

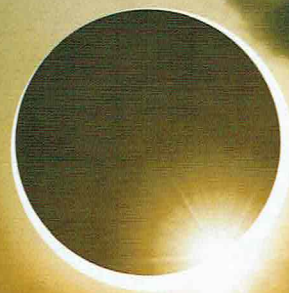


Planning for the April 8, 2024 Total Solar Eclipse

BY JONATHAN UPCHURCH, PH.D., P.E. (F)

Spectacular. Once-in-a-lifetime experience. Truly awesome! These are common reactions from someone who has just witnessed a total solar eclipse.

On April 8, 2024, tens of millions of United States and Canadian citizens will have a unique opportunity to view a total solar eclipse and transportation agencies will face the challenge of managing the special event traffic. The path of totality will enter the United States in Texas, along the Rio Grande River, and extend northeastward toward northern New England and into Canada from southern Ontario and into portions of Atlantic Canada (Figure 1).



A total solar eclipse is a rare event and many people will choose to view the event by traveling for hours or days to get to the “right” location. The combination of lots of travelers, and willingness to travel great distances, will lead to increased highway traffic resulting in traffic congestion that could be extreme.

If you work for a public agency along or near the path of totality, this story will help your agency to prepare for this special event and help you understand why millions of people will travel to the path of totality. If you are personally interested in travelling to the path of totality, this story will help you plan.

A total solar eclipse on August 21, 2017, served as a “warm-up” event for 2024. It was the first total solar eclipse in the 48 states since 1979 and gave many people their first exposure to totality.

The 2017 event was also a “warm-up” event for public agencies that will be responsible for managing traffic, emergency services, law enforcement, communications, and tourism in 2024. The

experiences of agencies in 2017 will help agencies along the 2024 path of totality to better prepare.

The 2017 total solar eclipse saw millions of visitors traveling to and from the narrow path of totality that extended across the United States, from Oregon to South Carolina. Successfully managing traffic and parking was a major challenge for those who planned for and carried out the day’s event management.

The millions of people drawn to locations along the eclipse path taxed limited transportation facilities, and traffic congestion was intense in many locations. Across the country, Interstate highways near the path of totality experienced traffic congestion shortly after the eclipse, with longer-than-normal travel times on Interstate highways. For example, travel from Casper, Wyoming, to Denver, Colorado—normally a 4-hour trip—took 10 hours or more. Traffic congestion on rural Interstate routes lasted for up to 13 hours after the eclipse.



Figure 1. Path of totality—April 8, 2024 total solar eclipse.

Lessons Learned from the 2017 Total Eclipse

The lessons learned in the 2017 eclipse can help transportation agencies better prepare for the 2024 eclipse. These findings include the following:

1. The best estimate is that at least 5 million people traveled to see the totality.
2. Almost all viewers traveled to the path of totality by motor vehicle.
3. In the hours immediately following totality, almost every Interstate route passing through the path of totality showed red on Google Traffic maps (Figure 2).
4. On some Interstate routes, traffic congestion, slow speeds, and long travel times lingered for up to 13 hours after totality. The headline from the Lexington Herald-Leader in Kentucky, sums it up: “The rare eclipse was memorable. The ride home was something they want to forget.” (Figure 3.)
5. Rural, nonfreeway routes also experienced significant traffic congestion, slow speeds, and long travel times.
6. Many state departments of transportation with roadways in the path of totality worked hard to minimize freeway lane closures for construction or maintenance. If lane closures had not been minimized, congestion would have been much more severe.
7. Most of the path of totality was cloud-free on August 21; in only a few locations, travelers were deterred by cloudy skies. For the April 8, 2024, eclipse, planners need to assume that

Why Viewers Choose to Travel to See Totality

Unless someone has the good fortune to live within the path of totality, they will have the choice of either viewing a partial solar eclipse (in which the moon covers only a portion of the sun), or traveling to the path of totality to see the entire sun covered by the moon and the display of the spectacular solar corona.

