THE ROADWAY FACILITY BICYCLE LOS
LINKING THE SEGMENT AND INTERSECTION MODELS

Contract # BD545-23

FINAL REPORT

Submitted to

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September 2006

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
BD545-23		

4. Title and Subtitle	5. Report Date / 6. Performing Organization Code
The Roadway Facility Bicycle LOS Linking The Segment and Intersection Models	5. Report Date: September 2006 6. Performing Organization Code:
7. Author(s) Bruce Landis, Theodore Petritsch , Linda Crider , Martin Guttenplan, Peyton McLeod	8. Performing Organization Report No. Project #00043129
9. Performing Organization Name and Address University of Florida Department of Urban and Regional Planning P.O. Box 115706 at UF Gainesville, FL 32611-5706	10. Work Unit No. (TRAIS) 11. Contract or Grant No. *BD545-23*
12. Sponsoring Agency Name and Address Florida Dept. of Transportation 605 Suwannee St. MS 30 Tallahassee, FL 32399	13. Type of Report and Period Covered Final Report 1/13/2005 Through 09/30/2006 14. Sponsoring Agency Code

15. Supplementary Notes

Final Report and Executive Summary Report on file at FDOT Research Office

16. Abstract

This report documents a Florida Department of Transportation (FDOT) sponsored study to create a model that predicts how bicyclists perceive the arterial roadway environment. It builds upon FDOT's highly successful adopted segment and intersection bicycling level of service (LOS) models. Data for the new Bicycle LOS for Arterials model were obtained from the FDOT's innovative "Ride for Science" field data collection event and video simulations, which was conducted November 12, 2005. The data consist of participants' perceptions of how well roadways met their needs as they rode selected arterial roadways and/or viewed simulations of those and other roadways.

The objective of this most recent research was to create a user calibrated method which could be used to rate a wide range of arterial roadway conditions for how well they serve the bicycle mode. The desire to have users rate a wide range of environments led to the FDOT to request the use of a video simulation methodology to represent the more extreme traffic conditions found on some arterial roadways. This request for a video simulation methodology created another objective of developing, testing, and refining a moving camera filming platform configuration that accomplished five major goals:

- Portray the full range of roadway conditions.
- Accurately simulate a bike ride along an arterial.
- Allow extended viewing by study participants.
- Ensure the safety of the videographer/bicyclist filming the simulation.
- Ensure motorists' passing behaviors are not changed.

These research results will be incorporated into FDOT's *2002 Quality/Level of Service Handbook* for use by FDOT, MPOs, and communities around the state.

17. Key Word	18. Distribution Statement
LOS (Level of Service) Multimodal Bicycle Modals	No restrictions

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	61	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

ACKNOWLEDGMENTS

The authors wish to thank the many volunteer participants and volunteer event personnel who made the *Ride for Science 2005* possible, including those from the FDOT District 7 Office, the FDOT Central Office, the University of Florida, the University of South Florida, URS Corporation, and the Tampa Museum of Science and Industry. In particular, we would like to thank Harry Reed, Michael Munroe, and the USF Student Chapter of ITE. We would also like to thank our corporate sponsors, too many to name here. Finally, we appreciate the support of the project managers at the Florida Department of Transportation and the University of Florida in providing the opportunity to work on this important study.

We wish to recognize the following research teams for all phases of the Facility Bicycle LOS Project:

Phase I: Facility Level of Service for the Bicycle Mode

Funded by Florida Department of Transportation Central Office through the University of Florida

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UF Project Manager: Linda Crider, Ph.D.

Phase II: Facility Bicycle Level of Service Ride for Science

Funded by Florida Department of Transportation District 7 Office

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Phase III: Arterial Level of Service for the Bicycle Mode

Funded by Florida Department of Transportation Central Office through the University of Florida

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EXECUTIVE SUMMARY

This report documents a Florida Department of Transportation (FDOT) sponsored study to create a model that predicts how bicyclists perceive the arterial roadway environment. It builds upon FDOT's highly successful adopted segment and intersection bicycling level of service (LOS) models. Data for the new Bicycle LOS for Arterials model were obtained from the FDOT's innovative "Ride for Science" field data collection event and video simulations, which was conducted November 12, 2005. The data consist of participants' perceptions of how well roadways met their needs as they rode selected arterial roadways and/or viewed simulations of those and other roadways.

A high-fidelity simulation methodology has been developed presenting the perspective of a bicyclist riding an arterial roadway. Research indicated that previously used filming methods are lacking in several respects. The researchers then developed, tested, and refined a moving camera filming platform configuration that accomplished five major goals:

- Portray the full range of roadway conditions.
- Accurately simulate a bike ride along an arterial.
- Allow extended viewing by study participants.
- Ensure the safety of the videographer/bicyclist filming the simulation.
- Ensure motorists' passing behaviors are not changed.

FDOT's intent to collect user data on types of roadways not feasible for the volunteer event (high truck volumes, speeds, and/or conflicts) created an ambitious objective for this project - to develop a video simulation methodology of such high fidelity it could be calibrated with real-time field collected data and used to expand the range of variables collected. Statistical analyses comparing data using the video simulation and during the field event indicated no significant difference. Therefore, researchers can present the bicyclists view of riding environments without exposing them to potentially hazardous traffic/roadway conditions.

The final Bicycle LOS for Arterials model is based upon Pearson correlation analyses, stepwise regression, and PROBIT modeling of approximately 700 combined real-time perceptions (observations) from bicyclists riding a course along arterial roadways. An additional

700 combined perceptions obtained from the participants viewing a video simulation were used to refine the model for arterial roadways. The study participants represented a cross section of age, gender, riding experience, and residency. The Bicycle LOS for Arterials model provides a measure of the bicyclist's perspective on how well an arterial roadway's geometric and operational characteristics meets his/her needs. Although further hypothesis testing may be conducted in a future study, this model is highly reliable, has a high correlation coefficient (R^2=0.74) with the average observations, and is transferable to the vast majority of metropolitan areas in the United States.

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BACKGROUND

In the Year 2000, the Florida Department of Transportation (FDOT) adopted the operational Bicycle LOS Model for the segment portions of the roadway facility (*1*). In 2001, FDOT turned its attention to the intersection environment, beginning the development of the intersection bicycle level of service model for through bicycle movements. The operational model was completed in July of 2002. These two models provide important and reliable insight into the two major features of bicycle travel: road segments and intersections. Transportation professionals throughout Florida and the United States have found these analysis tools very helpful and applicable to their needs. As an example, since the original development of the segment Bicycle LOS Model (*2*) by the staff of Sprinkle Consulting, Inc. (SCI) in 1995, the Model has been applied in over 200,000 miles of roadways throughout North America and it is in extensive and widespread use by numerous state, regional and metropolitan and local transportation agencies. The intersection bicycle LOS model (*3*) recently developed by FDOT is expected to have similar success and widespread use. However, an important analysis tool remained undeveloped for the roadway facility; there is no method available to link the intersections and roadway segment models together to confidently measure people's bicycle travel along a roadway facility.

Why is a facility-level "Bicycle LOS" model needed? It is needed for several important reasons. First, most of the analysis and planning of Florida's collector and arterial roadway system is conducted at the facility level (Figure 1). Concurrency management systems, development impact assessment, mitigation measure identification, Work Program, Capital Improvement Programs, and TIP developments are accomplished considering the facility analysis level results. Secondly, during more detailed analyses, planning, and design of transportation facilities, route alternatives for the bicycle mode cannot be accurately measured and evaluated without a statistically reliable method of combining the segment and intersection components. For example, numerous shared use path connections, particularly overpasses (bridges), are being considered without effective analytical tools – a significant shortcoming in evaluative information especially considering the construction expense and land requirements of these transportation features. Additionally, oftentimes important connections among on-street bicycle facilities are not being identified or constructed due to the lack of an evaluation method available to planners and engineers. Finally, the successful development of a facility-level model can provide insight and potentially verify the current assumption of multiple segment LOS weighting within the FDOT's *2002 Multi-Modal Q/LOS Handbook*.

Figure 1. Roadways with varying levels of accommodation for bicyclists

This project is a three phase research effort. Phase I developed the methodology to be used to collect data for the development of a facility LOS model for bicycles. Phase II was the critical data collection effort itself. Phase III included data reduction and development of the final facility LOS for bicycles model. The methodology to be used for this study is patterned after the proven techniques used to develop the previous segment and intersection LOS models for bicycles. However, to develop a model based upon the widest possible range of values for the independent variables (i.e. higher truck volumes, more frequent driveway conflicts), a bicyclist's perspective video/simulation component is being included within this project. This research, resulting in a statistically reliable model for the operational level of service analysis for roadway facilities throughout Florida, will not only aid in achieving the Department's immediate objectives for this project, but it will also help validate the video simulation approach for multiple uses in future FDOT research projects.

Data Collection Methodologies

In the preliminary developmental stages of the Facility LOS model development study, the following methods were considered as potential methodologies for collecting data:

- Staged Real-Time Field Event – Involves an event in which subjects are directed to ride a course and grade each facility on a scale of A to F immediately after they have traversed that facility. This methodology was used by the Florida Department of Transportation (FDOT) to develop the Pedestrian and Bicycle LOS models for segments and intersections, and the Pedestrian LOS model for facilities.

- Contingent Valuation – Involves taking subjects to various facilities and asking them to observe then grade the facilities without actually riding along them. Contingent valuation was used by FDOT in developing an LOS model for pedestrian mid-block crossings.
- Intercept Survey – Involves stopping in-situ cyclists after they have traversed a facility and asking them to grade the previous section (Figure 2).

Figure 2. Intercept survey of bicyclists

- Simulation – Involves having participants view a representation (a still camera video or moving camera video) of the bicycling environment and asking them to grade facilities based upon the video presentation.
- Focus Groups – Involves interviewing participants as to what features affect their perceptions of accommodation and how they would grade various facilities. While the other methodologies usually involve independent evaluations by individual participants, this method involves group discussions.

While each method has its benefits and drawbacks, the researchers elected to use a staged real-time field event (the *Ride for Science 2005*) to provide the primary observational data for the creation of an LOS model of roadway facilities for the bicycle mode. The primary reason for this decision was the high reliability a staged event offers because it exposes participants to all possible stimuli. Previously, FDOT has developed field validated methods for measuring bicycle and pedestrian LOS along roadway segments (between intersections) and at intersections. This project was undertaken to create a method which could be used to rate an entire facility. The latest real time event included two major studies: (1) the development of a model of LOS along roadway facilities for the bicycle mode and (2) the creation, testing, and calibration of a corresponding video simulation.

VIDEO SIMULATIONS

Studies using video simulations allow for the widest range of possible traffic variables. Facilities with wide ranges of traffic, geometric, and operational factors can be selected and filmed to obtain widely distributed values for the (hypothesized) independent variables. Because the participants do not experience travel time between the intersections, more facilities can be reviewed by each participant for the same survey time investment. Additionally, each study participant is exposed to identical conditions. Finally, the cost of running a simulation tends to be lower than the cost associated with a real-time field bicycling course event.

Simulation studies, however, do not expose the participants to all of the stimuli associated with the real bicycling environment. For example, the impact on personal safety and wind blast effects of motor vehicles or trucks are not experienced. Views of all roadway perspectives such as all approaches cannot be fully represented in a video format. The impact of delay upon the participants' perceptions of the intersections is also likely to be skewed by the simulation format, partly because they are not standing in the elements waiting for a signal to change and also because there is no trip associated with the simulation methodology. Thus, some factors may be under-represented and others may be over-represented in a video simulation.

However, based on the potential-long term benefits of video simulation, the researchers and FDOT decided to develop a video simulation and use participants from the staged real-time field event to view the simulation. As a result, the combined data collection event would allow for video simulation hypothesis testing and future refinement for ultimate calibration to expand field data.

Selecting the Simulation Methodology

The first step in developing a simulation was to determine the methodology for video taping the roadway arterial from a bicyclist's viewpoint. There were three main objectives for the video simulation:

1. It must portray the full range of geometric and operational conditions:
    - Traffic volumes
    - Total number of through lanes
    - Percent heavy vehicles
    - Traffic speeds
    - Width of the travel lanes
    - Pavement condition
    - Crossing width at intersections
    - Turning conflicts at intersections
    - Driveway conflicts
2. It must simulate a bike ride along arterial roadways with the highest practical fidelity. It was important to capture the above listed characteristics and the bicyclist's interaction therewith, with the highest fidelity practical. To this end, extensive testing for the most appropriate camera platform and filming protocol was very important.
3. It must be viewable by participants for an adequate duration to allow simulation of a number of arterials with a variety of conditions.

In addition to the video simulation objectives, the researchers had two additional objectives:

4. The methodology must provide for the safety of the cyclist/videographer.
5. The method should ensure that the behavior of motor vehicle drivers overtaking the filming platform is similar with those of motorists passing regular bicyclists.

With these objectives in mind the project team researched potential video simulation methodologies, as described in the next section.

Previously Used Video Simulation Methodologies

The researchers performed a literature search to determine what other methods had been used to simulate riding in the roadway environment. The advantages of each method were then evaluated to determine if it would be appropriate for application in this research effort. Three of those efforts are discussed below.

Fixed Camera Mounted Roadside

Harkey *et al.* used video clips from a stationary camera to develop the Bicycle Compatibility Index (BCI) (*4*). The video clips reflected a variety of characteristics including a range of curb lane widths, motor vehicle speeds, traffic volumes, and bicycle/paved shoulder widths.

Participants were asked to rate their comfort level based on a six-point scale in the following categories: volume of traffic, speed of traffic, width or space available for bicyclists, and overall rating. In the end, eight variables were found to be significant in the BCI regression model:

- Number of lanes and direction of travel
- Curb lane, bicycle lane, paved shoulder, parking lane, and gutter pan widths
- Traffic volume
- Speed limit and 85 percentile speed
- Median type (including two-way left turn lane)
- Driveway density
- Presence of sidewalks
- Type of roadside development

Since this research was done in a video laboratory setting, the subjects could not take into account the comfort effects of pavement condition or crosswinds and suction effects caused by high-speed trucks and buses. These factors consequently are either absent or show up to a minimal extent in the BCI model.

Moving Motor Vehicle Mounted Camera

Jones and Carlson developed a rural bicycle compatibility index (*5*) using a moving camera methodology. They employed a web-based survey consisting of questions and thirty-two 30-second video clips. The 30-second video clips were edited from 15-minute videos shot with image stabilization from a car moving 10 mph at a height 4.5 feet above the ground. According to the researchers, since overtaking motor vehicle traffic tended to give wide clearance to the slow moving car on the shoulder, the video clips tended to show overtaking vehicles giving bicyclists more clearance than they would in reality.

The rural bicycle compatibility index in this model is a function of two factors: shoulder width, and the volume of heavy vehicles traveling in the same direction as the bicyclist. The authors intentionally excluded pavement condition from the survey due to various data difficulties (including the difficulty of representing rough pavement in a video shot from a camera mounted on a car). All sites had relatively level grades, with only two traffic lanes and speed limits in excess of 50 mph.

Bicycle Helmet Mounted Camera

Hummer *et al.* (including one of the authors of this paper) used a helmet mounted camera to produce a video to obtain user bicyclists' feedback and develop a level of service estimation method for shared use paths (*6*). Thirty-six 60-second video clips were used in this research effort. The video clips were in black and white and had no audio. The video was then digitized; the quality of the digitized video was considered good to marginal. However, the researchers described some camera angles as marginal and noted the quality was also impacted by level of brightness and contrast control of the equipment used. The images were considered 'good enough' and presented for periods of sufficient time to give respondents a realistic view of operations on the trail.

Video Simulation Methodology Testing

Based upon a review of the literature, the FDOT and the researchers determined the first two methods discussed above would not meet the needs of this project. The stationary and motor vehicle mounted cameras did not capture the full range of variables expected to be significant in an arterial setting for bicyclists. Additionally, the position of the passing motorists represented in the video would not accurately represent that experienced by actual cyclists.

The helmet cam used in Hummer's study was still considered a viable option but was seen as needing further refinement. The quality of the video would have to be improved and sound would need to be included to accurately represent the roadway environment. Also, it was reported that some participants viewing the video experienced nausea and/or headaches because of the camera's movement.

The researchers decided to experiment with numerous different moving camera video platforms and evaluate them to determine which would be the best to use in the arterial roadway environment. Videos were shot using six different camera/bicycle configurations. These configurations included a mountain bike with the rider wearing a helmet cam; a frame mounted camera on a fully suspended mountain bike; a tandem bicycle with front suspension and the stoker operating a stabilized camera; a two person adult tricycle with the videographer in the left front seat; and, a Viewpoint bicycle with the front rider (stoker) operating a hand held camera.

These were first evaluated by the project team viewing sample video filmed with the various configurations. Subsequently a group of 44 individuals viewed the video clips in a controlled environment. They provided comments on an evaluation form as they watched video footage shot with the various filming platforms. Each individual was interviewed after watching the videos to obtain any additional insights s/he might have had. Summaries of their observations and the researchers' conclusions regarding each of the moving camera video platforms are presented below:

Bike with Rider Wearing Helmet Cam

The first configuration tested was a helmet cam mounted on the helmet of a cyclist riding a mountain bike. With respect to the objectives we found the following:

1. Most of the variables could be represented using this configuration. However, pavement roughness was not well represented on the video; evidently the cyclist's body acted to dampen vibrations due to roadway surface irregularities.
2. The mountain bike/helmet cam met the second criterion very well. It is absolutely clear from the video that one is getting a cyclist's eye view of the roadway.
3. The video <u>did not meet</u> the third criterion of being viewable by participants for an adequate duration. Every movement of the rider's head was reflected on the video tape. Additionally, the scanning movements of the bicyclist (required to maintain an awareness of traffic) occurred much too fast on video. The constant motion was found to make several viewers nauseous after only a few minutes.
4. This configuration requires the cyclist to both operate the bicycle (in heavy traffic) and act as the videographer. To provide consistent video representations of each facility, it is necessary to "script" the cyclist's speed and any camera movements to eliminate

unintended biases. For instance, on a busier highway, a cyclist might look over his shoulder more frequently than on a quiet residential street. This could cause the video to over-represent the effect of some of the variables.

