

Report No. CSS24-54
November 20, 2024

Tackling Emissions: Analyzing Football Travel Emissions from Big Ten Expansion at the University of Michigan

Paige Greenberg and Molly Russell

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by
Paige Greenberg and Molly Russell

Center for Sustainable Systems
University of Michigan
November 20, 2024

Advisors:
Dr. Geoffrey Lewis, Research Area Specialist Lead
Shoshannah Lenski, CSS Associate Director

Acknowledgement:
We would like to thank Dr. Brian McCullough and Dr. Gregory Keoleian for their expertise and comments that improved this report. The responsibility for the content and any remaining errors remains exclusively with the authors.

Introduction

Founded in 1896, the Big Ten Conference is one of the cornerstone collegiate athletic leagues in the United States, initially grouping together universities from the Midwest known for both their academic and athletic excellence, particularly in football. Over the years, the conference has expanded several times, growing its footprint and boosting its influence in collegiate sport.

Significant additions over the decades have included powerhouse football programs like Penn State in 1990, Nebraska in 2011, and Maryland and Rutgers in 2014. Each of these expansions broadened the Big Ten's geographic and market reach, pulling in new fan bases and opening up additional television markets.

2024 marks the most drastic change yet with the addition of USC, UCLA, Oregon, and Washington from the Pac-12.¹ This expands the Big Ten's territory from coast to coast, increasing travel for athletic teams. It also reflects a larger trend of collegiate sport decisions being increasingly driven by financial considerations over traditional regional rivalries and geographic boundaries.^{2,3}

Institutions like the University of Michigan (U-M) are increasingly committed to sustainability, raising questions about how to reconcile environmental goals with the realities of increased carbon emissions resulting from conference expansion. This report aims to explore these challenges by estimating the impact of travel-related emissions for U-M football, examining the alignment of increased travel emissions with sustainability commitments, and proposing strategies to mitigate environmental impacts while maintaining the conference's competitive spirit.

Existing Research

Hong et al., researchers at Arizona State University (ASU), examined the increase in carbon emissions for each of the "Power Five" conferences in 2024.⁴ They found that the recent conference expansions in the ACC, Big Ten, Big 12, and SEC all led to increases in emissions, with the Pac-12's future left unclear since ten schools are leaving the conference. The increase in emissions was largely attributed to the broadening of conference boundaries, requiring teams to travel farther. After the addition of the four West Coast teams in the Big Ten, the researchers from ASU are projecting a nearly 2.5-fold increase in emissions from the 2023 to 2024 season.

¹ "About the Conference." *Big Ten Conference*, 12 Mar. 2024, bigten.org/about/general/about-big-ten-conference/.

² See, Shaw, Susan M. "Money Has Torn the Pac-12 Apart. Student-Athletes Are Left Holding the Pieces." *Forbes Magazine*, 8 Aug. 2023, www.forbes.com/sites/susanmshaw/2023/08/08/money-has-torn-the-pac-12-apart-studentathletes-are-left-holding-the-pieces/?sh=57101b6965c1.

³ See, Geary, Molly. "Report: 24 Public Schools Met NCAA's Benchmark for Self-Sufficiency." *Sports Illustrated*, 26 May 2015, www.si.com/college/2015/05/27/ncaa-athletics-finances-revenue-expenses-oregon-texas.

⁴ Hong, J., Sheguri, S., Askin, R. G., & Maciejewski, R. (2024). *Carbon emission in football games: Footprint impact of power five conference realignment*. *Sustainability and Sports Science Journal*, 2(2), 98–106. <https://doi.org/10.61486/KDVT9069>

The ASU study looked at the Big Ten conference as a whole, rather than individual schools, and excluded non-conference games. We build on their work with a deep-dive specifically into U-M, and add two new components, with the inclusion of regular season non-conference games and an investigation of the relationship between these emissions and the University's sustainability commitments.

Methods

We use key methods and assumptions from Hong et al., including distance, mode of transportation, number of people traveling, and emissions factors, to estimate travel-related carbon emissions for U-M and their opponents every season from 2010 to 2027, excluding 2020 due to interruptions from the COVID-19 pandemic.⁵

Conference-Only Games

First, we calculate emissions for every conference game Michigan traveled for and the emissions for conference opponents traveling to play U-M in Ann Arbor (Figure 1). Between 2010 and 2015, U-M played eight conference games per season, increasing to nine beginning in the 2016 season.