An analogy can explain the difference between a partial solar eclipse and a total solar eclipse. It's like the difference between watching 5-year olds play flag football and having seats on the 50-yard line at the Superbowl. You want to be in the path of totality. Most of the public has learned this and that is why many will choose to travel, thus increasing highway traffic.

skies also will be clear and to prepare for large numbers of vehicles and people.

8. Attractions in and near the path of totality can expect high visitation on days before and after an eclipse. For example, Yellowstone National Park had to close the entrance to Old Faithful and its 1,000-space parking lot on both Tuesday and Wednesday after the eclipse because the parking lot had filled.
9. For the April 8, 2024, event, border crossings between upstate New York and Canada and upper New England and Canada may be much higher than usual.

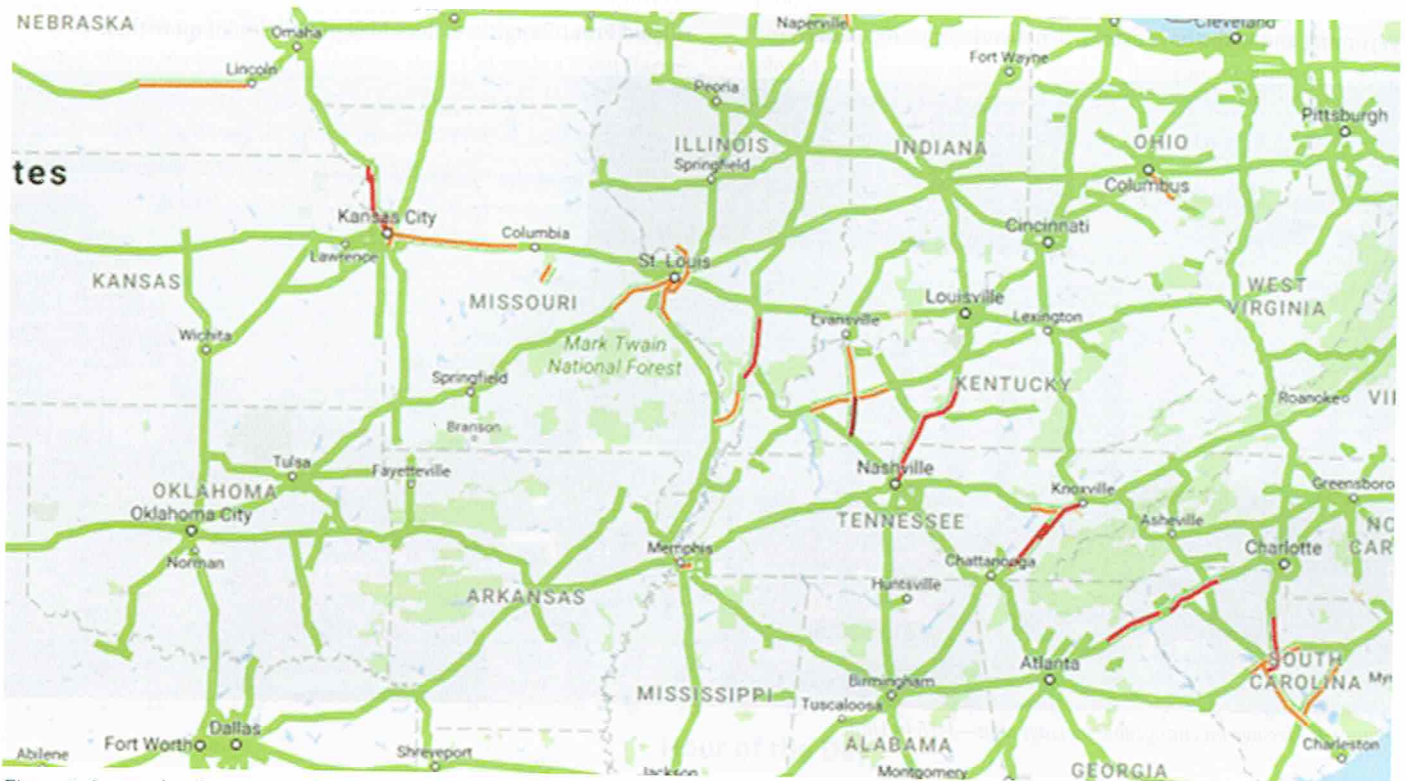


Figure 2. Screen shot from Google Traffic about 3:30 p.m. EDT on August 21, 2017.

