is not signed well, bicyclists riding down canyon may attempt to share the narrow space with those going in the opposite direction, creating a safety issue.

Because of the environmental modification involved, and because the Zion Canyon Scenic Drive is on the National Register of Historic Places, a road widening project would need to go through significant environmental review in accordance with the National Environmental Policy Act (NEPA). NEPA outlines three levels of

environmental compliance: environmental screening, environmental assessment (EA), and environmental impact statement (EIS). An environmental screening form is used to evaluate the significance of a project's impact. The park, along with the FHWA and the Utah State Historic Preservation Office, would need to consider impacts on vegetation, wildlife, soils, geology, water resources, floodplains, wetlands, air quality, visual resources, archaeological resources, historic structures, and ethnographic resources. Based on the environmental screening, the park would decide which type of review is necessary – or if the project is a categorical exclusion (no compliance necessary). An environmental assessment is the less costly, less time consuming of the two options. Any project involving new construction will require at least an EA. If the impact of the project is deemed especially impactful, it would require an EIS. An EIS takes a minimum of two years and can be very expensive. A community impacts assessment needs to be done as part of either the EA or the EIS process. This is the part of the process in which the public is notified of the project and has their chance to have a say.

In terms of congestion, safety, and visitor experience, a striped bicycle lane would be a better option than either the education campaign or restricting bicycle use. Since bicyclists and motorized vehicles have their own separate riding lanes, buses would not have to worry about getting delayed behind a slow moving cyclist. It would improve safety for the same reason. As long as motorized and non-motorized vehicles kept to their own lane, there is little risk of an accident. It would also eliminate the desire for cyclists to ride out into the oncoming traffic lane while buses drive by. Unlike the previous two alternatives, it would greatly improve the visitor experience for cyclists. Riders would not have to worry about a bus tailing them, nor would they have to pull over and stop to let the bus by.

Off-Road Multi-Use Path

A multi-use path running alongside the Virgin River would greatly improve visitor experience for the cyclist. Through most of the canyon, a relatively flat topography appears to allow adequate room for an off-road bicycle path. The *Guide for the Development of Bicycle Facilities* recommends a minimum 10 foot width for a two way path. This is also the general width of the Pa'Rus Trail. The guide also recommends an 8 foot vertical clearance. Utah's State Non-Motorized Trails Grant Program estimates that a trail like this, paved with asphalt, would cost between \$70,000 and \$150,000 per mile⁵. There is one area just below Birch Creek, the site of a recent landslide, where it would be difficult to put a trail in. The best option then, is to begin the trail at the Court of the Patriarchs shuttle stop and extend it all the way to the Temple of Sinawava. This gives riders coming up the Pa'Rus Trail two options. They may choose to ride on the road from the end of the Pa'Rus Trail to the beginning of the new multi-use trail. Bicyclists uncomfortable riding on the road would have the option of loading their bikes onto the shuttle and getting a ride to the Court of the Patriarchs, where they can pick up the trail again.

Even where topography is suitable, constructing this trail presents significant challenges. Because of the river's meandering course, any trail would need to bridge the river at least a half dozen times. The major issue is that the entire canyon is a floodplain. The Virgin River flash floods frequently and the park would have to accept the risk that the trail could be washed out rather easily. There is also the issue of runoff. Some

surfacing options, including porous concrete and crushed stone, allow rainwater to seep through them rather than creating runoff, and therefore excess erosion. The type of surface used is often dictated by soil capacity. There are also a few wetland areas, mainly near the Temple of Sinawava, that the trail would need to be routed around. No known archaeological sites exist in this part of the canyon, but a NEPA analysis would need to be conducted in order to document the project's effect on the natural and human environment.

Though the portion of the valley between the river and the road is largely undisturbed, remnants of the historic Bridle Path can be found intermittently between Birch Creek and the end of the Scenic Drive. This overgrown trail is no longer used or maintained and scarcely exists except on maps. Since this area has already been disturbed, upgrading the bridle path to a paved trail may require only an EA rather than an EIS. There is also a network of social trails following the river that were neither built nor maintained by the Park Service. If the multi-use trail is built in the canyon, visitors may use this rather than the unmaintained trails and they would be allowed to return to their natural state.

A multi-use path on the floor of the valley would mitigate congestion by removing bicyclists from the road. Many regular riders would choose to be on the road anyway, but less experienced riders, including children, could be on the trail. These less experienced riders are the ones that cause most of the congestion issues. A path would make bicycling in the canyon safer as well because riders would be completely separated from all motorized traffic. In terms of visitor experience, this is the best of the four options. Bicyclists have the option of using whichever route best suits their ability and preference. More experienced road bikers could ride on the road alongside traffic, while families, children, and other casual riders could use the off-road trail. They could go at their own pace without having to worry about pulling over to let shuttles pass. This trail also provides a good place for visitors to ride Segways, if the park should choose to allow them. The park currently prohibits the use of Segways, though they are considering making allowances under certain circumstances for the mobility impaired.