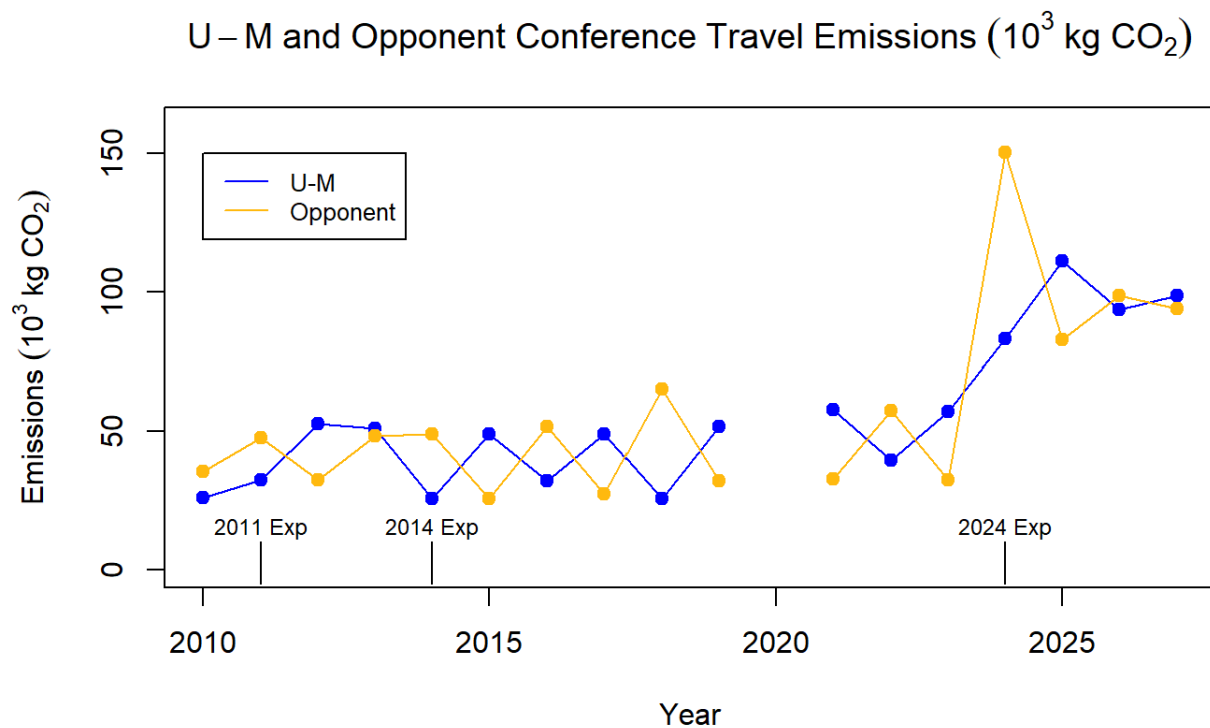


Figure 1. Travel emissions for U-M and opponents in Big Ten conference games, conference expansions noted, 2020 COVID season excluded.

⁵ U-M played the 2020 season, but had five games canceled due to COVID protocols

From 2010 to 2023, Michigan and opponent emissions ranged from 25,000 to 65,000 kg CO₂, with each team averaging around 41,000 kg CO₂. The party responsible (U-M or opponents) for the greater emissions typically alternates each year with home-away match-ups.

Following the Big Ten expansion in 2024, emissions increase for both U-M and opponents. From 2024 to 2027, the average emissions of conference games per season increases 2.3 times for U-M, to roughly 96,000 kg CO₂, and 2.6 times for opponents, to about 106,000 kg CO₂.

All Regular Season Games Including Non-Conference

Next, our analysis adds regular season non-conference games (Figure 2). Michigan rarely travels for non-conference games, with the majority of these games played in Ann Arbor, so the impacts on Michigan’s direct travel emissions are modest. However, non-conference opponent travel is considerably higher in some years, dwarfing conference emissions. In 2016, travel from three non-conference teams, Hawai’i, Colorado, and UCF, to Ann Arbor contributed to 61.8% of the season’s emissions from U-M and opponents combined. Similarly, dramatic spikes in opponent travel emissions in 2022 and 2024 reflect the travel of non-conference teams to Ann Arbor from states including Hawai’i, California, and Texas. The range of travel emissions from regular season opponents is very wide, about 57,000 kg CO₂ to 274,000 kg CO₂, because opponents for non-conference games vary from year to year.