The rare eclipse was memorable. The ride home was something they want to forget.



BY MIKE STUNSON
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AUGUST 22, 2017 11:37 AM

Figure 3. Headline from the Lexington Herald Leader.

How Many People Traveled in 2017?

Forecasting traffic demand for the 2017 eclipse was exceedingly difficult, but lodging facilities sold out a year in advance along much of the eclipse path—indicating that many areas would see huge influxes of people and vehicles.

A forecast model was created by Michael Zeiler, then an employee of ESRI and the creator of the GreatAmericanEclipse.com website. Using GIS tools, census data, and a road-network model of every street in the lower 48 states, Zeiler estimated that between 1.8 and 7.4 million people would travel to the path of totality. He also estimated the number of people who would travel to specific locations all along the path of totality.*

To document the actual numbers of people who traveled to the 2017 eclipse, the author of this article sought data from traffic-counting stations in Wyoming and Idaho. That data created a good estimate of actual numbers for those locations. Like all states, both Wyoming and Idaho have extensive networks of traffic-counting

Facts about the April 8, 2024 total solar eclipse

- Only one other total solar eclipse has occurred in the 48 states since 1979
- The next total solar eclipse in the 48 states will not occur until 2044
- The last total solar eclipse in populous eastern Canada was in 1979
- The next total solar eclipse in populous eastern Canada will not occur until 2079
- The path of totality is about 115 miles (185.1 kilometers [km]) wide. Within the United States, 31.6 million people live inside the path of totality
- In the United States 149.5 million people live within 200 miles (321.9 km) of the path of totality – a reasonable driving time

stations on the roadway system. The analysis utilized hourly traffic count data from selected dates before, after, and on August 21, 2017.

Wyoming

The path of totality in Wyoming stretched from near Jackson in northwestern Wyoming to just north of Torrington in eastern Wyoming. Many eclipse observers traveled from the more-populated Front Range in Colorado (a population of more than 4



Figure 4. Message on changeable message sign—I-15 in Utah.

*Additional information on Zeiler's model can be found at www.greatamericaneclipse.com/statistics



Figure 5. Post-eclipse traffic—Interstate 25 near Douglas, WY, USA.

million) to points in eastern Wyoming. I-25 was the primary facility serving this population.

The author’s analysis focused on post-eclipse traffic. Although a huge exodus occurred immediately after the eclipse, a significant number of eclipse viewers waited until the following day, Tuesday, August 22, to leave the eclipse path.

I-25 was the most heavily traveled route from the path of totality in eastern Wyoming to population centers along Colorado’s Front Range. The generally east–west alignment of I-25 from Casper to Glendo to Cheyenne was located near the centerline of the path of totality. From Glendo, I-25 heads south toward Cheyenne and Colorado. All of I-25 is a four-lane divided freeway, from Casper to Colorado.

Normally, the 278-mile (447.4 km) trip from Casper to Denver on I-25 is approximately 4 hours driving time. After the eclipse on August 21, media commentaries and anecdotal accounts reported travel times of up to 10 hours from Casper to northern Colorado. A review of I-25 southbound traffic count data shows very heavy traffic volumes from noon until 1:00 a.m. the following morning. The traffic counting station at Milepost 1, 1 mile north of the Colorado–Wyoming state line, showed that volume jumped from 351 at 11:00 a.m., to 1,565 at noon, to 3,114 at 1:00 p.m. Traffic volumes then declined slowly, to 2,303 vehicles per hour after midnight (Figure 6). Media accounts reported that traffic speeds from early afternoon to late night were very slow.