5. If the video unit and batteries are placed within a trunk bag or saddle bags, the impact of this device on motorists' behavior is minimal.

While the method may have been adequate for a shared use path environment, the project team decided that the mountain bike/helmet cam configuration would not adequately meet the objectives of this video simulation project for this arterial roadway project. The nausea caused by the video made viewing the tape for more than just a few minutes impractical. In addition, the expert advisory committee had concerns about the safety of the cyclist acting as both the driver of the bike and the videographer.

Suspended Mountain Bike with Frame Mounted Camera

This configuration is a mini camera mounted on a tripod attached to the top tube of a suspended mountain bike.

1. Many of the expected variables could be represented quite well using this configuration. However, because this method eliminates the opportunity for scanning, the impact of side streets or multiple lanes may be under-represented in viewers' responses.
2. This configuration met the second criterion quite well. It is absolutely clear from the video that the video was taken from a bicycle.
3. The video did not meet the third criterion of being viewable by participants for an adequate duration. Because a bicycle is constantly swerving (albeit ever so slightly), the video had a back and forth sway throughout its length. Additionally, even though the bike was equipped with both front and rear suspension, surface irregularities caused a near constant and very severe vibration to the picture. The constant motion was found to make several viewers nauseous after only a few minutes.
4. This configuration does not require the cyclist to act as a videographer and is therefore acceptable from a safety standpoint.
5. Based upon the passing position of the motor vehicles in the video, this arrangement appears to have minimal impact on the behaviors of motorists passing the bicycle.

The project team decided the camera mounted to the top tube of a fully suspended mountain bike would not adequately meet the objectives of this video simulation project. The nausea caused by the video made viewing the tape for more than just a few minutes impractical. In addition, the advisory committee decided that because the opportunity to pan the camera is eliminated, some variables of the urban arterial environment would not be adequately represented in the video.

Front Suspended Tandem Bicycle with Rear Rider (Stoker) Operating a Camera Mounted on a Glidecam™ Stabilization System

The Glidecam™ Stabilization System stabilizes the camera to eliminate unwanted roll, pitch and yaw in a video.

1. Many of the expected variables could be represented quite well using this configuration. The long wheelbase of the tandem bicycle and the shock absorber on the Glidecam™ dampened the effect of surface irregularities on the video. However, because this method eliminates the opportunity for scanning to the right, the impact of side streets may be under-represented in subsequent viewers' responses.
2. This configuration met the second criterion quite well. It is absolutely clear from the video that the video was taken from a bicycle. The front cyclist was in the picture for most of the video. There was some discussion as to whether having the cyclist in the frame would create a scoring bias.
3. The video obtained using this method provided excellent picture stability and quality. No one watching the video complained of any discomfort or nausea.
4. This configuration does not require the cyclist to act as a videographer and is therefore acceptable from a safety standpoint.
5. The test configuration involved using a large body mounted Glidecam™ arrangement. Consequently, the obvious presence of the camera and videographer on the back of the tandem may have influenced motorists' overtaking behaviors. However, it is felt that with modifications – using a smaller camera configuration – this effect could be minimized.

This platform and camera combination provided stable, clear video. However, the advisory committee decided that because the opportunity to pan the camera is eliminated, some variables, such as interactions with motorists at intersections and driveways, would not be adequately represented in the video.

Two-person Adult Tricycle with the Videographer in the Left Side Seat

This configuration had the videographer sitting to the left of the individual who actually drove the bicycle.

1. Many of the expected variables could be represented quite well using this configuration. However, surface irregularities were not well represented by this methodology.
2. This configuration resulted in a travel speed too low to represent realistic bicycle speeds on busy roadways.
3. The video obtained using this method provided excellent picture stability and quality. No one watching the video complained of any discomfort or nausea.
4. This configuration does not require the cyclist to act as a videographer and is therefore acceptable from a safety standpoint.
5. Because of the additional width of the tricycle, motor vehicle drivers gave additional space to the tricycle, as evidenced in the test video clips.

Because of the potential (lack of) speed and the influence of the tricycle's design on motorists, the advisory committee found this option to be unacceptable for this project.

Viewpoint Bicycle with Front Rider (Stoker) Operating a Hand Held Camera

A Bilenky Viewpoint bicycle is a tandem bicycle on which the captain, the one who steers the bicycle, sits in the back on a regular upright frame. The stoker (and cameraman) sits in the front on a recumbent style seat. The videographer's arm was braced on part of the bicycle to aid in steadying the camera.

1. Many of the expected variables could be represented quite well using this configuration. The videographer's arm provided some dampening effect on the effect of roadway irregularities. Intersection, driveway and lane number effects can be captured because scanning can be readily executed by the videographer.
2. This configuration met the second criterion quite well. It is absolutely clear from the video that the perspective is that of a bicyclist.

3. The video obtained using this method provided excellent picture stability and quality. No one watching the video complained of any discomfort.
4. This configuration does not require the cyclist to act as a videographer and is therefore acceptable from a safety standpoint.
5. The effect of the Viewpoint bicycle on passing traffic appears to be minimal; motorists appear to overtake and pass the bicycle as they would a regular bicycle (Figure 3). This may be because the motorists' view of the bicycle is similar to that of a regular bicycle as the front cyclist (cameraman) is relatively hidden from the motorist until the overtaking is completed.

The project team found that this configuration provided the best overall potential for high quality, consistent video representation of arterial roadways.

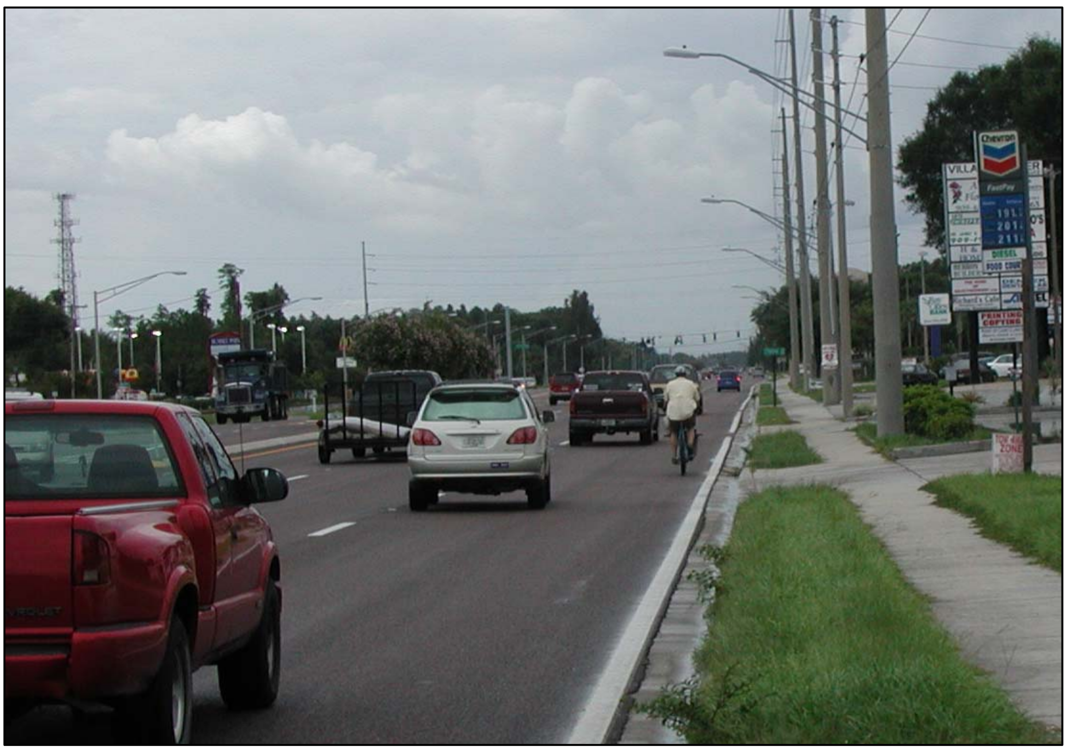

Figure 3. Rear view of the Viewpoint tandem

Final Video Platform

The final video platform was a Viewpoint bicycle with Glidecam^{TM} placed on a vertical mast added to the bike's forward boom (Figure 4). The handle of the Glidecam^{TM} slipped over the vertical mast and rested on foam shock absorbing material. This modification had several advantages over a hand held camera. The mast made it easier for the videographer to stabilize the camera, particularly through curves. It also helped the videographer execute camera panning maneuvers along the roadways and at intersections. The shock absorption material was chosen to dampen, but not eliminate, the vibration experienced by cyclists on rougher roads. The final length of the camera mast was chosen to approximate the height of an average bicyclist's eye (*7*). A digital mini-cam with an external microphone was used to provide high quality image and sound with a less conspicuous and cumbersome camera setup (Figure 5).

Figure 4. Videotaping using steady-cam unit mounted on a Viewpoint bicycle (testing)

Figure 5. Video taping facilities

A final filming technique modification was an increase in speed over that used in the preliminary testing. The video clips shot for the initial test were filmed at approximately the fiftieth percentile for bicyclists' speeds (*7*), about 17 kilometers per hour (10 – 11 miles per hour) when traveling at speed. This speed was chosen because it was anticipated that the average cyclist would perceive this as a "normal" speed for bicycling. Responses from the testing revealed those viewing the video felt the speed was too low. Consequently, the speed was raised to 22 kilometers per hour (13 - 14 mph) to represent approximately the eighty-fifth percentile speed for bicyclists.

RIDE FOR SCIENCE 2005

The *Ride for Science 2005*, a research event sponsored by FDOT District 7, was held in Tampa, Florida on Saturday, November 12, 2005. The event captured how arterial roadways accommodated bicyclists by eliciting their perceived level of safety, comfort, and travel efficiency (*i.e.*, delay) provided by the bicycling environment. During the event, participants completed two primary activities: (1) they experienced a video simulation and (2) they rode a marked course through the surrounding metropolitan area. In the process, individuals rated the varying geometric and operational environments on a pseudo-academic ("A" to "F," representing "best" to "worst") scale.

Participants

The study team recruited volunteers through a broad media outreach to participate in this data collection event. The researchers solicited participation from all types of individuals ranging from recreational cyclists, to high-end cyclists to those who use bicycles as their sole means of transportation. Participants completed registration forms, either in advance or on the day of the event. The registration forms generated background information about the participants – age, gender, years living in the metro area, and miles ridden per week for various purposes.

VIDEO SIMULATION

As stated previously, the video simulation in conjunction with the real-time field data collection event had two primary purposes: to expand the range of bicycling conditions beyond what the course provided and to calibrate the video simulation to physical reality. Accordingly, a number of arterials from the *Ride for Science* course were videotaped during weekday rush hour conditions. Additionally, sections of arterial roadways with on-street parking and sections with heavy truck volumes were videotaped and included in the study. Through the use of video simulation, participants would be able to view and rate complex roadways with high traffic volumes and numerous conflicts that would have possessed a higher degree of risk for participants than what they experienced on the riding course. To calibrate the video simulation to reality, some of the roadway sections were filmed on a Saturday morning when traffic conditions shown in the video coincided with those on the *Ride for Science* course itself.

Creation of the Video

Videotaping was performed with the camera configuration described above several weeks in advance of the actual event. To ensure consistent filming which reflects typical bicyclists' scanning behavior, a protocol was developed, tested, and employed by the researchers and videographer. The camera was panned at intersections and intermittently along the midblock sections of roadway. When not panning, the video shot was directed at the roadway ahead in the right-center of the frame to focus on the roadway and capture driveway conditions while not focusing on objects outside the right of way.

All traffic laws were obeyed during the filming of the roadway sections. The researchers considered this important as the intent of this project was to obtain cyclists' feedback on the roadway when used as intended. This meant the bicycle was ridden near the right side of the roadway, and positioned in the proper lane at intersections. The cyclist obeyed all traffic signals to ensure any impact from signal delay would be captured in the video.

The resulting video used during the event contained eleven (11) arterial roadway sections, with a running time of approximately forty-seven (47) minutes. The arrival at all videoed intersections was random relative to the traffic signal to ensure that the associated delay was also random.

Video simulation transitions were carefully designed to allow participants to finish their assessment of the arterial segment and circle a grade on a scorecard before focusing their attention on the subsequent video clip.

Sound Calibration

Because the video simulation was intended to both accurately reflect in-street riding conditions as closely as possible and to be used in other studies throughout the United States, the sound level of the video simulation was indexed to the physical environment. The week of the event, decibel readings were recorded along several arterials. Minimum and maximum values were taken in the field, as well as an average reading during which the parallel roadway traffic was moving. Maximum sound, usually representing a closely passing tractor trailer, was generally associated with a decibel level in the low 80s, with minimum levels in the high 50s and average levels in the high 60s. During the video simulation event, the audio levels were set to these measurements by adjusting the volume on the speakers.

Video Room Setup and Equipment

A room was set up to exact standards to ensure a consistent video simulation environment for all participants and to allow future accurate calibration of the video simulation data to bicycling course data (Figure 6). Participants, seated in four rows of chairs, watched the video as it was projected onto a screen from a projector situated on a table. High quality computer speakers and sub-woofers were used to provide sound. Two video projection setups were used simultaneously, with the audiences facing opposite directions. Each of the projections were of the same size, 62 inches (1.6 m) measured diagonally, and were projected using similar projectors.

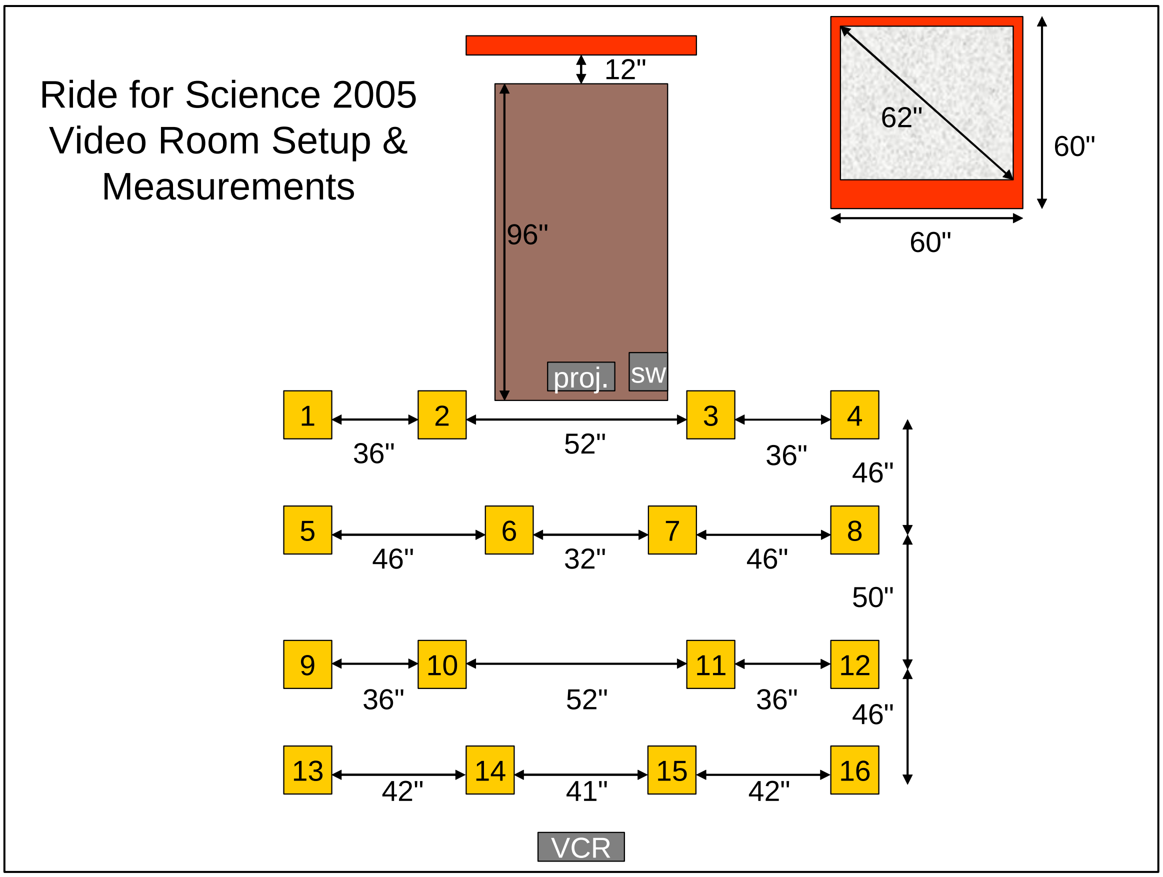

Figure 6. Video simulation room setup and measurements (single setup)

Given the length of the video (47 minutes) and the maximum number of participants expected in one hour (36), it was determined that two setups, each with sixteen chairs arranged into four rows, would allow for sufficient capacity. Within the rows, the chairs were arranged so that all viewers could see the screen without any obstructions from other seated participants. Participants were instructed not to move chairs, and proctors were available to restore chairs to their original positions when necessary.

Viewing Procedure

Participants were briefed by a proctor stationed outside the building regarding the viewing procedure, assessment of arterials, and the corresponding grading. A complete copy of the briefing script is presented in Appendix A. They were handed their scorecards showing a number for each video simulation segment and the letters “A” through “F” for them to circle after viewing each segment. An example scorecard is depicted in Appendix B. Each scorecard contained a written summary of the instructions on the back in addition to the grading form on the front. To ensure that everyone was fully briefed, individuals arriving in the middle of a briefing were instructed to wait for the next one.