U – M and Opponent All Games Travel Emissions (10³ kg CO₂)

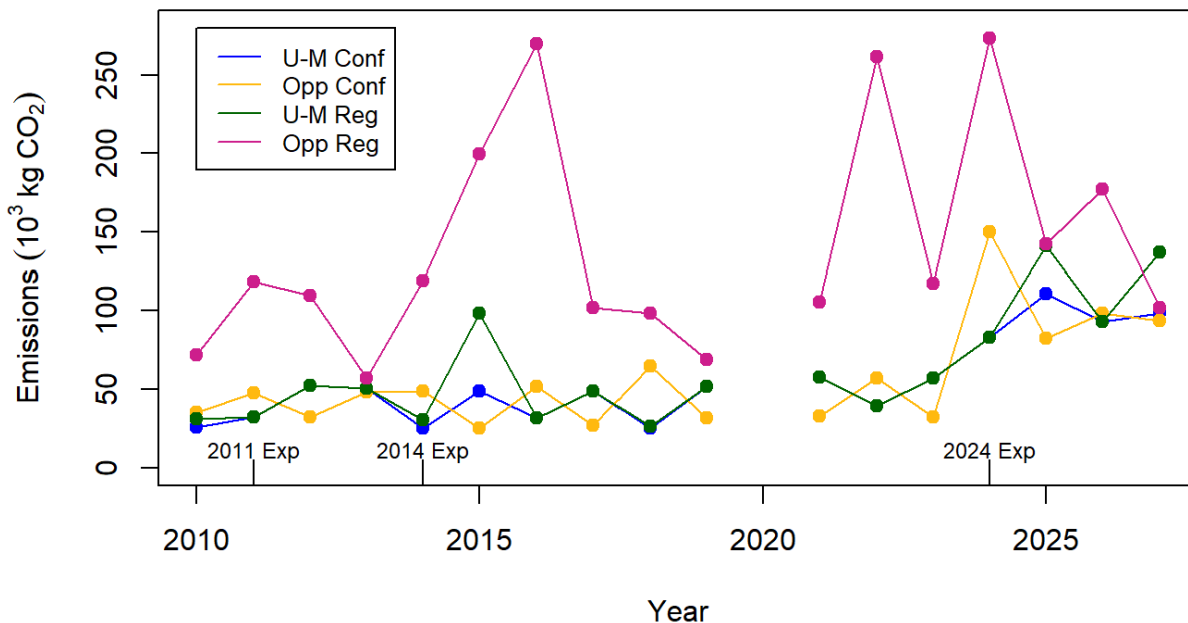


Figure 2. Travel emissions for U-M and opponents in conference and regular season Games, 2020 COVID season excluded.

Regardless of which team is traveling and which is at home, we argue that U-M bears responsibility for a share of total travel emissions (including opponents') for all games in which they play. This would be consistent with other interpretations of Scope 3 emissions responsibility. For example, the US EPA greenhouse gas guidelines for 'conferences and events' suggests that multiple organizations 'sponsoring' an event share responsibility for the indirect emissions in equal share to their portion of the costs.⁶ McCullough et al. (2023) include "participant travel" in Scope 3 emissions calculations for running events.⁷ As it is not uncommon for U-M to pay non-conference teams well over \$1 million to come to Ann Arbor for a game⁸, it is reasonable to consider this a 'purchased good or service' that would fall under the Greenhouse Gas Protocol's Scope 3 emissions definition.

Figure 3 illustrates the combined travel emissions of both teams from U-M games for both conference-only and regular season games. There is a marked increase in total emissions after the 2024 conference expansion. Although Figure 2 showed a more 'modest' 129% increase in U-M team emissions for conference-only games post-2024, we argue this combined view's 162% increase in conference-only games is a more complete representation of the emissions impact that U-M bears (partial) responsibility for.

⁶ Indirect Emissions from Events and Conferences. December 2018. EPA Center for Corporate Climate Leadership, USEPA, https://19january2021snapshot.epa.gov/sites/static/files/2018-12/documents/indirectemissions_draft2_12212018_b_508pass_3.pdf.

⁷ McCullough, Brian & Collins, Andrea & Roberts, Jack & Villalobos, Shelley. (2023). Sport Events and Emissions Reporting: An Analysis of the Council for Responsible Sport Standard in Running Events. Sustainability. 15. 14375. 10.3390/su151914375.