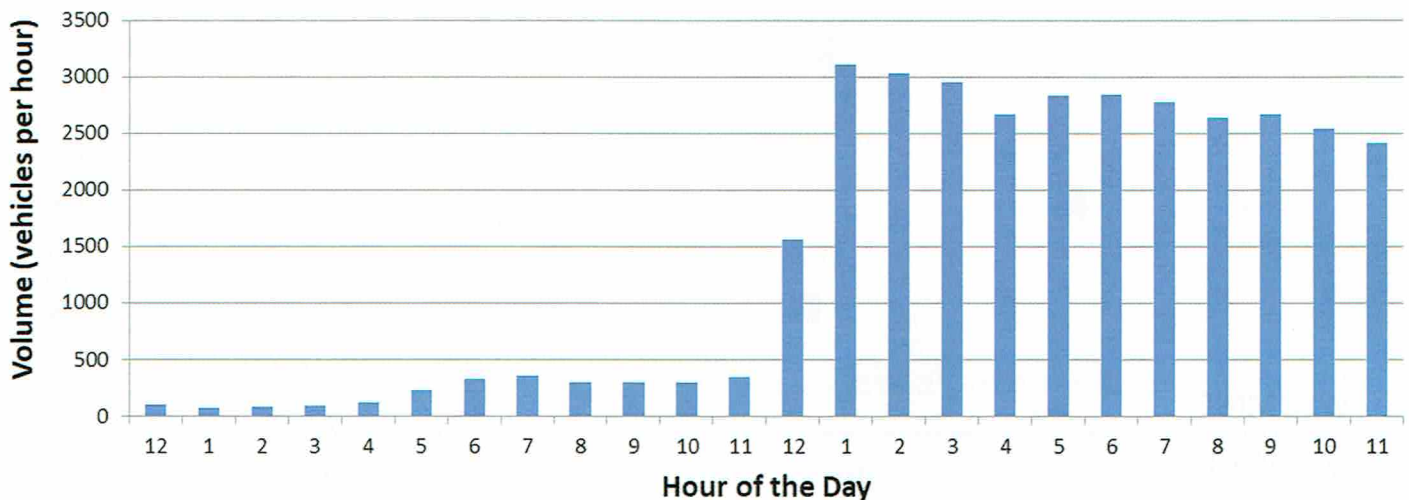


Figure 6. Southbound Hourly Traffic Volume, I-25, Milepost 1, Wyoming, August 21, 2017.

Using the Screenline

A screenline is an imaginary line on a map that can be used to count traffic going from one side of the line to the other. A screenline was created covering the eastern half of Wyoming along the Wyoming–Colorado border, from Wyoming Route 789 on the west to the Nebraska border on the east. Unlike in the central and eastern United States, the roadway network in Wyoming consists of a small number of widely separated state highways. No other paved roadways offer alternative routes between these state highways. The roadway network is sparse and may lack the capacity for an event like the eclipse.

Traffic counts were available from six traffic-counting stations along this screenline (Figure 7) at locations that would have captured almost all of the post-eclipse southbound traffic in the eastern half of Wyoming. Hourly traffic counts for the southbound direction, beginning at noon on Monday, August 21, and ending at 9:59 p.m. on Tuesday, August 22, were scrutinized.** This period captured the exodus of people headed south from the path of totality.

For each hour, the hourly count on August 21 was compared to the average of the hourly counts during the same hour on the preceding four Mondays and on the one following Monday, all

acting as a baseline for comparison. August 22 hourly counts were compared in a similar way. Hourly counts, beginning at 10:00 a.m. on Monday, August 21, and ending at 10:00 p.m. on Tuesday, August 22, are depicted in red, which depicts the traffic volumes for all six traffic-counting stations combined. The baseline volumes on the comparison dates are shown in blue (Figure 8).

Analysis

Southbound traffic counts on Monday (noon to midnight) were 48,275 vehicles higher than the baseline. Southbound counts on Tuesday (midnight to 9:59 p.m.) were 19,789 vehicles higher than the baseline. The combined total for both days was 68,063 extra vehicles—in other words, 68,063 more vehicles passed southbound from Wyoming to Colorado in the 34-hour period following the eclipse than would otherwise have been expected.

It is reasonable to assume that, for eclipse viewing, each vehicle would contain 3.0 persons. Three persons per vehicle x 68,063 vehicles = 204,190 persons who observed the eclipse in eastern Wyoming, coming from locations south of the Wyoming–Colorado border.