After being briefed, participants were directed to the video viewing room (Figure 7), where they were met by a room proctor. Because the video was constantly running (a second rewound tape was always available to replace the running one), the first facility section viewed and graded by a given individual was random. To allow testing for any potential scoring fatigue bias (grading differently later toward the end of the video than at the beginning) based on point of arrival, participants were asked to circle the number of their first viewed section. After they had graded each section, participants checked out with the room proctor, who collected their scorecards and directed them to the bicycling course briefing station to complete the remainder of the event.

Figure 7. Video simulation room

THE ROADWAY COURSE

The *Ride for Science 2005* course included a broad spectrum of arterial- and collector-type roadways typically found in U.S. metropolitan areas. Held in the areas around the University of South Florida and Busch Gardens, the course wound through a large variety of land uses typical of North American metropolitan areas. The course included roadways ranging from two to six lanes; with and without bike lanes or shoulders; and with varying traffic speeds, vehicle types, driveway densities, and pavement conditions. The course was designed to allow participants to experience a variety of roadway facility configurations and traffic conditions. Approximately 20 miles (mi) (32 kilometers (km)) in length, the course included 12 roadway sections (Figure 8). The beginning and end points of each section were identified by fluorescent yellow signs. The sections ranged from 0.3 mi (0.5 km) to 1.5 mi (2.4 km). The number of signalized intersections along each section ranged from 0 to 3, and the number of unsignalized intersections, from 0 to 10. Two sections had the fewest driveways (two each), and one section had the most (37). Several intersections along the course had crossing distances exceeding 100 ft (31 m).

On the day of the event, vehicle traffic volume and speed were recorded in 15-minute intervals for the roadway sections along the bicycling course, for traffic moving in the same direction as the bicyclists. Traffic volumes ranged from 5 to 320 vehicles for the 15-minute periods. The number of lanes on the cross streets ranged from two to six, divided and undivided. Posted speeds ranged from 30 to 50 mi/h (49 to 81 km/h). The course included sections with curb and gutter and other sections with open shoulders. The width of the outside motor vehicle lanes ranged from 10.5 to 15 feet (3.2 to 4.6 m). Striped bike lanes and paved shoulders ranged from non-existent to 9 feet (2.7 m) wide.

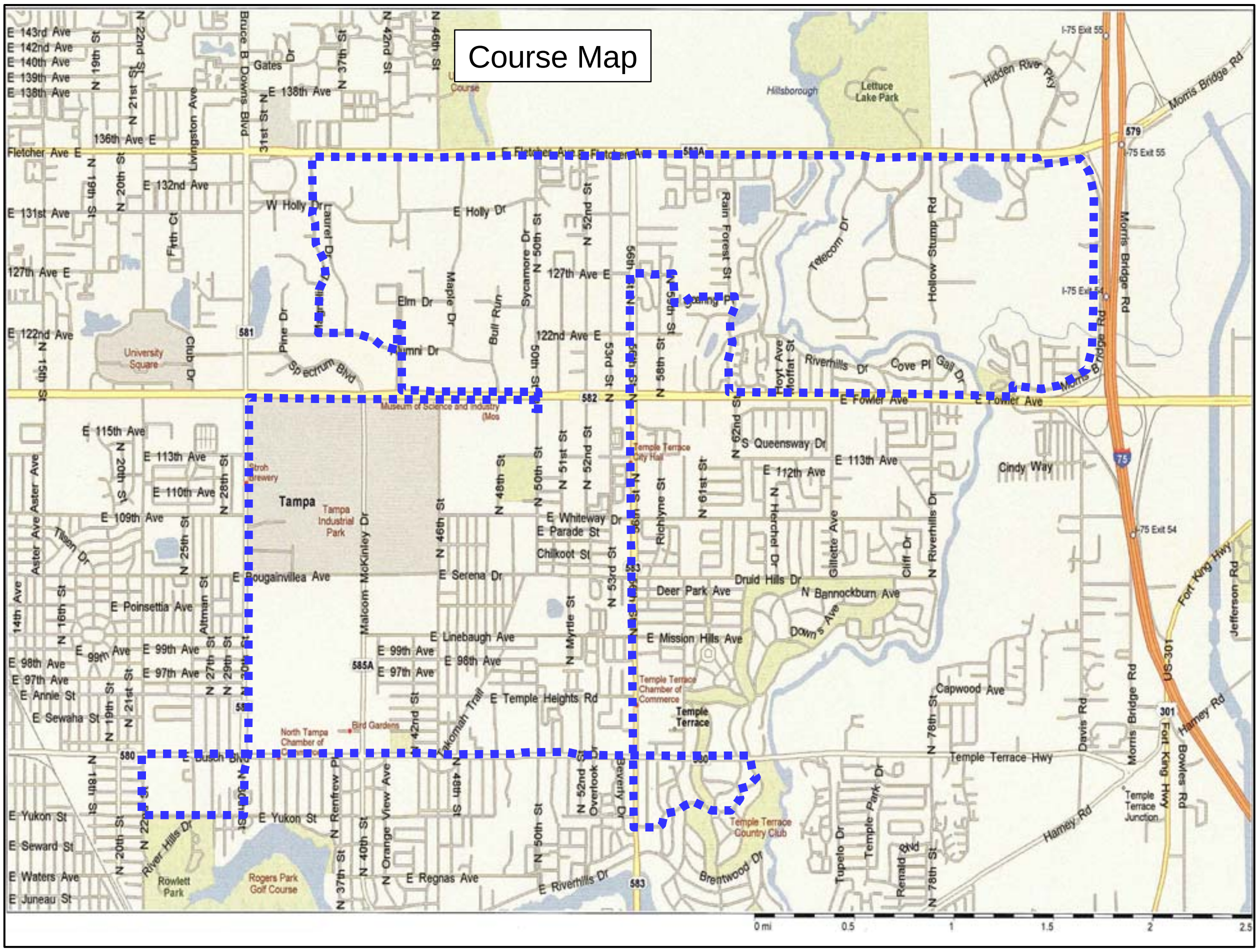

Figure 8. Ride for Science course map

Data Collection

Participants were provided scorecards to use during their ride. On the top of each scorecard, each arterial section number was listed followed by the letters, A through F. A map with the numbered roadway sections was shown at the bottom of the scorecard. An example course scorecard is depicted in Appendix C. At a pre-ride briefing, participants were directed to grade each section immediately after riding that section. Specifically, they were told to “circle the letter grade that best describes how well you feel each section serves your needs as a bicyclist.” The briefing script is presented in Appendix D.

Participants were told to obey the traffic signals when crossing the intersections. Obedience to traffic control devices was considered critical to the relevance of this research. As the intent of the project was to determine how geometric and operational characteristics of signalized arterials/roadways (including intersections) impacted the bicyclists' perceptions, it was important that the participants experienced each intersection as it was designed to operate.

Tube counters on the roadway sections recorded volume, speed, and class of motor vehicles on fifteen-minute intervals throughout the course. Five time keepers along the course recorded the time each participant passed the time keepers' stations. These counts and time checks allowed the researchers to determine what the specific traffic conditions were on the roadways as each cyclist rode the sections.

Event Day

The day of the event was mostly sunny. Early morning temperatures around 60 degrees Fahrenheit (16 degrees Celsius) quickly warmed to around 80 degrees Fahrenheit (27 degrees Celsius) by early afternoon. Most participants first went through the video simulation data collection stage and then went to the course briefing before riding the course. One out of four participants rode the course prior to watching the video. The first participant started riding the course shortly after 7:00 AM; the last participant finished riding the course shortly after 2:00 PM.

The event personnel included staff from Sprinkle Consulting, Inc., FDOT, the University of South Florida (USF), the USF Student Chapter of ITE, and a temporary employment agency. The event personnel ensured temporally spaced starts, controlled individual bicycling and scoring among participants, and made sure that participants kept current completed response cards.

Because there could be no attempt to "control" traffic or influence bicyclist or motorist behavior through placement of law enforcement officials, and because the bicyclists rode on regular roadways with motor vehicles, there was a degree of risk involved. This was explained to the participants in advance through the registration forms and during a pre-ride briefing session. Participants were also assured that they could stop at any time along the route, contact any one of the proctors along the course, and be picked up by a support vehicle if they were uncomfortable and did not wish to continue their ride. In addition, participants were reminded through the registration form and the pre-ride briefing that they were required to wear helmets at all times while on the course.

A participant's grades were valid only if they were the participant's own grades, reflecting his/her own perceptions of the roadway. Therefore, it was necessary that each participant ride and grade individually, without discussing his/her perceptions with other participants. A starter ensured that participants started at ninety-second intervals. Because of differences in riding speeds, some participants were likely to catch up to others. Therefore, the time keepers and proctors (see above) briefly detained participants at various points as necessary to maintain ninety-second headways.

DATA ANALYSIS – COURSE

Participant Demographics

The course participants provided demographic data including age, gender, years living in Tampa, bicycling trip purposes (work, shopping, school, etc.), and riding experience (*i.e.*, miles ridden per week). Figures 9-12 show the participants' age, gender, riding experience, and percent weekly mileage by trip purpose respectively.