Each of the four alternatives has certain advantages and disadvantages related to cost, impact, congestion, safety, and visitor experience. Building a new trail or widening the road to accommodate a bicycle lane would do the most to ease congestion, make the canyon safer, and improve visitor experience, however they are also the more costly and impactful options. In talking to bus drivers, bicyclists, park employees, and visitors, and observing the issues on the road, it seems that at the moment the bicycle/bus conflict is more of an annoyance than a serious issue. This study recommends continuing the ongoing information campaign – putting up signs, handing out flyers, and expanding efforts to inform bicyclists to pull over.

IMPLEMENTATION

The park has been implementing this recommendation since the policy began in 2004. Most recently, the park has designed and approved signage on the Scenic Drive. These signs are being made in-house for about \$1,200. The next step is to begin handing out informational flyers at fee stations, the visitor center, and local bike shops. These flyers have already been designed, so the park only needs to work with fee collectors and

local merchants to have them handed out to bicyclists. The cost of printing 5,000 of these flyers is about \$300.

Even though the bicycle/bus conflict on the Scenic Drive does not present a serious issue now, it may in the future. Anecdotal evidence from park and PTI staff suggests that more and more cyclists pedal the Scenic Drive each year. If bike traffic continues to increase, the current policy may not be enough to facilitate smooth traffic flow on the road. In addition to implementing a comprehensive information campaign, this study recommends developing a long range plan to deal with bicycle traffic. The most important aspect of this long range bicycle plan is to continue bicycle counts in order to track how much bicycle use increases or decreases from season to season. The work done this summer establishes a baseline number of users. Counts done under similar conditions in future summers will show just how much – if at all – bike traffic increases from year to year and the park will be able to make projections based on this and decide on a long term plan of action. If bicycle use increases to a certain point, some sort of trail will become a necessity rather than an amenity. Exactly what that point is, the park will have to decide based on visitor feedback, observation, and any incidents that may occur.

The bicycle counts show current demand for a new lane or path but they do not show latent demand. How many people are there not currently riding in the canyon, but would if conditions were more suitable? The best way to determine this is through a questionnaire asking visitors about their bicycling interests and whether or not they would use a multi-use trail or bicycle lane if it existed. A questionnaire was developed as a part of this project but has not yet been administered. Along with doing bicycle counts and conducting the questionnaire, a third way the park can begin to plan for increased bicycle traffic is by selecting the preferred route for a potential bicycle path. This includes deciding whether it will be an on-road lane or an off-road path. By having a route already selected, it will make it quicker and easier to develop the trail when and if it comes to that point.

CONNECTION TO WIDER TRANSPORTATION COMMUNITY

Zion National Park is not the only place in the southwest Utah region working to better accommodate bicycles. Zion is located in Washington County – one of the fastest growing counties in the nation. As the number of people in the county continues to grow, so does the number of miles of trail. New mountain bike trails have recently been cut or proposed in the area in addition to those that already exist. A feasibility study is also underway for the Zion Canyon Community Trail. Though the details have not yet been finalized, the concept is a walking and bicycling trail connecting the towns of Rockville and Springdale. The trail would begin where Rockville's sidewalk ends at the east end of town, following state route 9 through Springdale and ending at the entrance to Zion – a total distance of 6.5 miles. Once inside the park, riders can continue on the Pa'Rus Trail and on up the canyon. Cost estimates for this trail range from 4.1 to 4.6 million dollars, depending on whether it is adjacent to the road or the river and the number of bridges required to cross the Virgin River. There is also an effort to extend this trail beyond Rockville all the way to St. George, Utah, about 40 miles away. This effort is known as the Three Rivers Project.

With all of the trail development in Washington County, the coming years are bound to see more and more bicycles on the park's Scenic Drive. This will only

exasperate the road's existing conflict if nothing is done. On the other hand, a multi-use path along the river, connected to the Pa'Rus Trail, could be part of an extensive network that cyclists can ride from St. George all the way to the Zion Narrows.