It is interesting to compare the above estimate of 204,190 persons with Zeiler's forecast. For the eastern half of Wyoming—

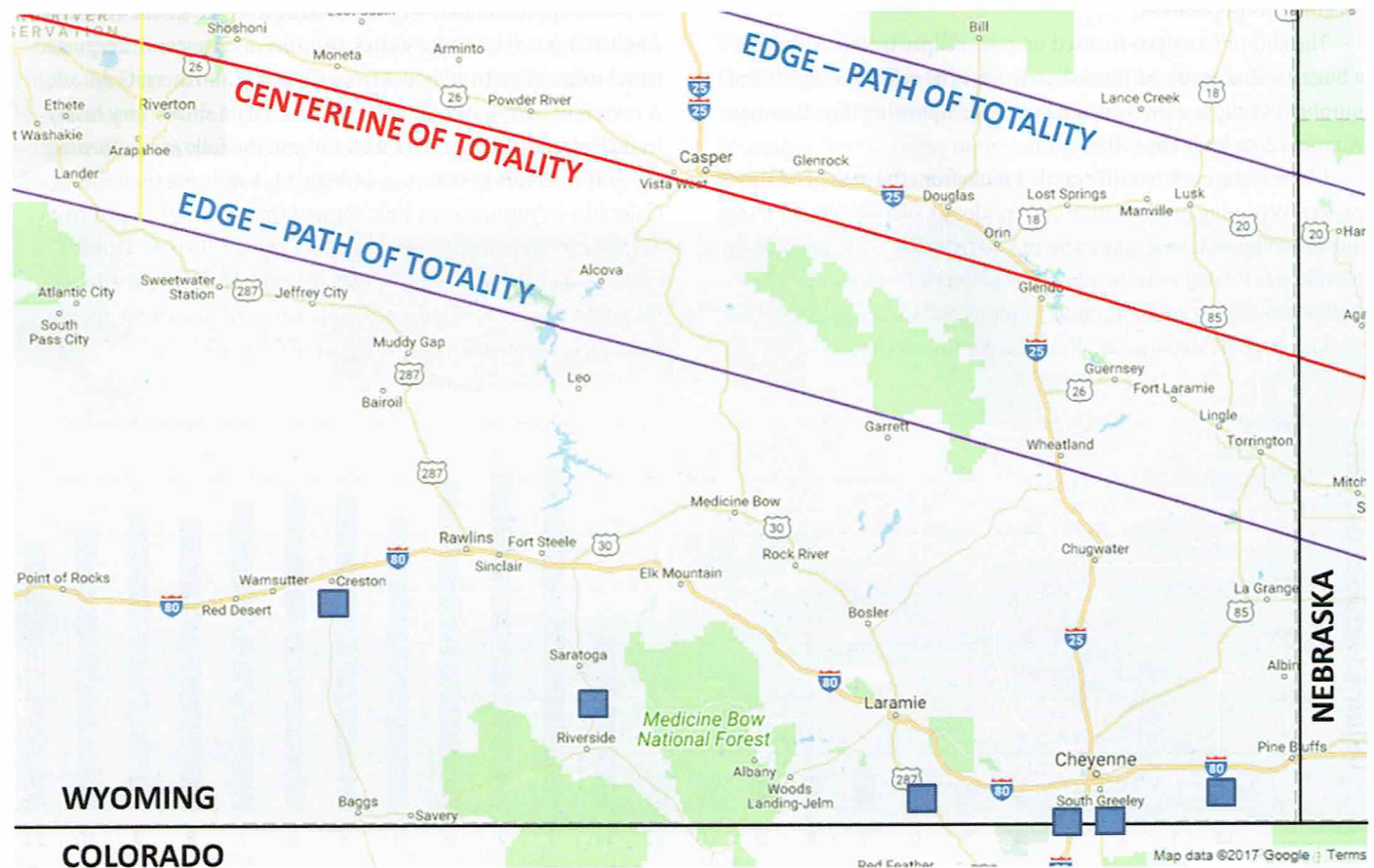


Figure 7. Path of Totality in eastern Wyoming and Locations of traffic counting stations.