⁸ Layberger, Tom. "Week 1 of 2024 College Football Season Includes Guarantee Games Nearing \$2 Million." *Forbes Magazine*, 26 June 2024, www.forbes.com/sites/tomlayberger/2024/06/23/first-full-week-of-2024-college-football-season-includes-guarantee-games-nearing-2-million/.

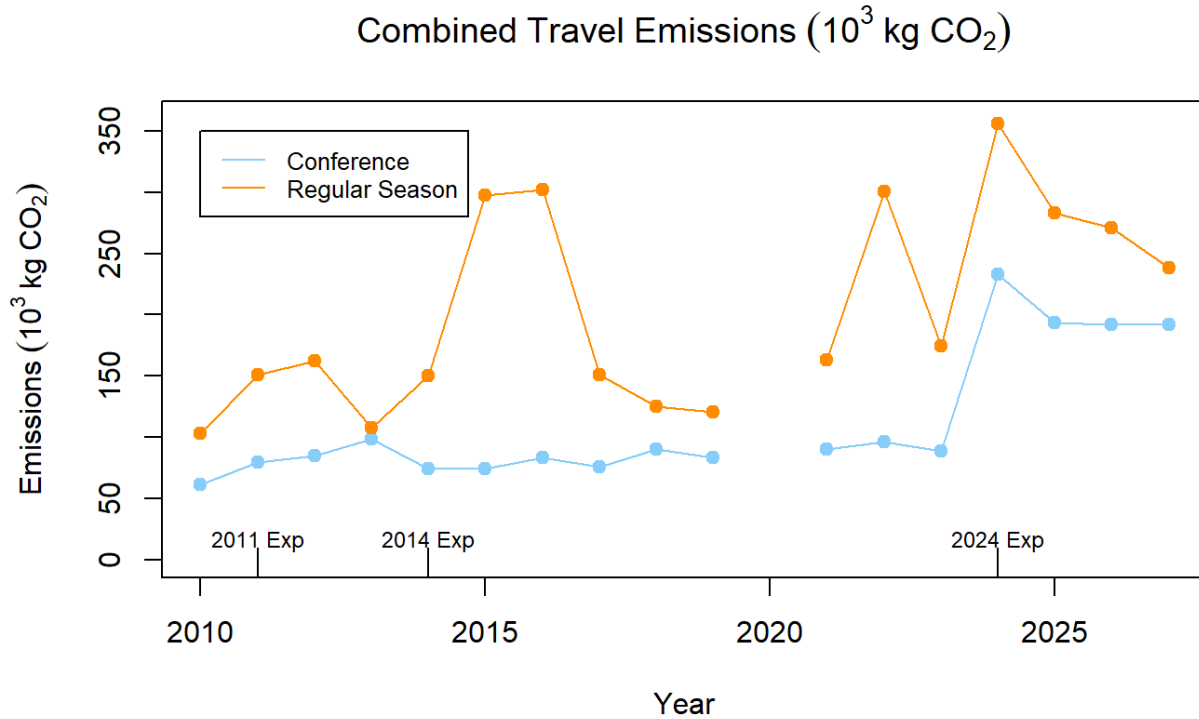


Figure 3. Combined travel emissions for conference and regular season games, 2020 COVID season excluded.

Fan Travel

The analysis above includes only the impact of team (player and staff) travel, similar to Hong et al. Previous research suggests that fans traveling to games often produce more emissions than the teams themselves, with fans utilizing various methods of transport, from individual car journeys to long-distance, private flights. Dolf and Teehan (2014) demonstrate that fan travel dominates the impacts of sporting events, even in cases of relatively small athletic departments and low attendance levels at the University of British Columbia.⁹ A 2023 report from Net Zero Now looking at the Men’s Vitality IT20 cricket match between New Zealand and England found that fan travel represented over 75% of the game’s total footprint.¹⁰ Fan travel is likely to dominate given the large number of people traveling, but we can assume that the most recent conference expansion is likely to drive emissions even higher.

We are not, at this time, able to estimate the emissions of fan travel to U-M football games or the impact of the expansion on fan travel. However, anecdotally, *MLive* reported about private planes parked at the Ann Arbor Municipal Airport for the duration of the September 2024 game between U-M and the University of Texas. Several of the planes arrived from Texas, with others

⁹ Dolf, M., & Teehan, P. (2014). Reducing the carbon footprint of spectator and team travel at the University of British Columbia’s varsity sports events. *Sport Management Review*, 18(2), 244–255. <https://doi.org/10.1016/j.smr.2014.06.003>

¹⁰ “Edgbaston Stadium Go Green Game.” *Net Zero Now*, Dec. 2023, <https://assets.edgbaston.com/wp-content/uploads/2024/01/Edgbaston-Go-Green-Game-Report.pdf>.

making the trip from Chicago.¹¹ The outsize emissions associated with private jet travel¹² mean that even a small number of visitors flying across the country to U-M football games could have a large impact on emissions.