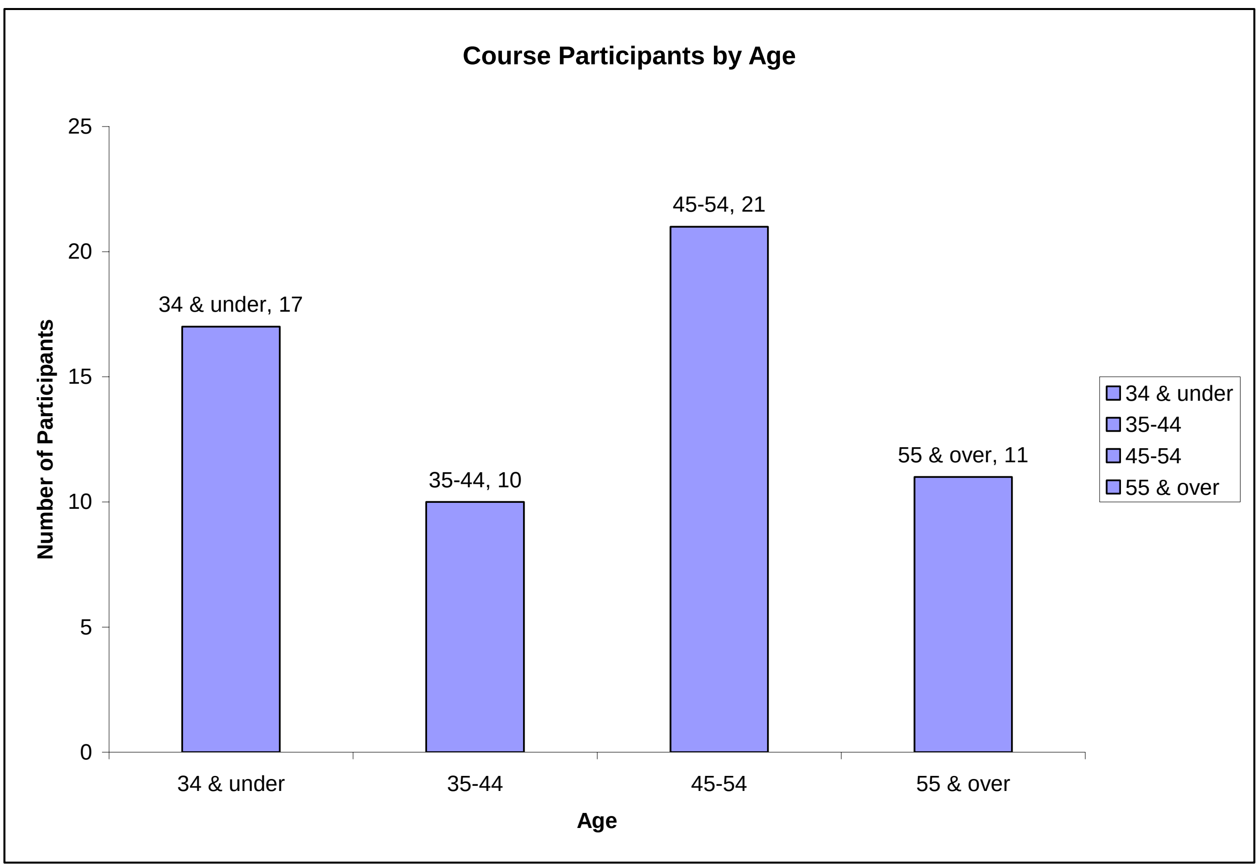

Figure 9. Course participants by age

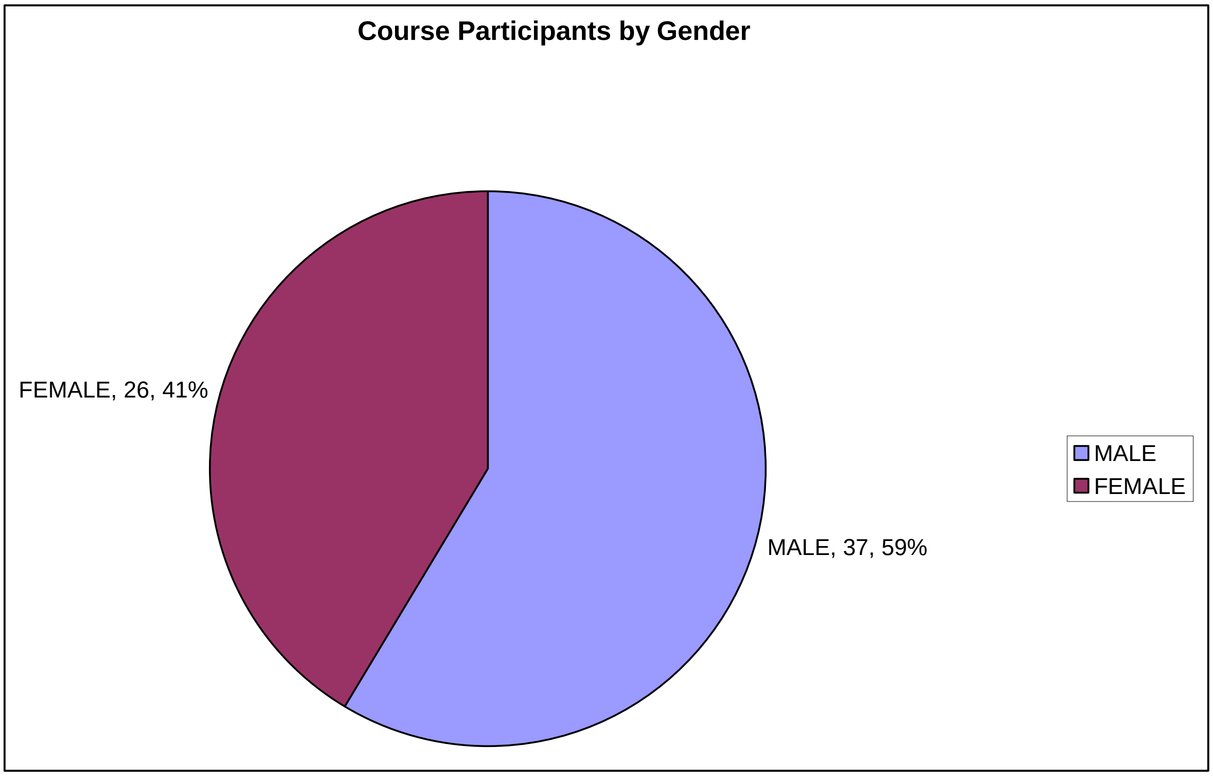

Figure 10. Course participants by gender

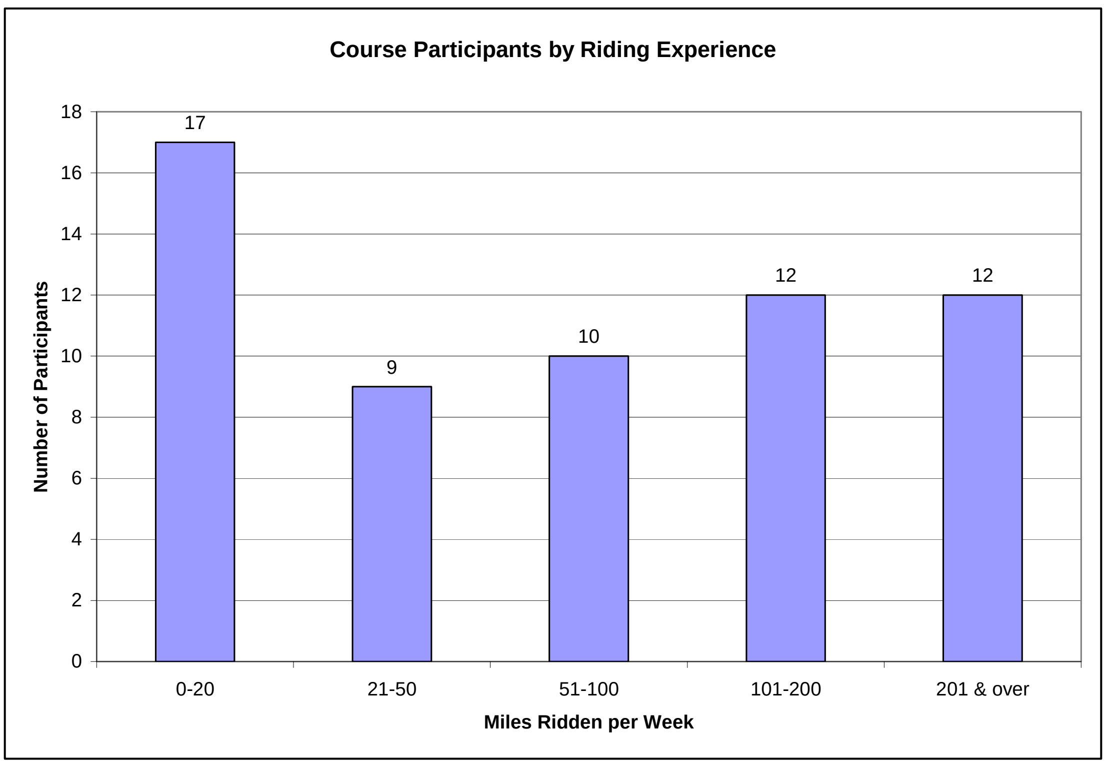

Figure 11. Course participants by riding experience

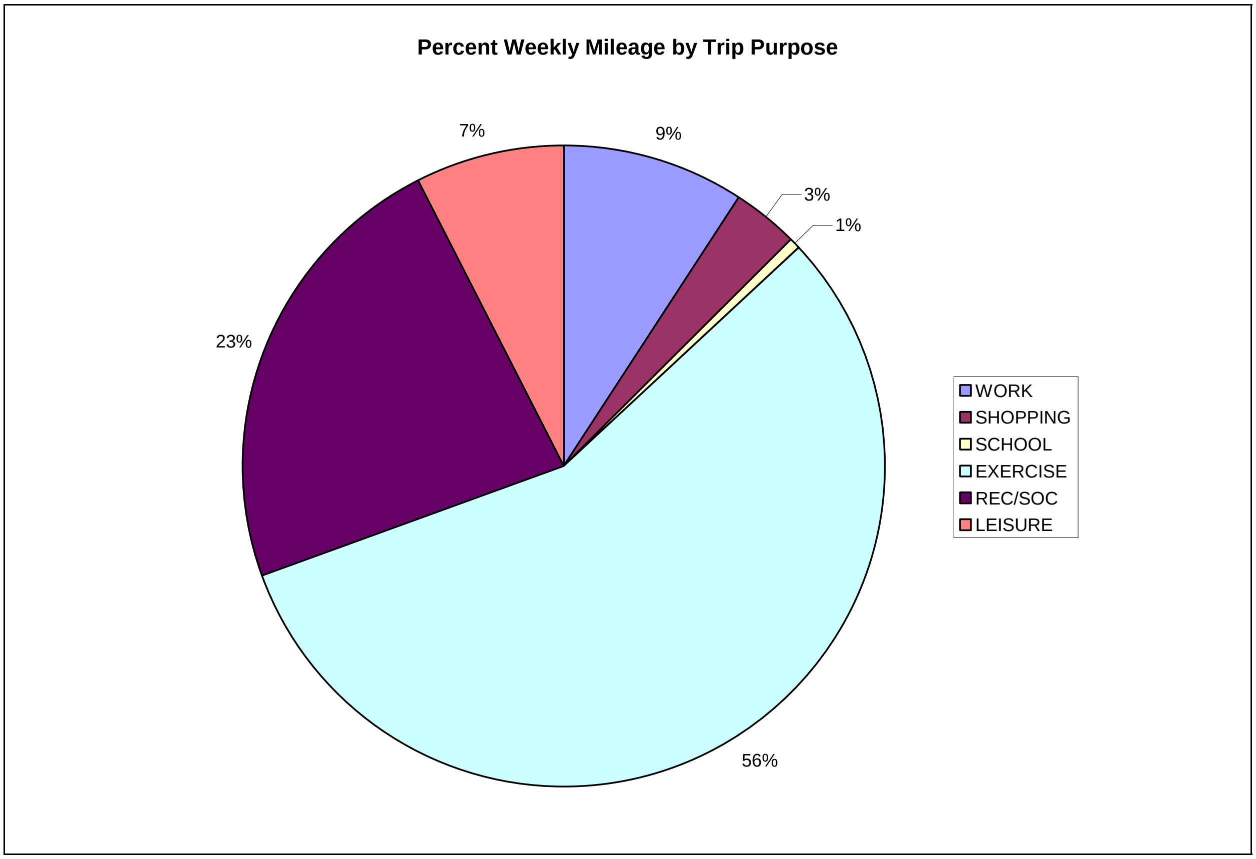

Figure 12. Percent weekly mileage by trip purpose

Course Grades

The course participants graded a total of 703 sections. This number represents the number of unique sections on the course, 12, multiplied by the number of participants, 63, minus sections that were not graded because some participants did not grade all 12 sections. Figure 13 shows the number of sections that received each grade.

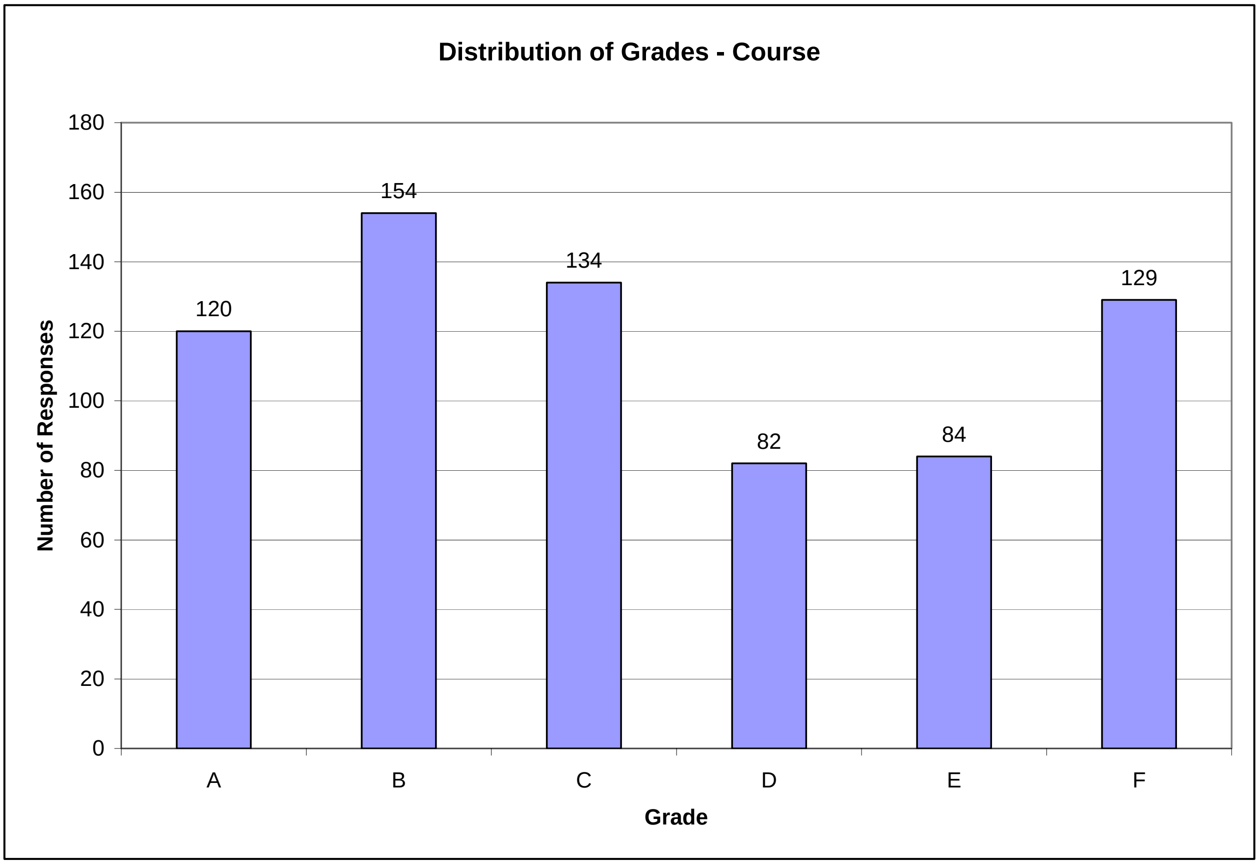

Figure 13. Course grade distribution

For analysis purposes, the grades were converted to numerical values: A = 1, B = 2, C = 3, D = 4, E = 5, and F = 6. A lower numerical value corresponds to a better grade, and a higher numerical value corresponds to a worse grade.

Figure 14 shows the average grade for each section. Sections 1 and 2 received the best grade (1.6, corresponding to an LOS of “B”). Both of these sections are located on the University of South Florida campus, included bicycle lanes, and had relatively light traffic volumes during the event (a Saturday, so classes were not in session). Section 10 received the worst grade (5.3, which corresponds to an LOS of “E”). This section is located on Busch Boulevard, which has no bicycle lanes or paved shoulders, and had high traffic volumes during the event.

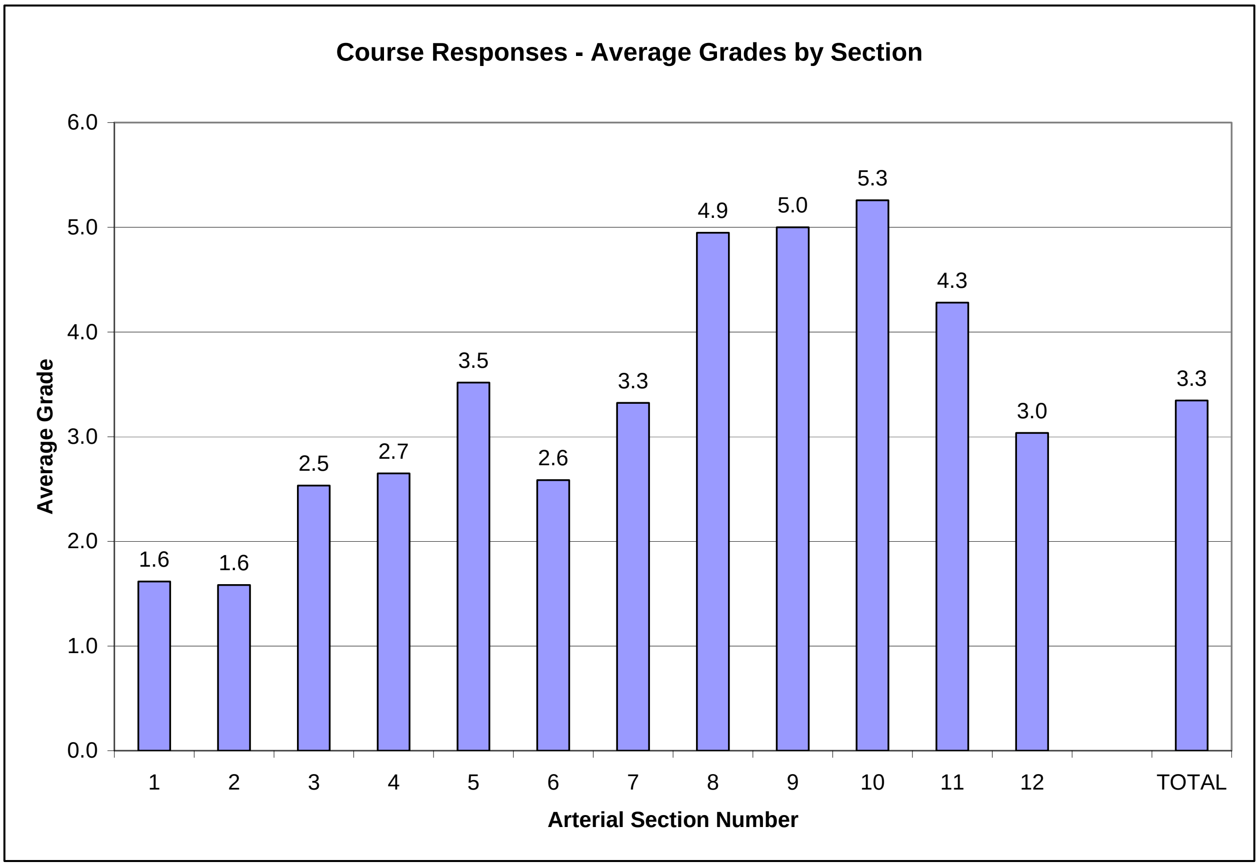

Figure 14. Average course grades by section

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Overall, participants who were older than 45 years graded the course more harshly than younger participants (3.4 vs. 3.3) (Figure 15, see "Total"). This difference was not statistically significant at the 0.05 level.

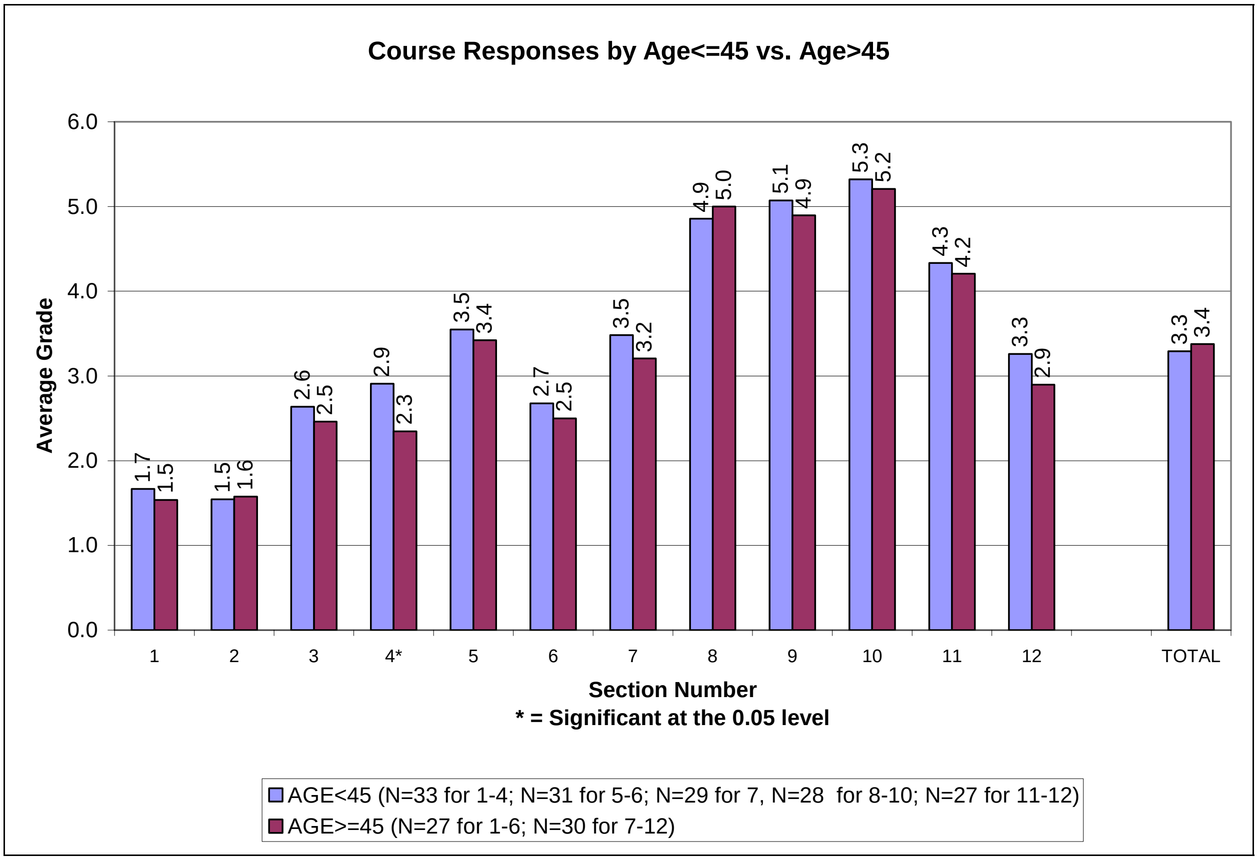

Figure 15. Course grades by age

At the 0.05 significance level, females graded more harshly overall than males (3.5 vs. 3.2) (Figure 16, see “Total”).

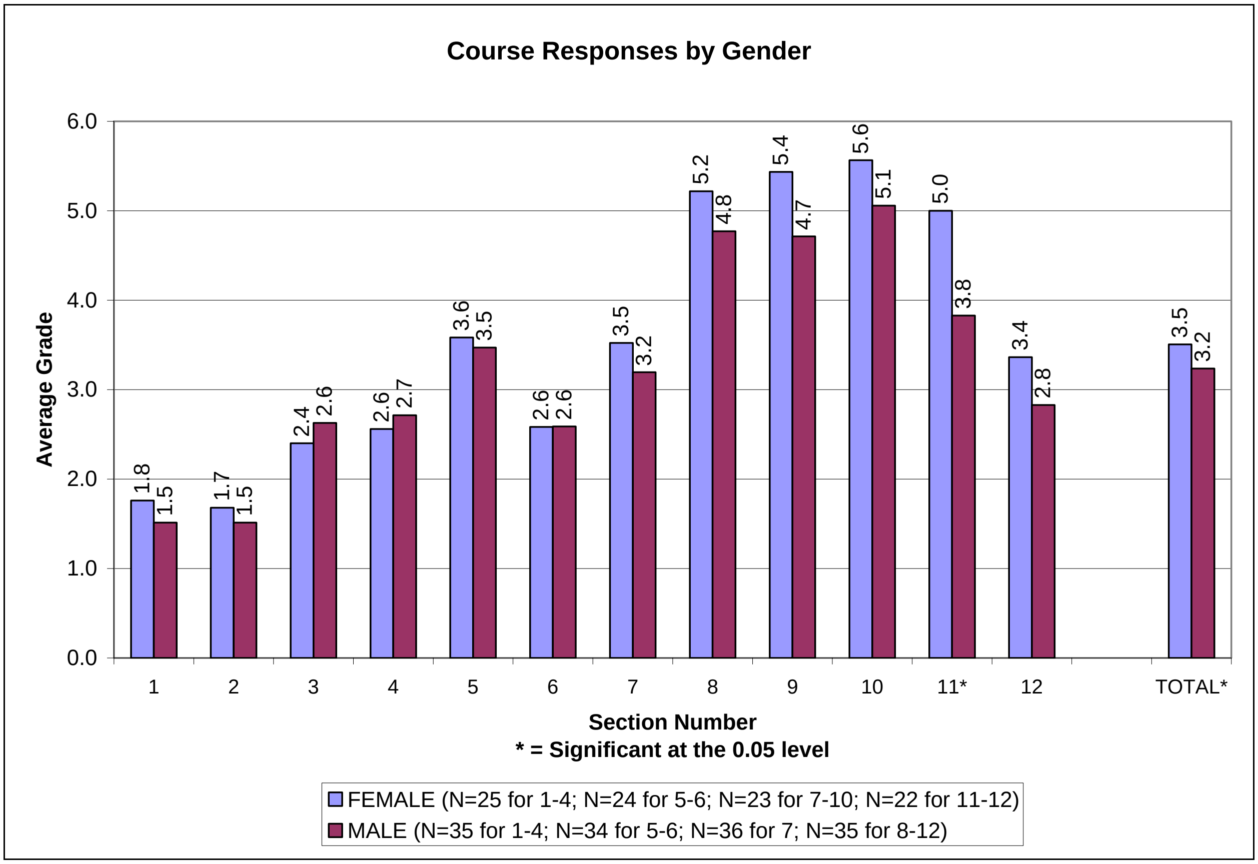

Figure 16. Course grades by gender

Based on riding experience (0-20 miles/week vs. 21 miles/week or more), there were no differences in how participants graded overall (3.3 vs. 3.4) (Figure 17, see “Total”).