Other National Parks are working out issues with bicycles as well. Some have chosen to place restrictions on bicycle use, such as Glacier's rules for using the Going-to-the-Sun Road. Others are putting in more miles of bicycle paths. Grand Canyon National Park's General Management Plan, created in 1995, proposes 73 miles of new greenways⁶. A Transportation Scholar working in Everglades National Park is evaluating the feasibility of upgrading a partially abandoned section of highway for bicycle use. In addition to the National Park System, many towns and cities are following the greenway trend, often converting long dormant railroad corridors to biking and jogging paths. Two examples are Rochester, NY, and Greensboro, NC. The City of Rochester has completed most of the Genesee Riverway Trail, a 13 mile greenway that follows the Genesee River from the Erie Canal, through downtown Rochester, to the shore of Lake Ontario. The City of Greensboro is in the early stages of planning its Center City Greenway. The 4.2 mile greenway will encircle the downtown area and include interpretive signs and links to other bicycle trails.

THE NPS TRANSPORTATION LANDSCAPE

I would guess that my work environment is unique compared to other transportation scholars. Instead of working directly with the park, I worked mainly with PTI, particularly with General Manager Kirk Scott, who has a great deal of experience and knowledge in transportation planning. I was able to learn a great deal about transportation planning while contributing to the park. Zion benefits greatly from having an office dedicated solely to transportation and I benefited greatly from being able to work with them.

There are factors that make planning in a park easier than elsewhere and factors that make it more challenging. In building a multi-use path for instance, there is no need to worry about land acquisition and private property rights. On the other hand, a large amount of energy needs to go into deciding the effect of the project on visitor experience. People – visitors, locals, and employees - feel very attached to Zion for different reasons and tend to be wary of changes being made to “their park.” The strategy that I found works best is simply good communication. There is no substitute for talking to and working with different people who have varying visions of how the park should look and operate. During my time in Zion, I focused on getting as many different opinions as possible. The data I've collected and recommendations I've made, I hope, address the questions and interests of most of the people that have a stake in the park.

PROFESSIONAL DEVELOPMENT

By being part of the National Park Transportation Scholars Program at Zion National Park, I was able to wed my academic interests in transportation geography and natural resources with my personal interests in bicycling, hiking, and just generally being outdoors in a place with ample recreation opportunities. It allowed me to do the work that I enjoy in the setting I wanted to be in. In the process I worked and lived with some great people and I feel that I was able to make a positive contribution to the park. None of this would've happened without the National Park Transportation Scholars Program.

In the short term, I hope to turn my findings into a capstone project for my master's degree that will be of further interest to Zion National Park and the wider National Park transportation community. For the long term, more than anything else, my experience in Zion has made me realize that I would like to continue working in natural or rural environments such as National Parks or state parks. It has also given me experience working with a variety of different people, balancing different interests, and coordinating a complex, long-term project. These are skills that will undoubtedly be indispensable wherever my professional career may take me.

REFERENCES

¹Harkey, D. L., and Reinfurt, D.W. (1998). *The Bicycle Compatibility Index: A Level of Service Concept, Implementation Manual* (Report No. FHWA-RD-98-095). Washington, DC: Federal Highway Administration.

²Jones, E.G., and Carlson, T.D. (2002). *Development of a Bicycle Compatibility Index for Rural Roads in Nebraska*. [CD-ROM]. 2003 TRB Annual Meeting.

³Noel, N., Leclere, C., and Lee-Gosselin, M. (2003). *CRC INDEX: Compatibility of Roads for Cyclists in Rural and Urban Fringe Areas*. [CD-ROM]. 2003 TRB Annual Meeting.

⁴(1999). *Guide for the Development of Bicycle Facilities*. [CD-ROM]. Washington, DC: American Association of State Highway and Transportation Officials.

⁵Eldridge, J. (1998). *Bicycle & Pedestrian Planning Guide for Utah*. Ogden, UT: Weber State University.

⁶Grand Canyon National Park (2002). *Greenway Trail Segments in Undisturbed Areas: Revised Environmental Assessment*. Grand Canyon National Park, Arizona.

**APPENDIX A
Raw Bicycle Count Data**

**June 28, 2007 (Thursday)
Court of the Patriarchs**

Size	Type	Children	Adults	Skill	Direction
1	single	0	1	S	D
3	other	3	0	L	D
6	family	5	1	L	D
5	family	3	2	L	D
2	family	0	2	L	D
1	single	0	1	S	D
4	other	3	1	L	D
1	single	0	1	S	D
1	single	0	1	S	D
2	family	1	1	L	D
1	single	0	1	S	U
2	family	0	2	S	U
1	single	0	1	S	U
3	family	2	1	L	D
1	single	0	1	S	U
2	family	0	2	S	U
Size	Type	Children	Adults	Skill	Direction
3	family	0	3	L	D
Size	Type	Children	Adults	Skill	Direction
2	family	0	2	L	U
3	family	1	2	L	D