We believe a critical next step is to assess fan travel emissions from the conference expansion. Fortunately, U-M School of Kinesiology Associate Professor and Program Chair of Sport Management Brian McCullough is actively involved in research to develop accurate emission estimates from fan travel.¹³

The University of Michigan, Football, and Sustainability

U-M, one of the founding members of the Big Ten Conference, is steeped in a rich football legacy that is second to none. From claiming victory in the 1902 Rose Bowl—the very first college football bowl game—to holding the record for the most wins in college football history, the Michigan Wolverines have a lot to celebrate.

Along with a commitment to athletic excellence, U-M has also been a vocal leader in sustainability, holding a Gold rating in the Sustainability Tracking, Assessment, and Rating System (STARS).¹⁴ U-M is a founding member of the Midwest Climate Collaborative, is the lead institution for the University Climate Change Coalition, and is a member of the U.S. Department of Energy Better Climate Challenge, the International Sustainable Campus Network, and the U.S. EPA Green Power Partnership. The University boasts more than 10,000 certified Planet Blue Ambassadors, more than 120 student organizations focusing on sustainability or the environment, and more than 650 faculty actively working on research related to sustainability.¹⁵

U-M has committed to eliminate on-campus direct greenhouse gas emissions (Scope 1) by 2040 and to reduce emissions from purchased power (Scope 2) to net zero by 2025. U-M plans to establish goals for indirect emissions (Scope 3) in 2025 and aims to achieve a net-zero endowment by 2050.¹⁶

¹¹ Kahn, Andrew. "For Michigan football games, some fans fly into Ann Arbor on private planes." *MLive*, 19 Sep. 2024,

<https://www.mlive.com/wolverines/2024/09/for-michigan-football-games-some-fans-fly-into-ann-arbor-on-private-planes>.

¹² Gössling, Stefan, Andreas Humpe, and Jorge Cardoso Leitão. "Private aviation is making a growing contribution to climate change." *Communications Earth & Environment*, vol. 5, no. 666, 7 Nov. 2024, <https://doi.org/10.1038/s43247-024-01775-z>.

¹³ "Brian McCullough, PhD." *University of Michigan School of Kinesiology*, <https://www.kines.umich.edu/directory/brian-mccullough>, Accessed 24 Oct. 2024.

¹⁴ Fisher, Adam. "U-M Earns Gold Rating for Climate, Sustainability Work." *The University Record*, University of Michigan, 10 Mar. 2023, <https://record.umich.edu/articles/u-m-earns-gold-rating-for-climate-sustainability-work/>.

¹⁵ "Environment, Sustainability, and Carbon Neutrality." *Office of the President*, University of Michigan, <https://president.umich.edu/initiatives-and-focus-areas/environment-sustainability-and-carbon-neutrality/>. Accessed 19 Nov. 2024.

¹⁶ "Goals." *Planet Blue*, University of Michigan, <https://planetblue.umich.edu/campus/goals-and-dashboards/goals>. Accessed 19 Nov. 2024.

In 2021, as part of its commitment to reducing emissions, the U-M President's Commission on Carbon Neutrality (PCCN) proposed a travel mitigation fee on university travel, including for athletics. The PCCN acknowledged that there are significant reservations about the fee, which may have influenced its non-implementation.¹⁷ More recently, the 2023-24 State of Student Sustainability report highlights continued student advocacy for carbon pricing strategies, including the implementation of an air travel mitigation fee. This reflects ongoing student engagement and support for measures that could help the university manage its Scope 3 emissions effectively.¹⁸

While U-M has positioned itself as a leader in sustainability within higher education, the recent Big Ten expansion contradicts this image and poses significant challenges to the University's commitments. By welcoming West Coast teams into the conference, U-M has significantly increased the travel required for athletic events, leading to a dramatic rise in associated carbon emissions. This increase challenges U-M's ambitious goals for reducing greenhouse gas emissions, raises questions about its commitment to achieving carbon neutrality, and fails to fully respect the substantial efforts of the many U-M community members who have been working tirelessly on sustainability initiatives. As U-M continues to strive for sustainability leadership, reconciling the increased emissions resulting from expanded athletic schedules with its aggressive environmental goals will be critical. This challenge highlights the complex interplay between collegiate conference expansion and the urgent need for higher education institutions to lead the way in decarbonization.