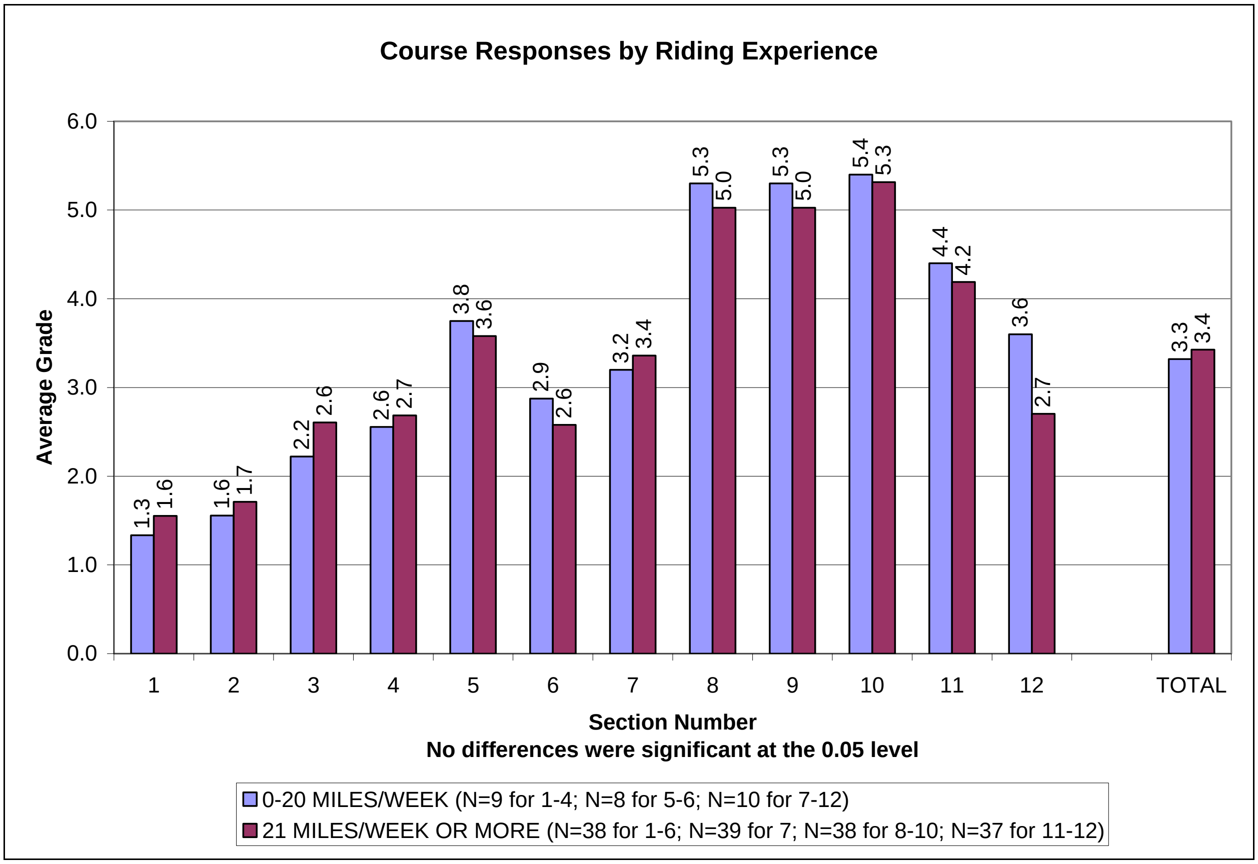

Figure 17. Course grades by riding experience

To test for possible scoring fatigue, some participants were directed to start with Section 7 (“half-on” participants) instead of Section 1 (“normal” participants). The “half-on” participants rode and graded Sections 7-12 and then proceeded to ride and grade Sections 1-6. The lower graph compares the grades of “half-on” and “normal” participants. Three “half-on” participants are not included in the comparison because they graded only Sections 7-12. Overall, the “half-on” participants graded less harshly than the “normal” participants (2.8 vs. 3.4) (Figure 18, see “Total”). This difference was statistically significant at the 0.05 level. In fact, on 11 of the 12 sections, the “half-on” participants graded better, though not all of the differences were significant at the 0.05 level.

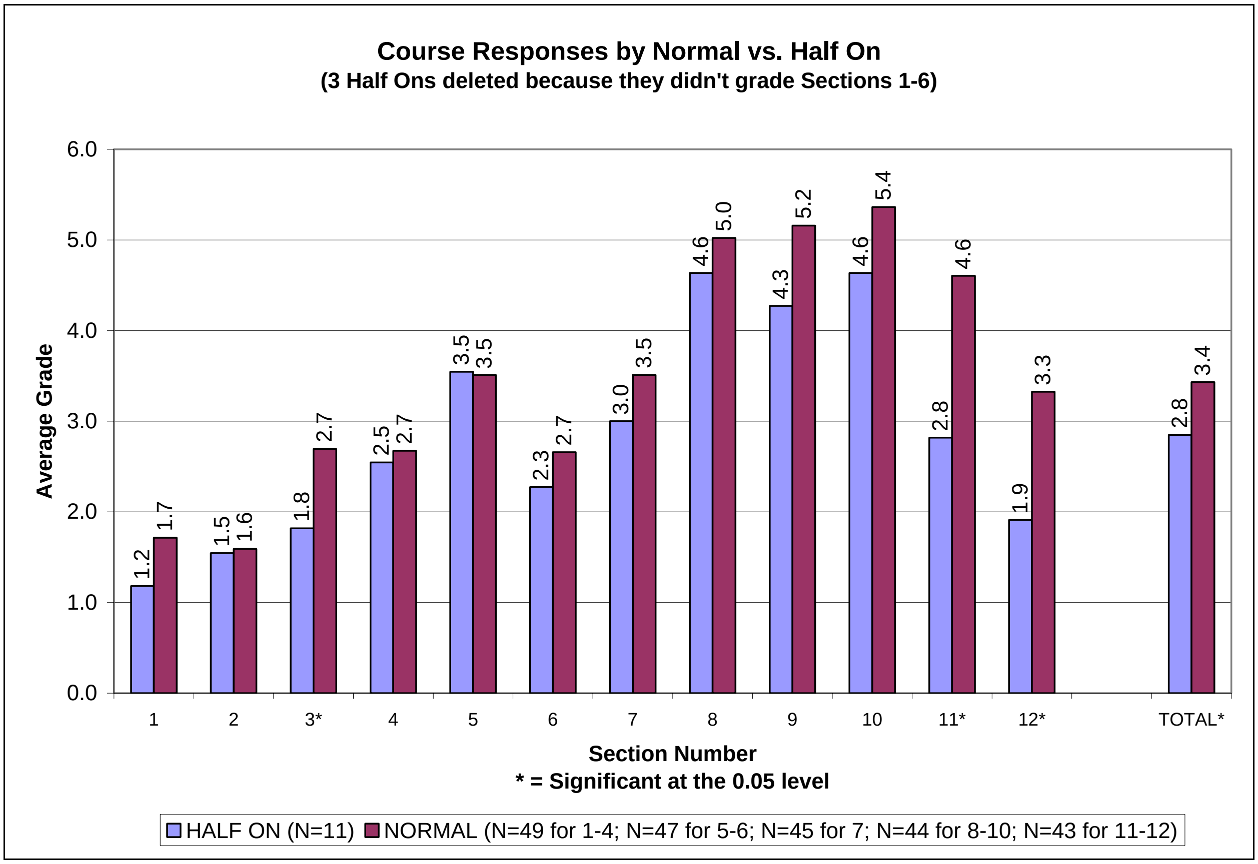

Figure 18. Course grades by normal vs. half on

Most participants watched the video first and then rode the course ("normal" participants), but some participants rode the course first and then watched the video ("reverse" participants). This next figure shows that the "normal" and "reverse" participants did not grade differently at the 0.05 level (3.4 vs. 3.2) (Figure 19, see "Total").

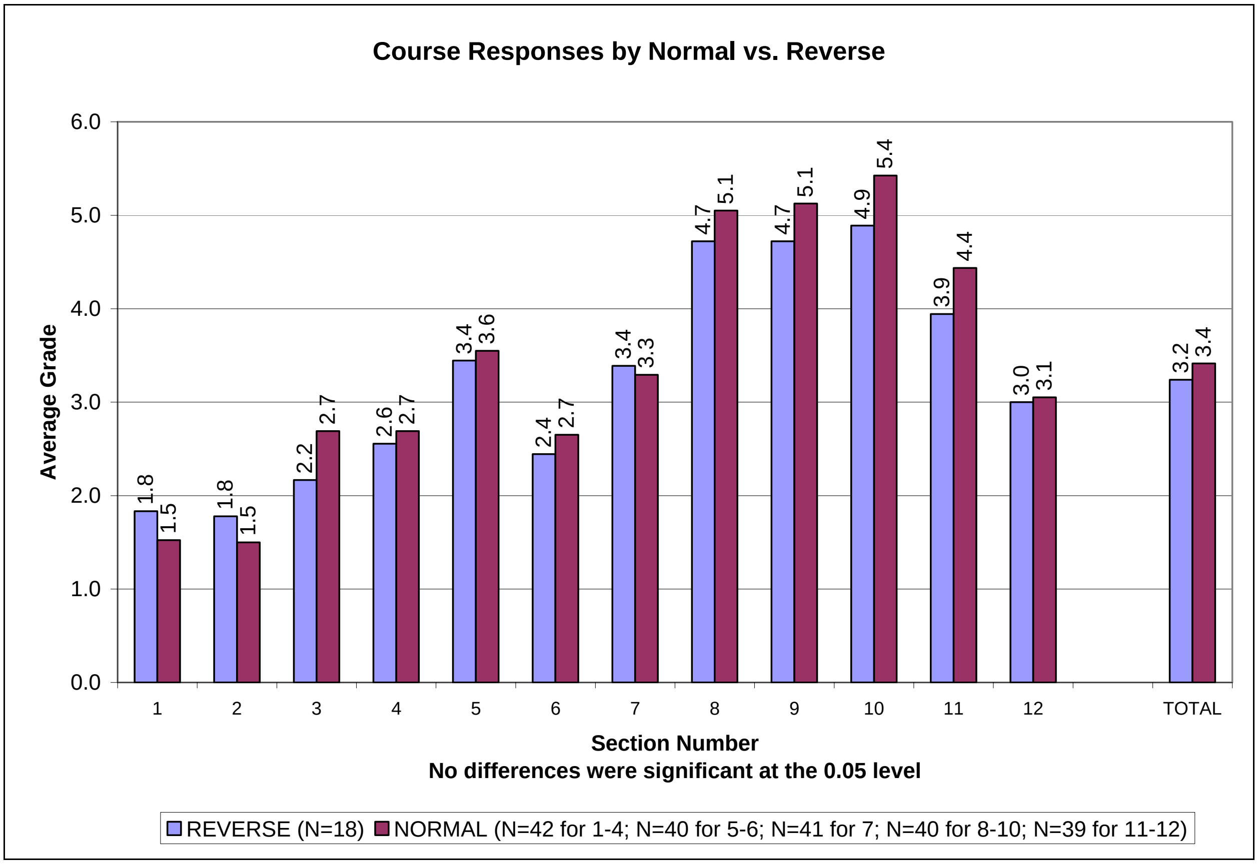

Figure 19. Course grades by normal vs. reverse

Course Debriefing

"Normal" participants were debriefed after they finished riding the course. The course debriefer looked at each participant's scorecard and asked why he/she graded certain sections "A" or "B" and why he/she graded certain sections "E" or "F." Each participant could give up to three answers. Although the participants gave a wide variety of answers, they can be categorized as shown in Figure 20. The most common answers pertained to bike lanes (80 responses), traffic volume (58 responses), roadway condition (42 responses), and accommodation/space (39 responses).

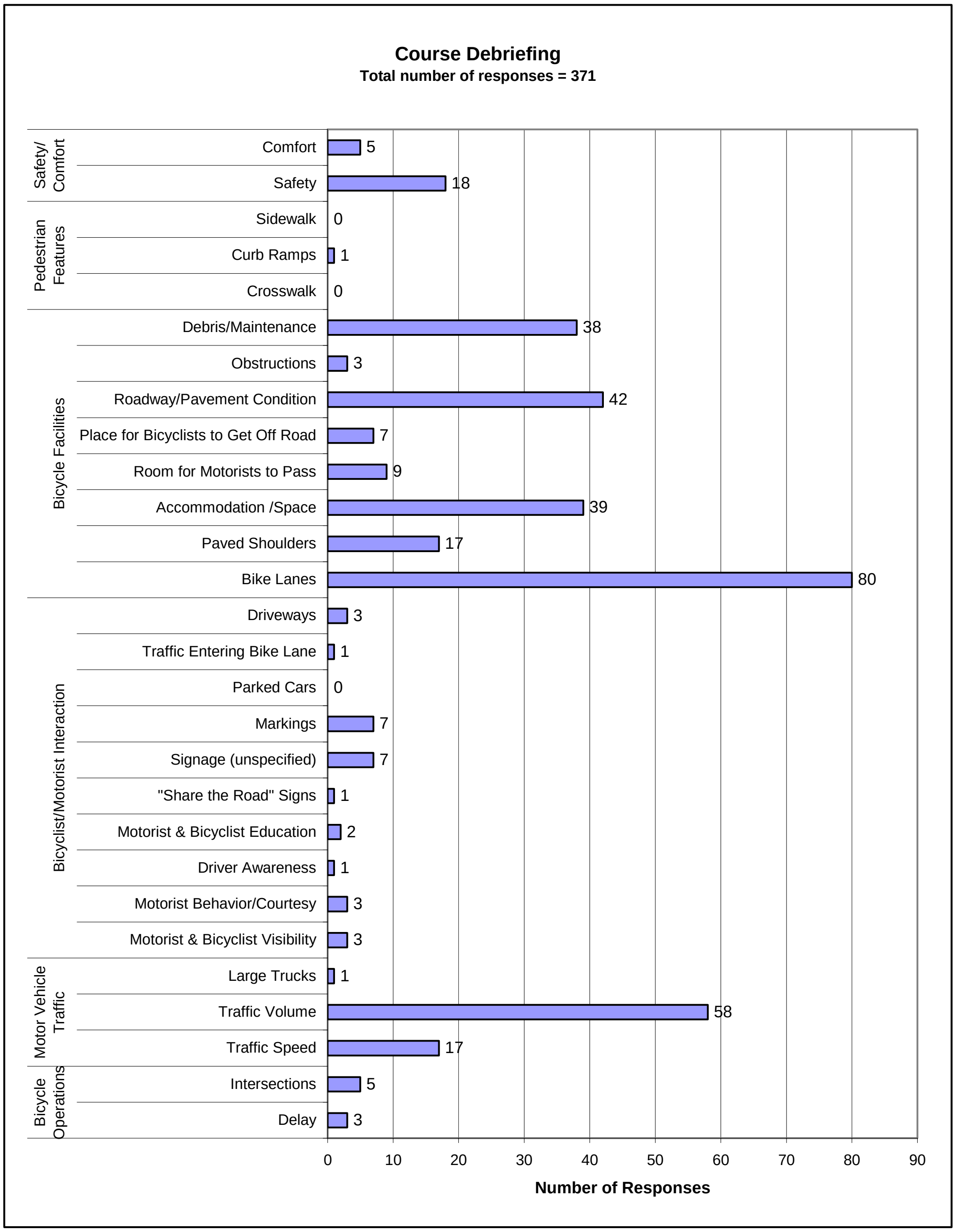

Figure 20. Course debriefing responses

DATA ANALYSIS – VIDEO SIMULATION

Participant Demographics

The seventy-five (75) participants in the video simulation study provided demographic data including age, gender, years living in Tampa, bicycling trip purposes (work, shopping, school, etc.), and riding experience (*i.e.*, miles ridden per week). The participants represented a good cross section of age, gender, and geographic origin. Participants ranged in age from 17 to 71; although minors were prohibited from riding the course, one 17-year-old watched and graded the video (Figure 21).