Big Bend

Size	Type	Children	Adults	Skill	Direction
1	single	0	1	M	D
3	family	1	2	L	D
3	family	1	2	L	D
1	single	0	1	S	D
1	single	0	1	S	U
1	single	0	1	S	U
2	family	0	2	M	U
1	single	0	1	S	D
1	single	0	1	S	D
2	family	0	2	M	D
Size	Type	Children	Adults	Skill	Direction
3	family	0	3	L	D
Size	Type	Children	Adults	Skill	Direction
3	family	1	2	L	D
2	family	0	2	L	U

June 30, 2007 (Saturday)
Court of the Patriarchs

Size	Type	Children	Adults	Skill	Direction
2	family	0	2	L	U
2	family	0	2	S	D
2	other	0	2	L	U
3	family	1	2	L	U
1	single	0	1	L	D
1	single	0	1	S	D
3	family	2	1	L	U
2	family	0	2	S	U
2	family	0	2	L	D
3	family	2	1	L	U

Size	Type	Children	Adults	Skill	Direction
2	family	0	2	S	D
2	other	0	2	M	D
1	single	0	1	S	U
1	single	0	1	L	D
1	single	0	1	M	U
3	family	1	2	L	U
1	single	0	1	S	D
3	family	2	1	L	D
3	family	2	1	L	U

Size	Type	Children	Adults	Skill	Direction
2	other	0	2	L	D
1	single	0	1	L	D
2	family	0	2	L	D

Big Bend

Size	Type	Children	Adults	Skill	Direction
2	family	0	2	S	D
1	single	0	1	M	U
4	family	4	0	L	D
1	single	0	1	M	D
2	family	0	2	L	D
4	family	4	0	L	D
1	single	1	0	L	D
4	family	2	2	L	D
2	family	0	2	L	U
1	single	0	1	M	U
1	single	0	1	S	U

Size	Type	Children	Adults	Skill	Direction
3	family	2	1	M	U
1	single	0	1	S	U
1	single	0	1	S	D
3	family	2	1	M	D
1	single	0	1	L	U

Size	Type	Children	Adults	Skill	Direction
1	single	0	1	L	D
2	family	0	2	L	D

July 12, 2007 (Thursday)
Court of the Patriarchs

Size	Type	Children	Adults	Skill	Direction
1	single	0	1	S	U
1	single	0	1	M	D
2	family	0	2	M	D
1	single	0	1	S	D
1	single	0	1	M	D
Size	Type	Children	Adults	Skill	Direction
2	family	2	0	L	D
2	family	1	1	L	D
1	single	0	1	S	D
Size	Type	Children	Adults	Skill	Direction
4	other	0	4	S	D
4	other	0	4	S	U
2	family	0	2	S	D
1	single	0	1	M	U
4	other	0	4	S	D

Big Bend

Size	Type	Children	Adults	Skill	Direction
2	family	0	2	M	D
1	single	0	1	S	U
1	single	0	1	M	U
1	single	0	1	S	D
1	single	0	1	M	D
Size	Type	Children	Adults	Skill	Direction
1	single	0	1	L	D
Size	Type	Children	Adults	Skill	Direction
4	other	0	4	S	D
2	other	0	2	S	D
4	other	0	4	S	U
4	other	0	4	S	D

**June 14, 2007 (Saturday)
Court of the Patriarchs**

Size	Type	Children	Adults	Skill	Direction
2	other	0	2	M	D
2	family	1	1	L	D
2	family	1	1	M	D
2	family	1	1	L	D
3	family	1	2	L	D
1	single	0	1	S	U
2	family	1	1	L	D
1	single	0	1	L	D
2	other	0	2	S	D
2	family	1	1	L	D
1	single	0	1	L	U
1	single	0	1	L	D
2	family	0	2	L	D
Size	Type	Children	Adults	Skill	Direction
2	family	0	2	L	D
2	other	1	1	L	D
Size	Type	Children	Adults	Skill	Direction
2	family	0	2	L	D
1	single	0	1	M	U
4	family	2	2	L	D
2	single	0	2	L	U
1	single	0	1	S	D

Big Bend

Size	Type	Children	Adults	Skill	Direction
2	family	0	2	L	D
1	single	0	1	L	D
1	single	0	1	S	U
4	family	2	2	L	U
1	single	0	1	S	U
1	single	0	1	S	D
1	single	0	1	S	D
Size	Type	Children	Adults	Skill	Direction
2	family	0	2	L	D
2	other	1	1	L	D
Size	Type	Children	Adults	Skill	Direction
4	family	2	2	L	D

Size = Number of cyclists in group

Type = Type of group (family, single other)

Children = Number of children in group

Adults = Number of Adults in group

Skill = Skill level of least skilled cyclist in group (S = sport, M = moderate, L = leisure)

Direction = Direction of travel (D = down canyon, U = up canyon)

APPENDIX B
Topographic map of Zion Canyon