**Totality ended in eastern Wyoming at approximately 11:45 a.m. on Monday.

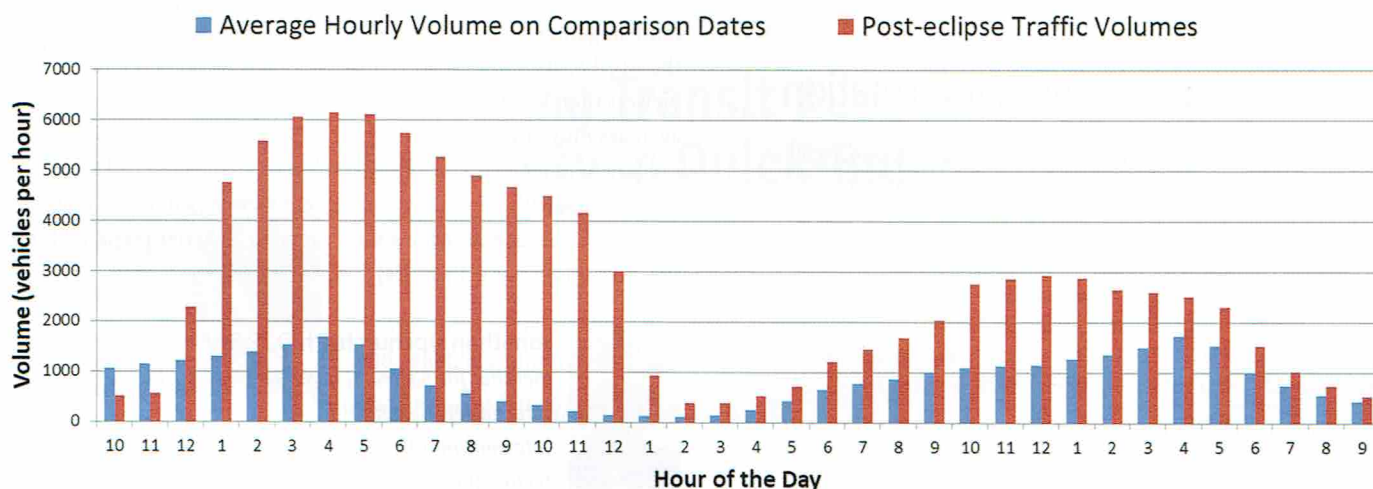


Figure 8. Southbound Hourly Traffic Volume, Screenline, Wyoming, August 21 and 22, 2017 versus Comparison Dates.

the area captured by the traffic count data—Zeiler’s high estimate was about 156,400. This included path-of-totality locations from Casper eastward to the Nebraska state line. Zeiler’s estimate included visitors coming from both the north and the south, and included visitors from points north of the Wyoming–Colorado border that were not captured by the screenline analysis. Thus, the traffic count–derived estimate of 204,190 visitors greatly exceeds Zeiler’s high estimate of 156,400.

Idaho

A similar analysis was conducted for eastern Idaho, where I-15 brought travelers to the path of totality from the large population center of 2.4 million people along northern Utah’s Wasatch Front.

The author’s analysis—again based on traffic counts—estimated that 124,204 persons who observed the eclipse in eastern Idaho came from locations south of the Idaho–Utah border. Zeiler estimated that eclipse visitation to eastern Idaho would be between 70,000 and 280,000 persons. The actual, traffic count–derived visitation estimate of 124,204 falls within the range of Zeiler’s high and low estimates.

Estimation of 2017 Viewing Total

The Wyoming and Idaho traffic counts provide two comparisons with Zeiler’s estimates. In Wyoming, actual visitation was higher than Zeiler’s high estimate. In Idaho, actual visitation was within the range of Zeiler’s high and low estimates. If the Wyoming and Idaho experiences are representative of those of the other states—and noting Zeiler’s estimate that nationwide, travelers to the path of totality numbered between 1.8 and 7.4 million—it is reasonable to conclude that at least 5 million people traveled to view totality.