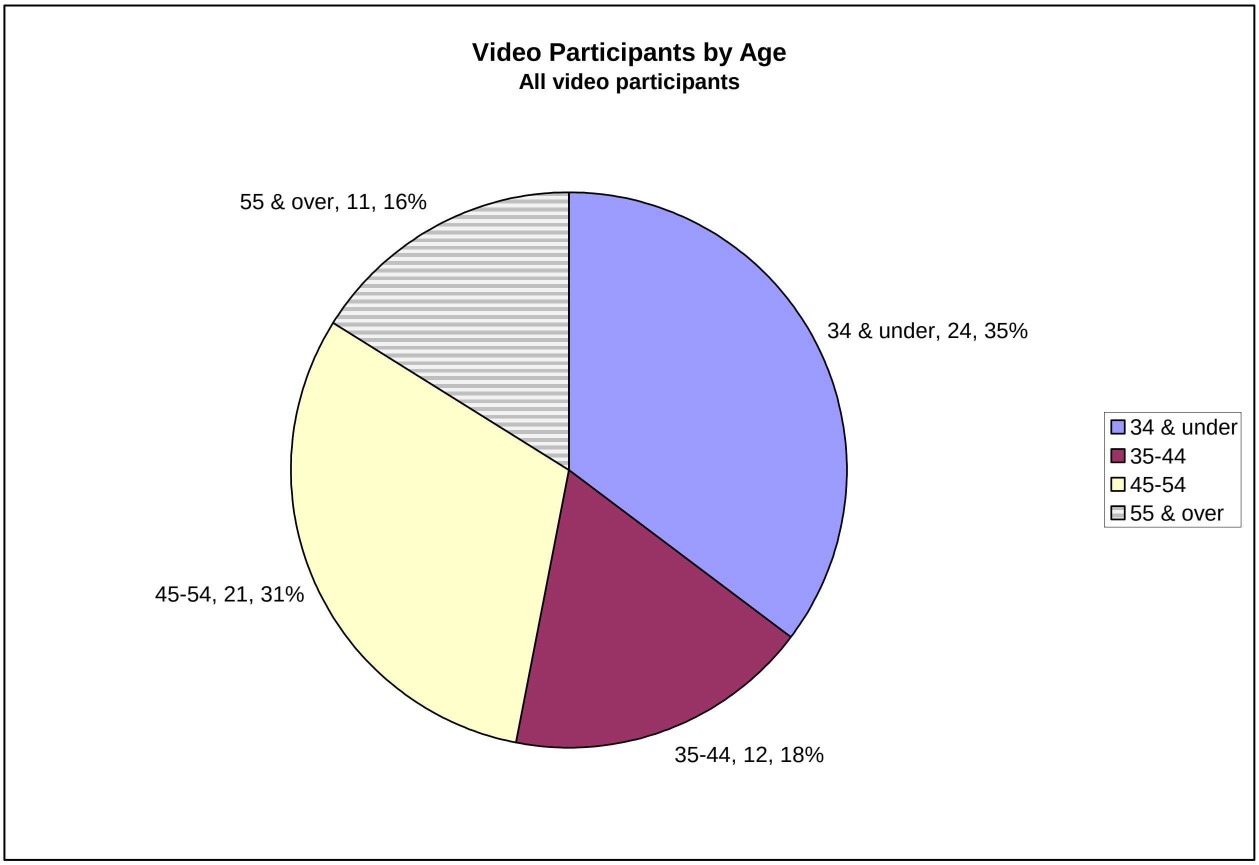

Figure 21. Video participants by age

The gender split of the study was 47 percent females and 53 percent males (Figure 22).

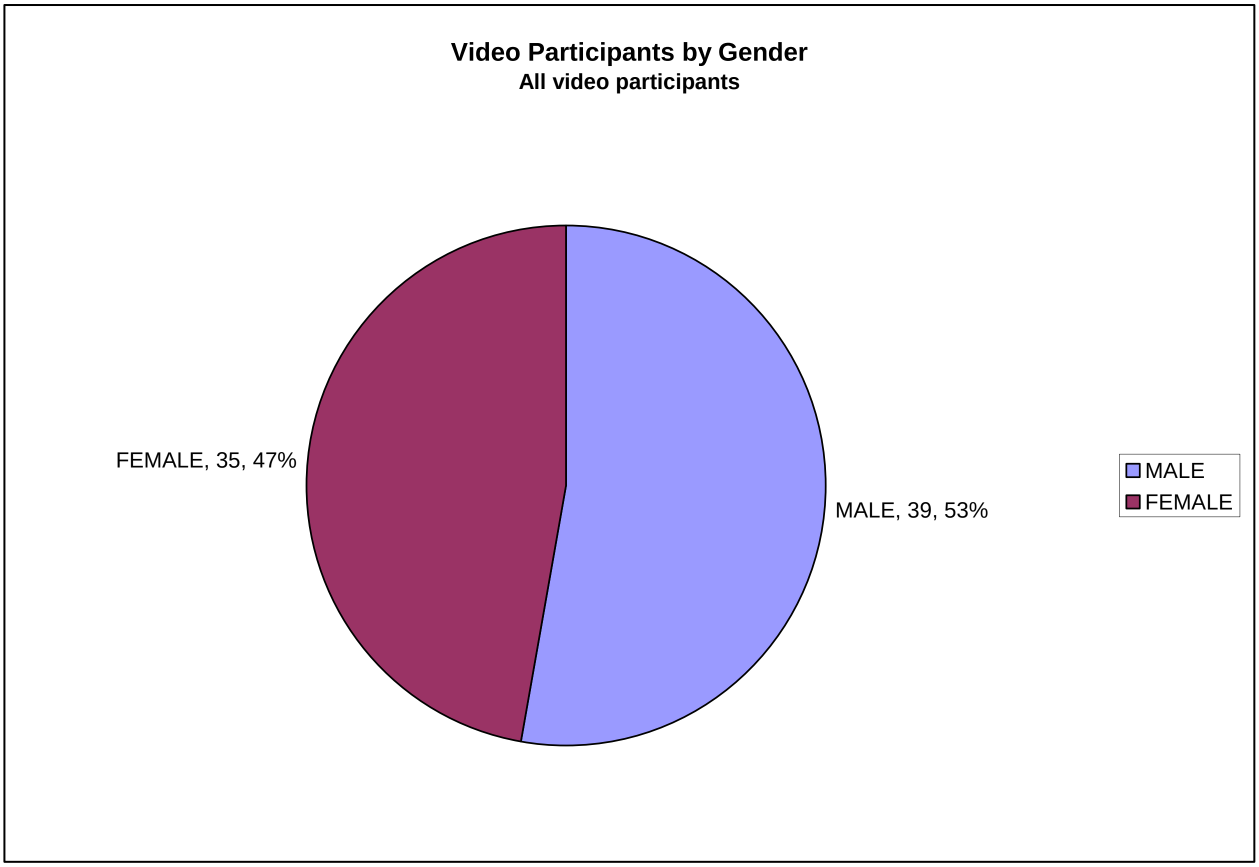

Figure 22. Video participants by gender

Most (63 percent) of participants had lived in areas other than the Tampa region for the majority of their lives.

Video Simulation Grades

The video participants collectively graded a total of 817 sections. This number represents the number of unique sections shown on the video, 11, multiplied by the number of participants, 75, minus sections that were not graded because some participants did not grade all 11 sections. For analysis purposes, the letter grades were converted to numerical scores: A = 1, B = 2, C = 3, D = 4, E = 5, and F = 6. The bar graph shows the number of sections that received each grade (Figure 23).

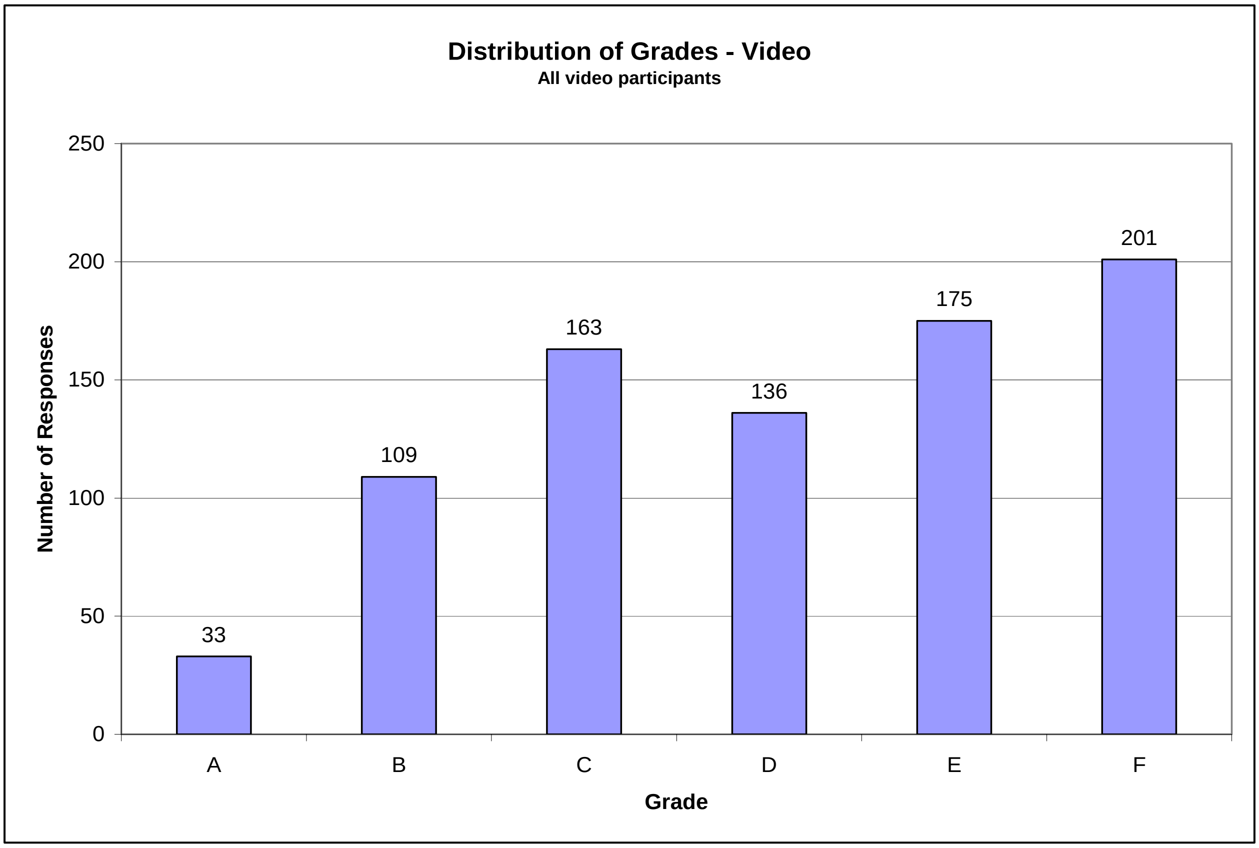

Figure 23. Video grade distribution

The average grade for each section is shown in Figure 24. If one compares these scores to those for the course sections (Figure 13), these grades for the video sections taken as a group appear worse than the grades for the course sections. This is as expected as one purpose of the video simulation was to represent sections with higher volumes, truck traffic, and turning conflicts.

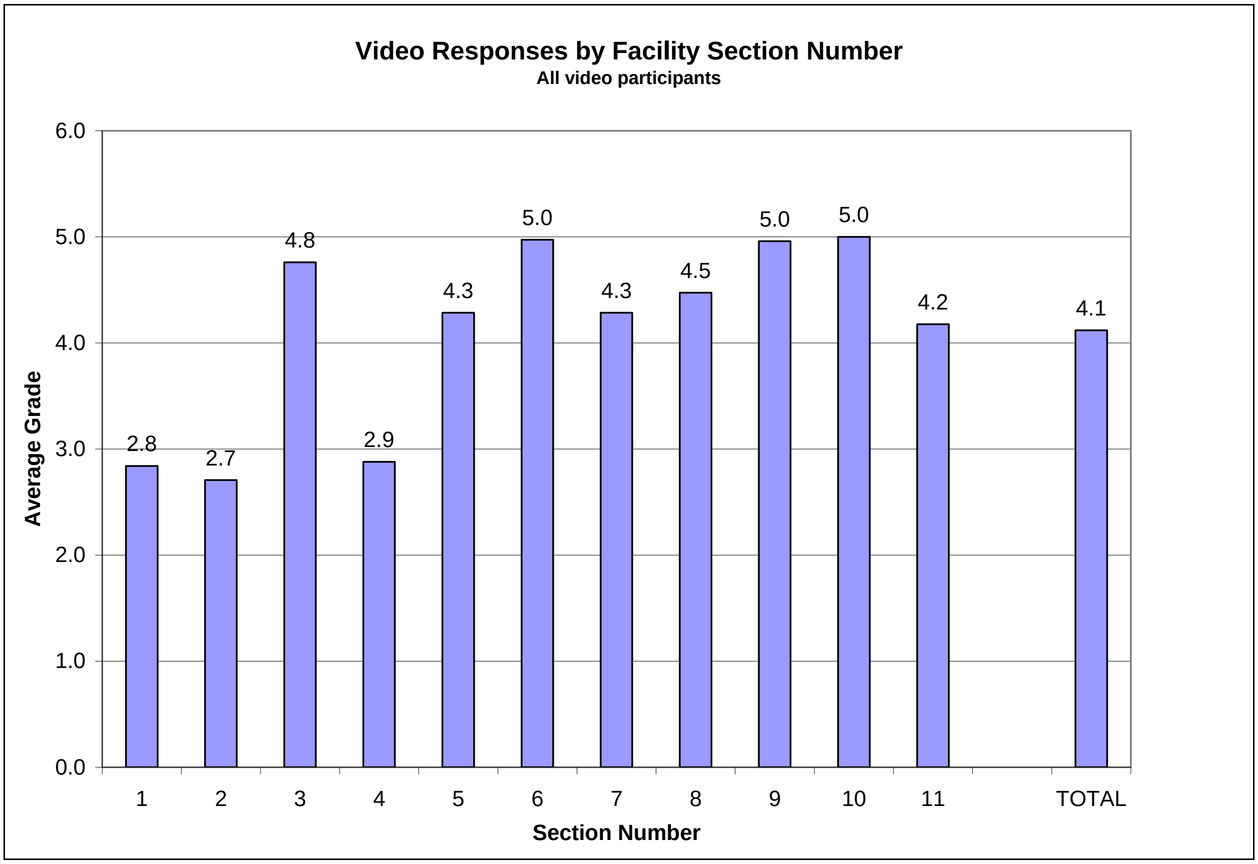

Figure 24. Average video grades by section

Overall, participants who were 45 years or younger graded more severely than older participants (4.1 vs. 4.0) (Figure 25, see "Total"). This difference was not statistically significant at the 0.05 level.

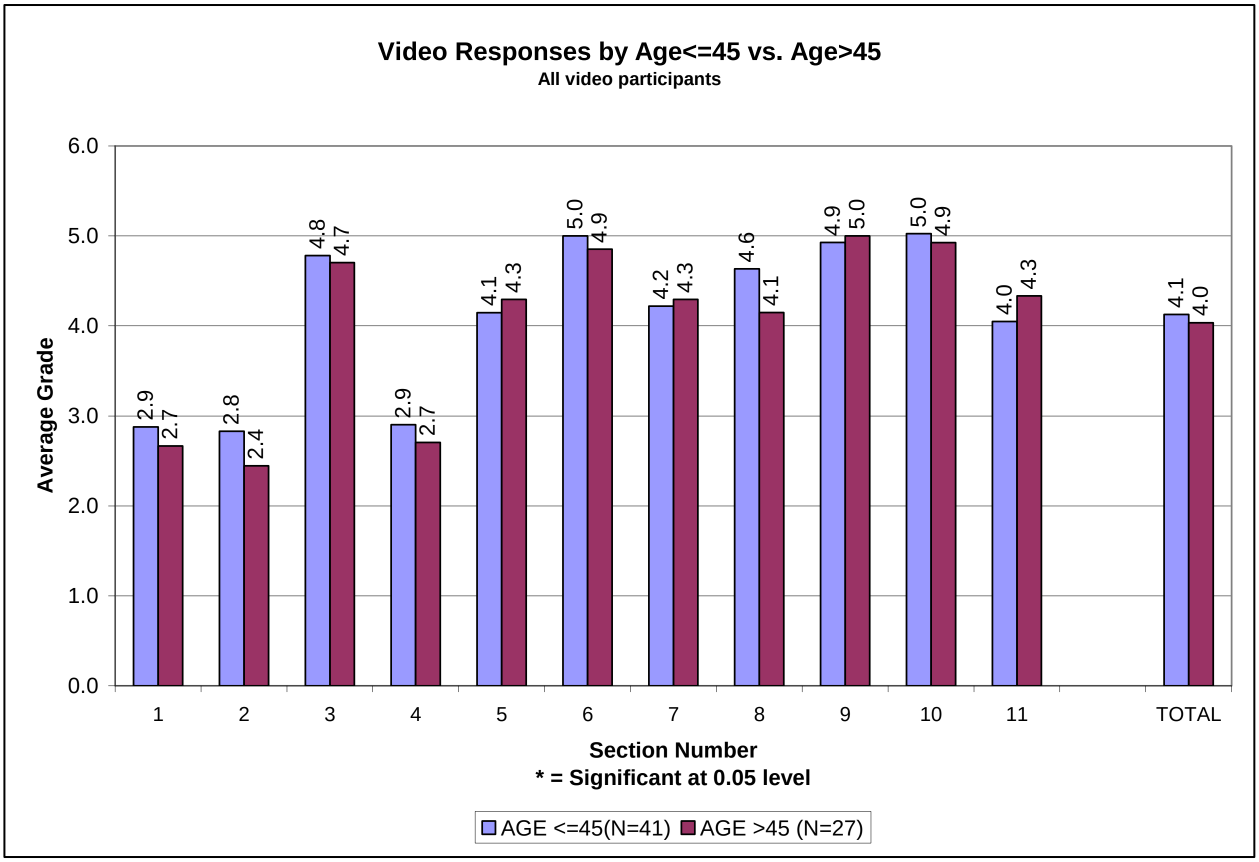

Figure 25. Video grades by age

At the 0.05 significance level, females graded worse overall than males (4.3 vs. 4.0) (Figure 26, see "Total").