Looking to the Future

U-M football fans can do our part by walking, biking, taking public transportation, and carpooling to the Big House and other stadiums where the Wolverines take the field. If traveling by car, opt for an electric vehicle over a traditional internal combustion engine vehicle and don't travel solo. Enjoy distant away games locally on a big screen in a festive atmosphere, like the "Game Watch" parties hosted in Ann Arbor. And if you must travel, opt for a commercial flight instead of private.

Following the latest Big Ten Conference expansion, we have three key recommendations. First, U-M athletics should include U-M and opponent travel emissions in the decision process for scheduling non-conference games.¹⁹ Second, U-M can include emissions from athletic travel (both team and fans) in their Scope 3 emissions target-setting process. Including these emissions in the Scope 3 accounting will encourage U-M to track and reduce these emissions and would demonstrate the aspiration to be "Leaders and Best." Third, and in the longer term, U-M may want to use its influence to push for a return to a more regional hosting model, a best practice being advocated by some across the sporting industry.

¹⁷ Williams, John, et al. "University-Sponsored Travel at the University of Michigan." *Michigan Publishing*, University of Michigan, 2021, <https://doi.org/10.3998/mpub.12095006>.

¹⁸ "2023-24 State of Student Sustainability." *Student Sustainability Coalition*, University of Michigan Planet Blue, 2024, <https://planetblue.umich.edu/campus/uploads/ssc-state-of-student-sustainability-23-24.pdf>.

¹⁹ Müller, M., Wolfe, S.D., Gaffney, C. et al. An evaluation of the sustainability of the Olympic Games. *Nat Sustain* 4, 340–348 (2021). <https://doi.org/10.1038/s41893-021-00696-5>

U-M President Santa Ono, in an April 2023 presentation²⁰, said that “addressing climate change” was his and the University community’s “number one priority” and encouraged students to “hold [his] feet to the fire” on it. He added that it was worth investing in, even at the cost of short-term budget metrics, saying “if there’s no planet, what does [the bottom line] matter?” We would ask the same about football. We strongly encourage U-M to take the actions recommended above, and heavily weigh the climate implications of all athletic and campus decisions, so that we can continue to enjoy watching the winningest football team on a healthy, thriving planet.

²⁰ Kisner, Kim. “University of Michigan President Santa Ono Expands on Sustainability Agenda at SBND event.” SBN Detroit, 11 April 2023, <https://sbn-detroit.org/university-of-michigan-president-santa-ono-expands-on-sustainability-agenda-at-sbnd-event/>. Accessed 14 November 2024.

Appendix

Changes in Travel Schedules

Distances were estimated using nautical miles between the airports closest to each school. If the distance was under 200 miles, we assumed teams traveled by bus. In 2023, Michigan's longest trip was to Nebraska, covering a round-trip distance of 2,256 kilometers. Other away games included Maryland (1,316 kilometers round trip), Minnesota (918 kilometers round trip), and Penn State (968 kilometers round trip). Shorter trips included the game against Michigan State, which involved a round-trip drive of only 204 kilometers. Michigan's home game against UNLV didn't require any travel for the team, but UNLV traveled 5,628 kilometers round trip from Las Vegas.

In 2024, Michigan travels to Washington, covering a round-trip distance of 6,204 kilometers, the longest trip of the season. Although Michigan plays USC and Oregon at home, those teams combine for over 12,800 kilometers traveled to and from Ann Arbor. Other away games in 2024, such as Illinois (478 kilometers), are shorter in comparison but still add to the overall increased travel burden.

Total conference travel in 2024 will rise to 8,494 kilometers for Michigan, compared to 5,662 kilometers in 2023. The combined conference travel for both Michigan and its opponents reaches 23,174 kilometers in 2024, up from 9,256 kilometers in 2023. From 2024 to 2027, the average kilometers traveled for both Michigan and their opponents is estimated to be about 20,242, while the average for 2019-2023 was just 9,347 kilometers.

It is also important to note that football is not the only sport affected by this conference expansion. Other teams (e.g., volleyball, soccer, basketball, baseball) travel more frequently than football and, despite some teams flying commercial, will also have increased emissions from longer travel distances. These team's travel, events, and fans all contribute to the overall emissions of the athletic department, but characterizing these additional emissions sources are beyond the scope of this report.