Looking Ahead to April 8, 2024

Transportation professionals have been conducting special-event traffic planning and management for decades—athletic events such

Why more people will travel to the April 8, 2024 total eclipse than in 2017

In 2017, 87.9 million people lived within 200 miles of the path of totality in the United States. In 2024 149.5 million people will live within 200 miles.

The 2017 path of totality was located within a 3-hour drive of only three metropolitan areas of more than 2 million population: Portland, Oregon (3.3 million); St. Louis (2.8 million), and Kansas City (2.2 million). In contrast, the April 2024 path of totality comes within a 3-hour drive of eight metropolitan areas and five of them have much larger populations than those in 2017. They are the metropolitan areas for: Chicago (9.5 million); Houston (6.9 million); Toronto (6.4 million), Ontario, Canada; Boston (4.8 million); Detroit (4.3 million); St. Louis (2.8 million); Pittsburgh (2.3 million); and Cincinnati (2.2 million).

The “snowball” effect will grow public interest. The 2017 event gave many people their first exposure to totality. The experience was so dramatic that many of those people yearn to see totality again. There will be repeat eclipse chasers in 2024. Many of those who did not witness totality in 2017 heard vivid accounts from others and are now determined to be first-time viewers.

Increasing online media coverage. Online media stories began in mid-2023. Continuing online media “hype” will undoubtedly influence lots of people to seek out the eclipse.

To view a partial solar eclipse, or to watch the portions of a total solar eclipse before or after totality, you must wear appropriate eye protection.

Additional sources of information

To learn more about how public agencies can plan for this event, go to the National Operations Center of Excellence webpage at:

- <https://transportationops.org/eclipse>

To learn more about viewing the total solar eclipse, go to:

- <https://www.greatamericaneclipse.com/april-8-2024>
- <https://nationaleclipse.com/maps.html>
- <https://skyandtelescope.org/total-solar-eclipse-2024/>
- http://xjubier.free.fr/en/site_pages/solar_eclipses/TSE_2024_GoogleMapFull.html

as the Super Bowl, parades, holiday celebrations, and fireworks displays. The 2017 total solar eclipse was unlike any other special event, however. At 5 million participants, it was likely the largest special event in U.S. history. For comparison, 5 million people leaving the path of totality at once is equivalent to 71 sellout

football games ending at the same time. For several reasons, the April 8, 2024 total solar eclipse will likely attract even more viewers than in 2017 (see sidebar on page 45). Transportation agencies must understand the sheer magnitude of traffic and prepare to manage traffic and parking. The lessons learned from 2017—along with an understanding that viewers will travel in large numbers—can help transportation agencies be better prepared for the 2024 total solar eclipse. **itej**



Jonathan Upchurch, Ph.D., P.E. (F) has been an ITE member for 53 years, has attended 50 ITE International Annual Meetings, and served as ITE's International President in 1991. In 2012, he was the recipient of the ITE Western District's Lifetime

Achievement Award. Jonathan has viewed six solar eclipses in his lifetime. He documented the traffic impacts of the August 21, 2017 total solar eclipse that is shared in this article. Jonathan is looking forward to viewing the April 8, 2024 total solar eclipse and helping public agencies plan for that event.

RECOGNIZING OUR FUTURE:

Young Leaders to Follow for 2024

Let's shine a spotlight on the best young professionals in ITE and the profession. We are looking for the top young members to recognize as the ITE Young Leaders to Follow for 2024, a group of 20 young members that represent the best of our emerging leaders.

Help us cast a wide net across all of ITE and the industry to find the best of the best among up-and-coming professionals. Nominate a young leader today! Employers, peers, friends, colleagues, and mentors can all nominate, and you can also self-nominate.

Nominate a Young Leader Today! The application deadline is March 15, 2024. For all the details, visit www.ite.org/youngleaders.

Eligibility: Candidates must be an ITE member and 35 years of age or younger on January 1, 2024.



Answer to "Where in the World" on page 29: Kahala Tunnel along Diamond Head Road that leads to Le'ahi (Diamond Head) crater from a volcanic eruption 300,000 years ago in Honolulu, HI, USA. Photo submitted by Kohinoor Kar, Ph.D., P.E., PTOE.