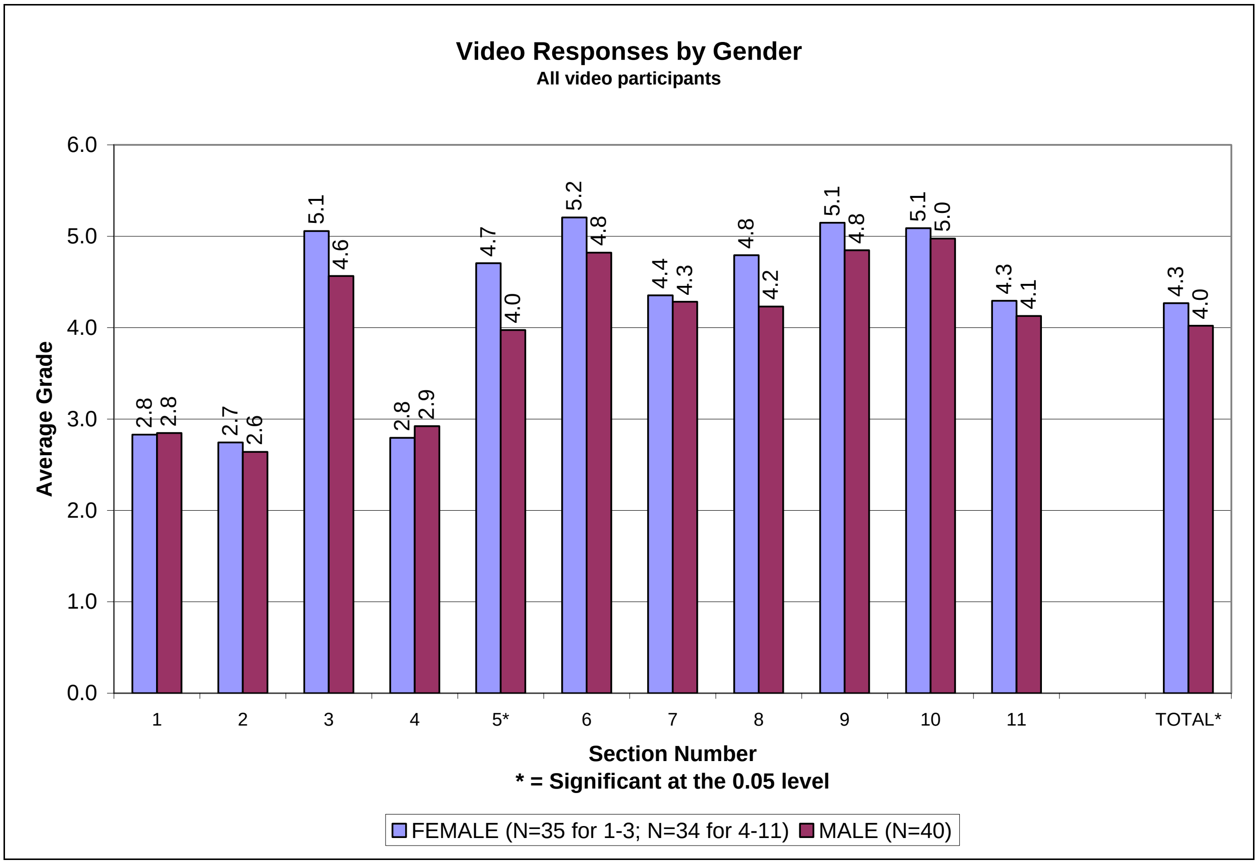

Figure 26. Video grades by gender

As shown, the "video-only" participants graded worse than "course-and-video" participants (4.3 vs. 4.1) (Figure 27, see "Total"). This difference was statistically significant at the 0.05 level. Of the sixteen "video-only" participants, thirteen volunteered to watch and grade the video ("volunteer video" participants).

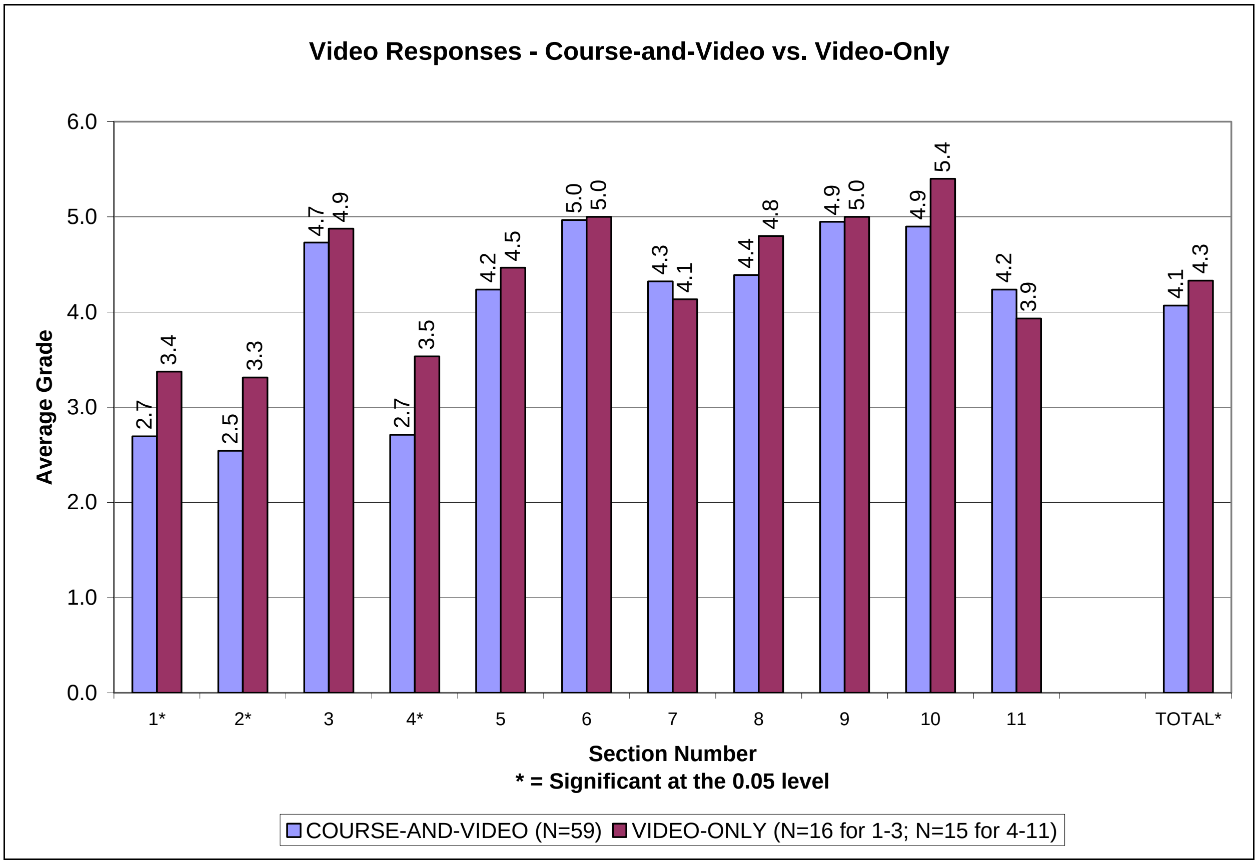

Figure 27. Video grades by course-and-video vs. video-only

The other three had signed up to ride the course but then decided, on the day of the event, not to ride the course (“refused to ride” participants). At the 0.05 significance level, “refused to ride” participants graded worse overall than “volunteer video” participants (5.0 vs. 4.2) (Figure 28, see “Total”). It is important to remember that this comparison involves a small sample size (of three).

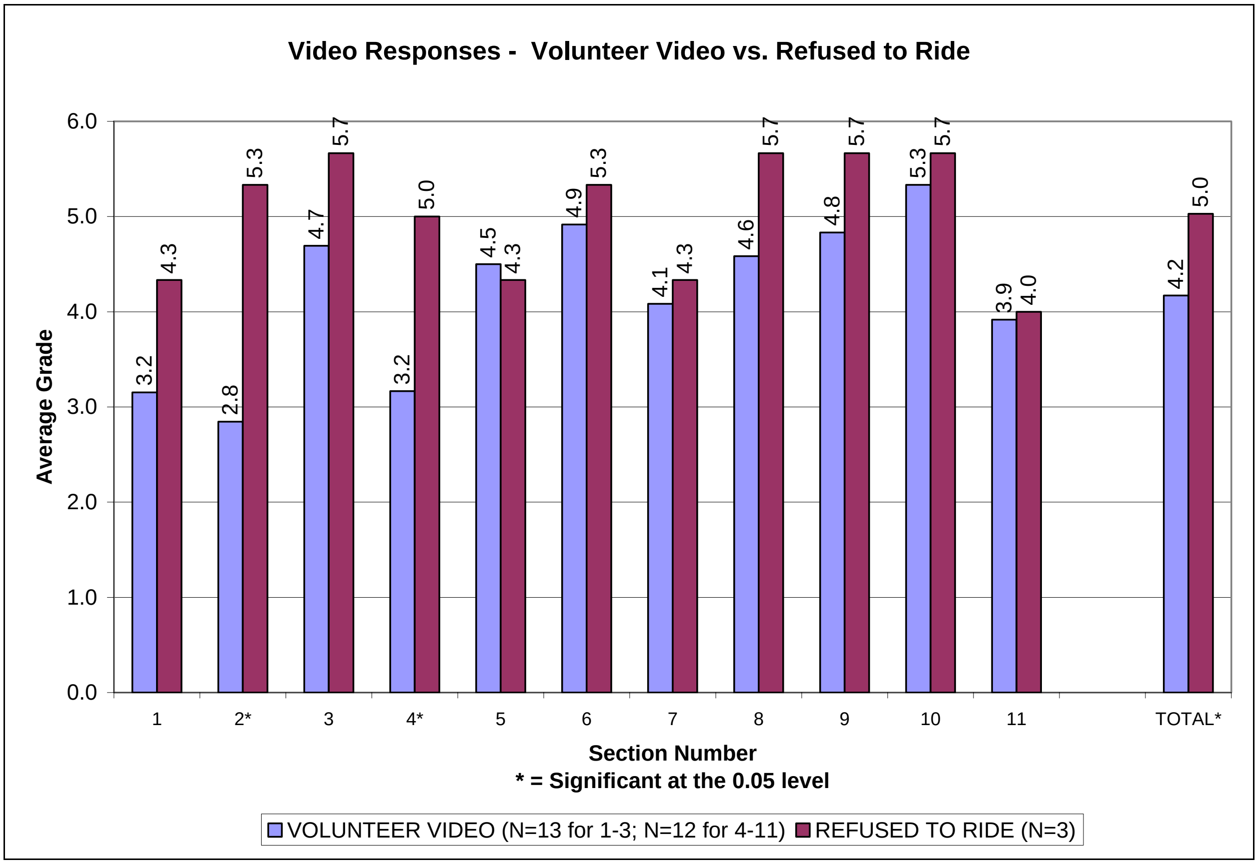

Figure 28. Video grades by volunteer video vs. refused to ride

Video Debriefing

Out of the 59 "course and video" participants, there were 42 participants who watched the video before riding the course. Seventeen "reverse" participants watched the video after riding the course. These "reverse" participants were debriefed after they finished watching the video. The video debriefer looked at each participant's scorecard and asked why he/she graded certain sections "A" or "B" and why he/she graded certain sections "E" or "F." Each participant could give up to three answers. Although the participants gave a wide variety of answers, they can be categorized as shown in Figure 28. The most common answers pertained to bike lanes (20 responses), accommodation/space (14 responses), and traffic volume (14 responses).

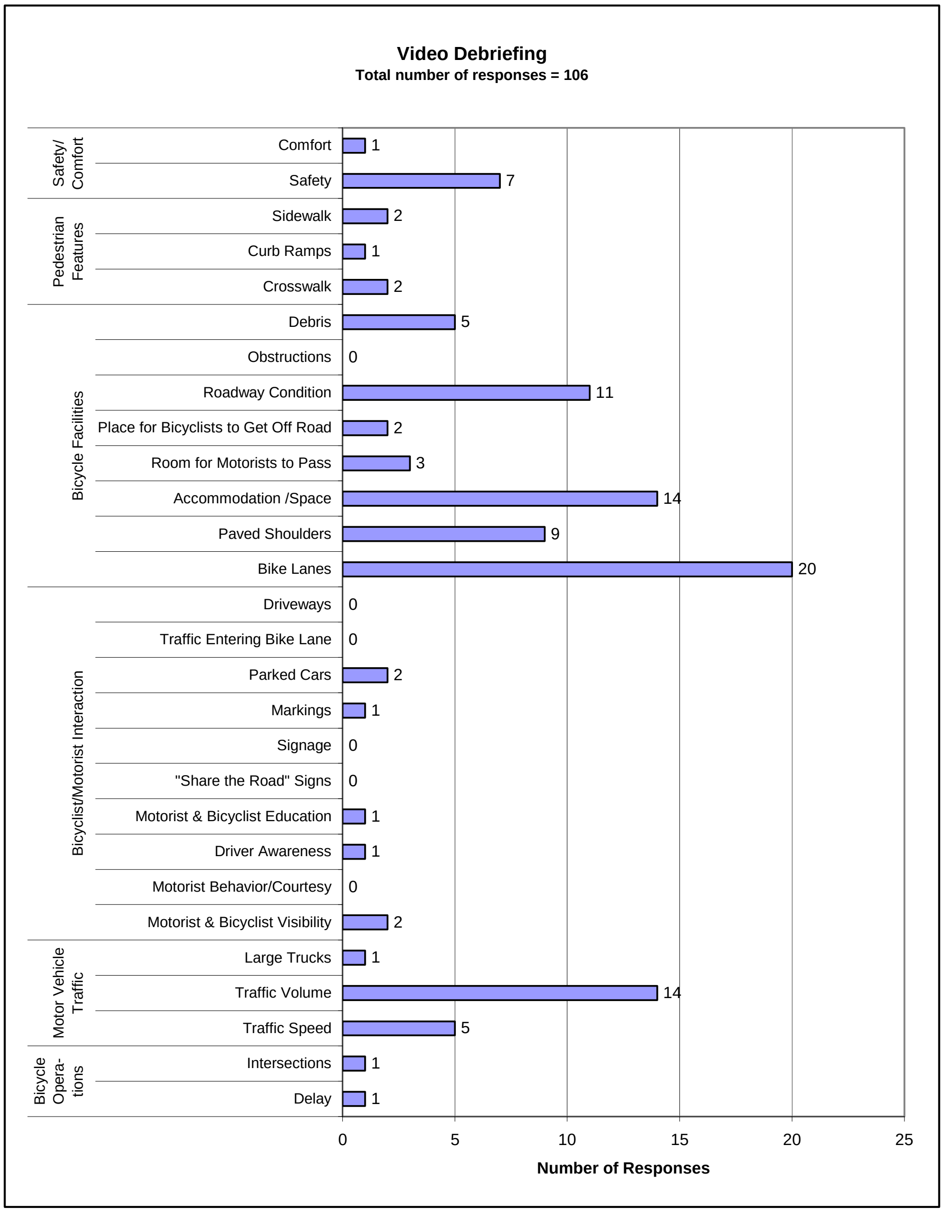

Figure 29. Video debriefing responses

Comparison of Video and Course Grades

Of the eleven sections shown in the video simulation, six represented facilities that were also graded as part of the riding course. They were filmed under similar traffic conditions as those experienced by the *Ride for Science 2005* participants. To test the hypothesis that people grade differently in a video simulation setting than they do within the riding environment, results for these six facilities were compared. The scores for both the video and course facilities were reduced. Based on a total of 615 observations (some of the potential responses from the 59 "video and course" participants were not included because of non-response), the video scores were not statistically significantly different from the course scores (t=1.39, not significant at the 0.05 level). Specifically, participants graded the common facilities nearly the same in the video simulation environment (mean=4.05) as they did on the course (mean=4.24). As a consequence, no calibration type equation to correlate the video grades to those obtained during the real-time field was needed.

MODEL DEVELOPMENT

This study sought to mathematically express the geometric, operational and traffic characteristics that affect bicyclists' perceptions of quality of service, or level of accommodation, along facilities. The first step taken in the modeling effort was to determine whether the previously developed Bicycle Level of Service Model for individual roadway segments accurately represents the level of service for facilities, composed of multiple segments and intersections. The segment model, which has been refined and applied to over 200,000 miles (322,000 km) of roadways throughout North America, has the following format:

Bicycle Segment LOS = $a_1\ln(Vol_{15}/L) + a_2SP_t(1+10.38HV)^2 + a_3(1/PC_5)^2 + a_4(W_e)^2 + C$

where

Vol_{15} = volume of directional motor vehicle traffic in 15-minute time period

L = total number of through lanes

SP_t = effective speed limit (see below)

SP_t = $1.12\ln(SP_P - 20) + 0.81$

SP_P = Posted speed limit (mi/h)

HV = percentage of heavy vehicles

PC_5 = FHWA's five point surface condition rating

W_e = average effective width of outside through lane

C = a constant

Coefficients:

a_1: 0.507 **a_2:** 0.199 **a_3:** 7.066 **a_4:** - 0.005 **C:** 0.760

Distance-weighted average segment levels of service for the study facilities were tested with the field-collected data. The results show that the existing model for segments has strong explanatory power for predicting bicycle level of service for segments ($R^2 = 0.53$). The existing Bicycle Level of Service Model for intersections was tested in combination with the segment model, but was not statistically significant.

Several other variables were also tested in combination with the average segment LOS. These variables were largely related to potential conflict points. When the Bicycle LOS for Segments model was developed, the number of driveways per mile was significant at the 90% level, but popular application of the Bicycle LOS for Segments model is without this factor. Because some observers have been surprised by the absence of conflict points in the popular model, such variables were re-examined for potential inclusion in the development of the Bicycle LOS for Arterials model. Driveways per mile, signalized intersections per mile, and unsignalized intersections per mile were all candidate variables and were examined using Pearson correlations and stepwise regression during this most recent effort. Ultimately the number of unsignalized intersections was selected as the most appropriate variable because it had the strongest correlation with the data (it also has the benefit of being relatively simple data to collect – a valuable property in actual application of the model over a roadway network). (Seventeen values ranging from no unsignalized intersections to more than 16 intersections per mile were represented in the database.) Consequently, it was added into the final model form. This variable, the number of unsignalized intersections per mile, is believed to be a surrogate for the number of driveways per mile, but has more explanatory power. Figure 30 illustrates the response of the Bicycle LOS for Arterials model to the number of unsignalized intersections per mile for a hypothetical roadway. The unsignalized intersection term includes only roadway intersections, not driveways.

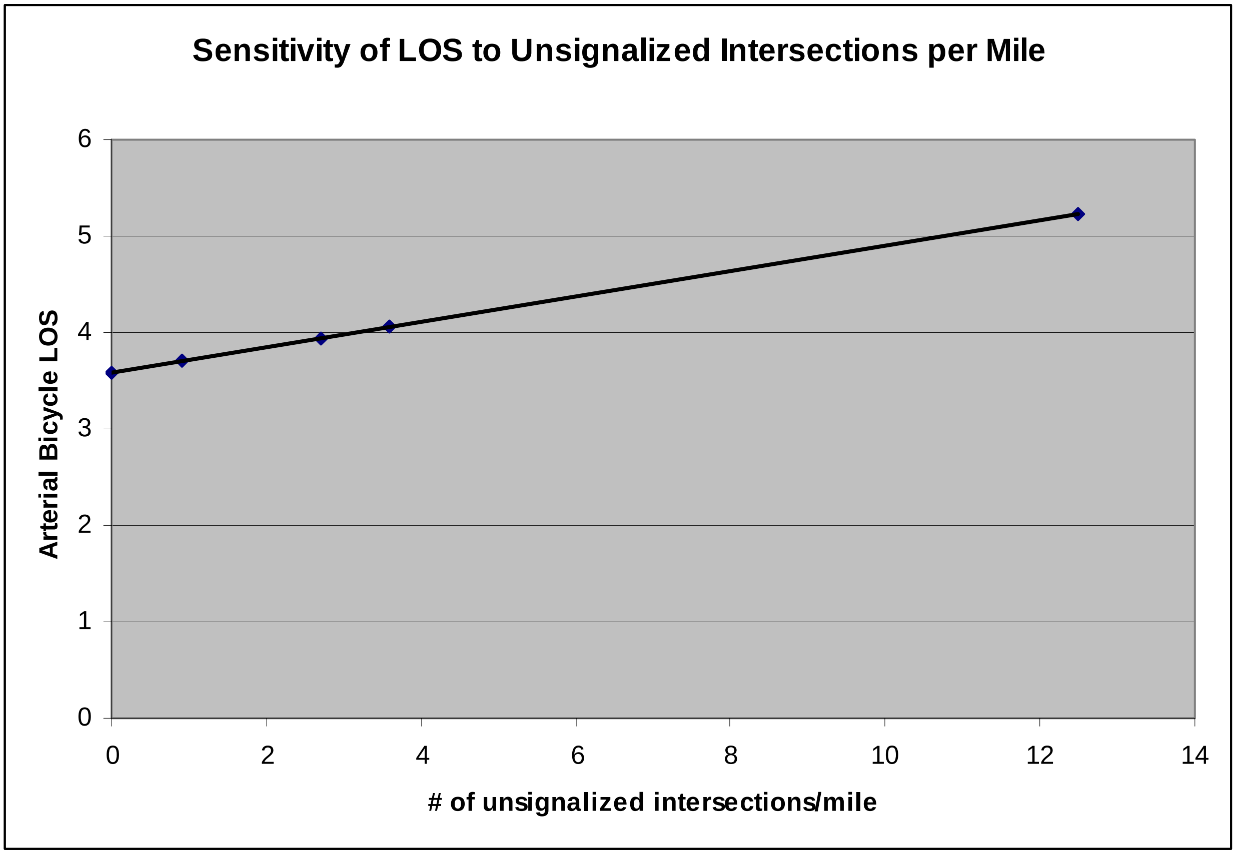

Figure 30. Sensitivity of LOS to unsignalized intersections per mile

The final model form follows:

Bicycle Facility LOS = a_1(AvSegLOS) + a_2 (NumUnsigpm) + C

where

AvSegLOS = distance-weighted average segment bicycle LOS along the facility

NumUnsigpm= the number of unsignalized intersections per mile along the facility

C = a constant

Table 1 shows the terms, coefficients, and *t*-statistics for the model. The correlation coefficient (R^2) of the best-fit model is 0.72, based on the averaged observations for the course and video simulation data from the twelve facilities. The coefficients are statistically significant at the 95 percent level. See Figure 31 for a plot of predicted Bicycle Facility LOS values versus mean observed values. Table 2 shows the Level of Service grade as it relates to the numerical score.

TABLE 1 Model Coefficients and Statistics

Model Terms	Coefficients	T-statistics
AvSegLOS	0.797	6.648
NumUnsigpm	0.131	4.061
Constant	1.370	4.074
Model Correlation (R^2)	0.717	

TABLE 2 Bicycle LOS for Arterial Roadways Categories

Bicycle LOS	Model Score
A	≤ 1.5
B	> 1.5 and ≤2.5
C	> 2.5 and ≤3.5
D	> 3.5 and ≤4.5
E	> 4.5 and ≤5.5
F	> 5

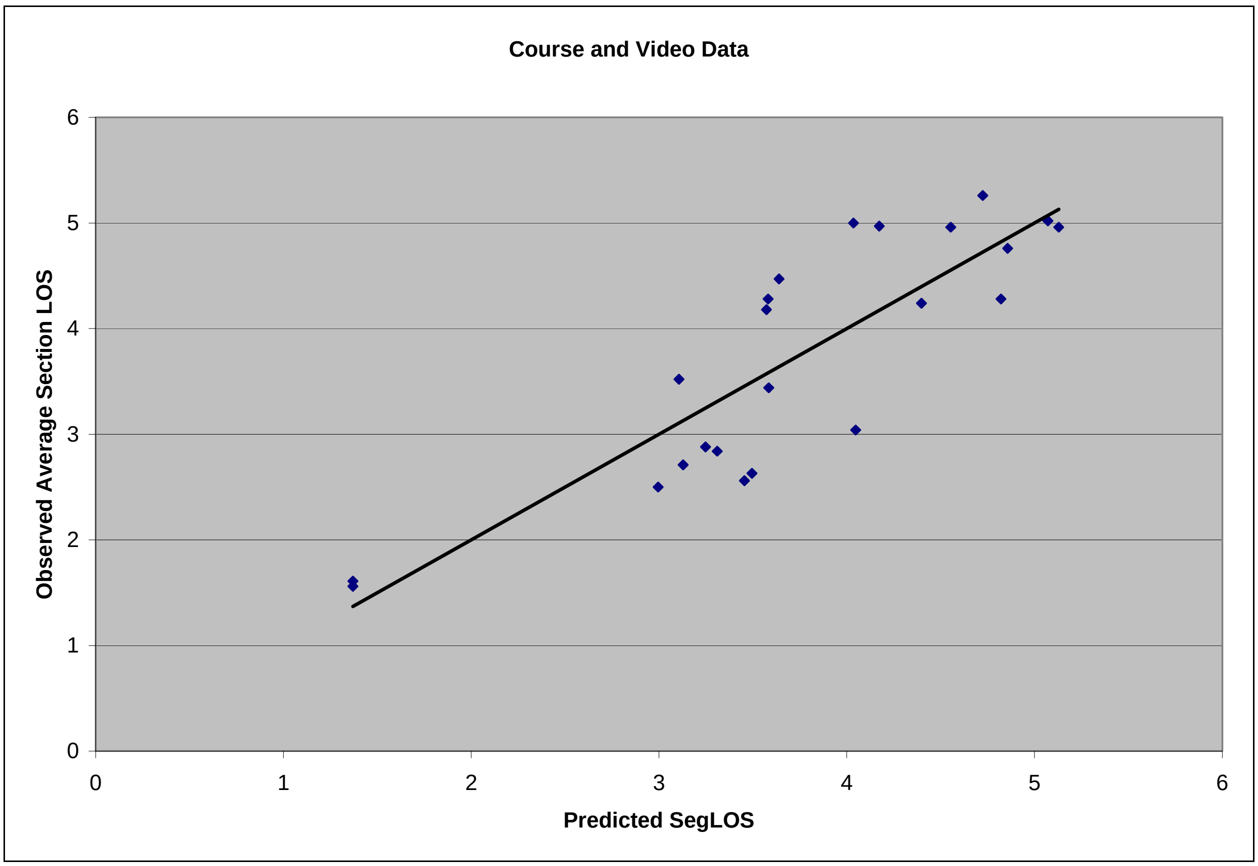

Figure 31. Predicted and observed section LOS values

APPLICATIONS

Ride for Science

The participants in this study represented a broad cross-section of the United States population of bicyclists, and the course arterials were typical of those prevalent in urban and suburban areas of the U.S. The initial result of this research is the development of a highly reliable, statistically calibrated bicycle LOS model for arterials suitable for application in the vast majority of U.S. metropolitan areas. Because the model was developed in urban and suburban environments, the model may not be transferable to rural arterials with few signals (the bicycle LOS model for roadway segments would be more appropriate in that setting (*2*)). Additionally, the model may not be appropriate along arterials where the number of side streets is kept low with frontage roads or facilities with very effective access management. On these types of roadways it may be more appropriate to use the segment model for the level of service for bicycles.

Video Simulation

The simulation video platform and protocol developed during this effort appears to have wide potential for professionals in the bicycle engineering, planning, and educational fields. Because of its high fidelity to the roadway environment and the portability of the project, this simulation methodology can be used to evaluate any number of roadway/path cross sections and traffic conditions to determine their effect on the perceptions and safety of bicyclists. Using this methodology it is possible to represent roadway conditions without putting subjects into actual traffic. Beyond just roadway conditions, this video platform can be used to compare shared use paths to bike lanes to “bicycle boulevards.” Additional video taping and research could expand the bicycle LOS model for arterials to include rural roadways and those roadways with frontage roads or effective access management. Also, using this video simulation methodology could yield information on route choices and the impacts of aesthetics. This video methodology could also be used for human factors testing of new or proposed traffic control devices.

The portability of the simulation methodology means that study subjects from across the United States can be exposed to identical roadway conditions. It has already been used to provide simulation video for the current NCHRP Project 3-70, Level of Service for Arterial Roadways. During this project, the study participants will need to be carefully screened to ensure those participants evaluating the roadway arterials represent a cohort which would actually ride a bicycle on-road. If this is not done, some correlation may have to be developed to calibrate the overall population (using the video only data set) to those who would actually ride.

The researchers found the simulation methodology to be an excellent method for documenting motorist/bicyclist conflicts on roadways and sidewalks. Because of its low impact on motorists' behaviors we were able to film conflicts and riding conditions that occur for cyclists riding with traffic on the roadway and for those riding against traffic on sidewalks. Consequently, this video platform could be used to perform actual evaluations of the conflicts on sidewalks or on sidepaths and to determine what traffic control devices mitigate those conflicts.

The FDOT and the University of Florida have used this methodology to evaluate bicycle facilities in construction zones and the simulations filmed in that project have been shown to engineers and to students to show them the impacts of design on bicyclists. This could be taken further to determine the effect of traffic work zone traffic control on the perceptions of bicyclists' comfort and safety.

A potential application for the video simulation methodology is for use in education. Having a high fidelity representation of the bicyclist's point of view could help the general public, transportation professionals, and elected officials better appreciate safety concerns, operational conditions, or proposed designs.

As can be seen from the above, the development of the video simulation methodology suggests extensive research that would benefit the Department can now be performed without asking any of the cycling public to ride under conditions they find uncomfortable. The fidelity and effectiveness of this research tool assures that the results of such research will be accurate and meaningful.

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APPENDIX A - VIDEO SIMULATION BRIEFING SCRIPT

PROCEDURE

1. *You are about to view a 46-minute continuously-running video, filmed from the perspective of a bicyclist, riding along 11 roadway sections, each several blocks long.*
2. *As you watch the video, you will be grading these sections.*
3. *When you walk in, please quietly take an available seat – the video will be running.*
4. *When the current section has been completed, the screen will say "Grade Section #__ Now" (for example). Five seconds later, the screen will say, "Start Section #__" (for example). This will be the first section that you grade. In other words, you will most likely not begin your grading at Section #1. Please circle the number of the first section that you grade.*
5. *When the video has returned to the point at which you arrived and you have graded every section, you have completed the video portion of the Ride for Science.*
6. *Return your completed scorecard to me, and I will give you further instructions.*

GRADING

1. *Each section can be graded from "A" to "F" with "A" representing the best and "F" representing the worst. Circle the letter grade that best describes how well you feel the section accommodates and serves your needs as a bicyclist. Grade each section as you view it. You can change your grades at any time; simply cross through the old grade and circle the new grade.*
2. *Do not consider aesthetics or conditions beyond the roadway. Ignore the surrounding land and buildings, and also ignore any debris in the street.*
3. *You won't always be able to see the traffic signal or STOP sign – don't worry. In all cases, the cameraman obeys all signals and signs.*
4. *The whole purpose of the Ride for Science 2005 is to get your **individual** scores. Please don't compare or discuss your grades with any other participant. Also, please do not make any audible reactions to what you see on the screen.*

APPENDIX B - VIDEO SCORECARDS

Official Use Only

Bicyclist Number

Reverse?
Yes __
No __

Video Scorecard

A F

Best ⟷ **Worst**

(Circle One Per Section)

Section	Score	Section	Score
1	A B C D E F	6	A B C D E F
2	A B C D E F	7	A B C D E F
3	A B C D E F	8	A B C D E F
4	A B C D E F	9	A B C D E F
5	A B C D E F	10	A B C D E F
		11	A B C D E F

T:data\05\8116-05\Video Scorecard.ppt

APPENDIX C - COURSE SCORECARDS

Official Use Only

Start	_____
Time 1	_____
Time 2	_____
Time 3A	_____
Time 3B	_____
Time 4	_____
Time 5	_____
End	_____

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Official Use Only

Bicyclist Number

Reverse?
Yes __
No __

Half On?
Yes __
No __

Course Scorecard

A ⟵⟶ F

Best **Worst**

(Circle One Per Section)

Section	Score	Section	Score
1	A B C D E F	7	A B C D E F
2	A B C D E F	8	A B C D E F
3	A B C D E F	9	A B C D E F
4	A B C D E F	10	A B C D E F
5	A B C D E F	11	A B C D E F
6	A B C D E F	12	A B C D E F

T:data\05\8116-05\Course Scorecard.ppt

APPENDIX D - COURSE BRIEFING SCRIPT

COURSE

1. *The course begins and ends at the Museum of Science and Industry (MOSI).*
2. *You will be riding on a 20-mile course, scoring 12 sections along the way.*
3. *All sections on the course that are to be scored are marked with yellow signs where they begin and end. Only score those sections signed along the course. The section number on the yellow signs corresponds to the numbers on your scorecard.*
4. *Much of the course has bike lanes, but some of it doesn't.*

GRADING

5. *Circle the letter grade that best describes how well you feel each section serves your needs as a bicyclist. Each section can be graded from "A" to "F" with "A" being the best grade and "F" being the worst grade. Grade each section as you complete it. You can change your grades at any time; cross through the old grade and circle the new grade.*
6. *Grade only the roadway. Do not consider aesthetics or conditions beyond the roadway. Ignore the surrounding land and buildings, and also ignore any debris in the street.*
7. *There are checkpoints along the course. <u>You must stop and check-in at the checkpoints.</u> The Time Checkers at the checkpoints are monitoring your progress. They are also checking your scorecard for completeness. After your scorecard has been checked, it will be returned to you.*
8. *Ride as you normally would. The whole purpose of the Ride for Science 2005 is to get your **individual** scores. Please don't compare or discuss your grades with any other rider.*
   Please <u>do not:</u>
   a. *Ride together*
   b. *Share your scores*
   c. *Consider the conditions before the section "start" and after the "end" signs, or beyond the pavement when grading.*

SAFETY

1. ***You must wear a helmet at all times while on the course!***
2. *Ride safely; proceed through the intersections with caution.*
3. *Remember, you have the same rights and responsibilities as motorists. <u>You must obey all traffic lights and STOP signs.</u>*
4. *If you choose to cross at a crosswalk, use pedestrian rules and signals.*
5. *Notify Event Staff if you need assistance or for an emergency. A vehicle will be available to transport riders who need/want to leave the course.*
6. *You may discontinue the Ride at any time; you are under no obligation to finish.*
7. ***This is not a race; travel at your own pace**. You may pass other riders on the course. If another rider passes you, don't be concerned or feel pressured to keep up.*
8. *If you need to, you can stop at any of the businesses along the Ride to purchase something to drink (other refreshments are available at MOSI).*