NATIONAL CENTER FOR UNDERSTANDING FUTURE
TRAVEL BEHAVIOR AND DEMAND

Final Project Report

Time Use, Travel, and Telework Dashboard (T3D)

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May 2026

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. N/A	**2. Government Accession No.** N/A	**3. Recipient's Catalog No.** N/A	
4. Title and Subtitle Time Use, Travel, and Telework Dashboard (T3D)		**5. Report Date** May 2026	
		6. Performing Organization Code N/A	
7. Author(s) Irfan Batur, https://orcid.org/0000-0002-8058-2578 Ram M. Pendyala, https://orcid.org/0000-0002-1552-9447 Ashwat L. Bhat, Mohammed Zaid, https://orcid.org/0009-0006-1219-7914		**8. Performing Organization Report No.** N/A	
9. Performing Organization Name and Address School of Sustainable Engineering and the Built Environment Arizona State University Tempe, AZ 85287		**10. Work Unit No. (TRAIS)** N/A	
		11. Contract or Grant No. 69A3552344815 and 69A3552348320	
12. Sponsoring Agency Name and Address U.S. Department of Transportation, University Transportation Centers Program, 1200 New Jersey Ave, SE, Washington, DC 20590		**13. Type of Report and Period Covered** Final Report, 2024-2026	
		14. Sponsoring Agency Code USDOT OST-R	
15. Supplementary Notes Dashboard accessible at: https://tomnetutc.github.io/t3d/			

16. Abstract

The American Time Use Survey (ATUS) provides a comprehensive source of information on the daily activities and time use patterns of Americans and has broad applications in transportation planning, economics, public policy, and urban planning. Despite its immense value, the complexity and scale of ATUS data make it difficult for policymakers, planners, researchers, and the general public to access, interpret, and utilize the information efficiently. Extracting meaningful insights often requires advanced analytical skills and repetitive data processing efforts, which create substantial barriers to the broader use of the dataset. To address these challenges and support the TBD Center's broader Data Hub initiative, this project developed the Time Use, Travel, and Telework Dashboard (T3D), a web-based interactive platform designed to improve the accessibility and interpretability of ATUS data. T3D provides users with instant insights into Americans' time use, travel behavior, and work arrangement patterns using ATUS data from 2003 to the present. The dashboard includes three dedicated topical modules focusing on the time use, travel, and telework aspects of the ATUS data. Within each topical module, the dashboard further provides within-year, between-year, and cross-segment analysis capabilities, allowing users to extract insights at multiple levels using various metrics of interest that can be customized for population segments defined by users through a set of socio-economic, demographic, and travel-related attributes. The project also explored and implemented efficient data processing and visualization techniques to ensure the dashboard remains responsive, scalable, and user-friendly. By transforming complex ATUS datasets into an accessible and interactive platform, T3D expands the usability and impact of ATUS data while supporting interdisciplinary research and evidence-based decision-making.

17. Key Words American Time Use Survey (ATUS); time use; travel behavior; telework; work-from-home; data dashboard; data visualization; transportation planning; travel trends		**18. Distribution Statement** No restrictions.	
19. Security Classif.(of this report) Unclassified	**20. Security Classif.(of this page)** Unclassified	**21. No. of Pages** 28	**22. Price** N/A

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated in the interest of information exchange. The report is funded, partially or entirely, under Grant No. 69A3552344815 and 69A3552348320 from the U.S. Department of Transportation's University Transportation Centers Program. The U.S. Government assumes no liability for the contents or use thereof.

ACKNOWLEDGMENTS

This research was supported by the National Center for Understanding Future Travel Behavior and Demand (TBD) and the Center for Teaching Old Models New Tricks (TOMNET), both National University Transportation Centers sponsored by the U.S. Department of Transportation (USDOT) under grant numbers 69A3552344815 and 69A3552348320. The authors would like to thank the TBD National Center, the TOMNET University Transportation Center, and USDOT for their support of university-based research in transportation.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The American Time Use Survey (ATUS) provides a comprehensive source of information on the daily activities and time use patterns of Americans and has broad applications in transportation planning, economics, public policy, and urban planning. Despite its immense value, the complexity and scale of ATUS data make it difficult for policymakers, planners, researchers, and the general public to access, interpret, and utilize the information efficiently. Extracting meaningful insights often requires advanced analytical skills and repetitive data processing efforts, which create substantial barriers to the broader use of the dataset. To address these challenges and support the TBD Center's broader Data Hub initiative, this project developed the Time Use, Travel, and Telework Dashboard (T3D), a web-based interactive platform designed to improve the accessibility and interpretability of ATUS data. T3D provides users with instant insights into Americans' time use, travel behavior, and work arrangement patterns using ATUS data from 2003 to the present. The dashboard includes three dedicated topical modules focusing on the time use, travel, and telework aspects of the ATUS data. Within each topical module, the dashboard further provides within-year, between-year, and cross-segment analysis capabilities, allowing users to extract insights at multiple levels using various metrics of interest that can be customized for population segments defined by users through a set of socio-economic, demographic, and travel-related attributes. The project also explored and implemented efficient data processing and visualization techniques to ensure the dashboard remains responsive, scalable, and user-friendly. By transforming complex ATUS datasets into an accessible and interactive platform, T3D expands the usability and impact of ATUS data while supporting interdisciplinary research and evidence-based decision-making.

1. INTRODUCTION

Transportation systems in the United States are shaped by the daily decisions of millions of individuals regarding how they allocate their time across a variety of activities (including travel and work). Over the past two decades, travel behavior and activity participation patterns have undergone substantial changes driven by advances in information and communication technologies, demographic and lifestyle shifts, economic and policy changes, climate-related disruptions, and the societal impacts of the COVID-19 pandemic. Understanding these behavioral changes has become increasingly important for transportation planning, public policy, and broader efforts related to mobility, accessibility, and quality of life.

The American Time Use Survey (ATUS), administered annually by the U.S. Bureau of Labor Statistics (BLS) since 2003, provides a comprehensive and longitudinal record of how Americans spend their time over a day. The survey includes detailed information on daily activities, travel behavior, work arrangements, and socio-demographic characteristics, making it an important resource for researchers and practitioners across multiple disciplines. Despite its richness and analytical potential, the complexity and scale of ATUS data make it difficult for policymakers, planners, researchers, and the general public to efficiently access, process, interpret, and utilize the information. Extracting meaningful insights often requires substantial technical expertise and repetitive data processing efforts, which create significant barriers to the broader use of the dataset.

To address these challenges, this project developed the Time Use, Travel, and Telework Dashboard (T3D), a web-based interactive platform designed to improve the accessibility and interpretability of ATUS data. Developed as part of the TBD Center's broader Data Hub initiative, T3D provides users with instant insights into Americans' time use, travel behavior, and work arrangement patterns using ATUS data from 2003 to the present. The dashboard includes three dedicated topical modules focusing on time use, travel, and telework, each providing within-year, between-year, and cross-segment analytical capabilities that are fully customizable for user-defined population segments.

The within-year analysis module provides a comprehensive view of ATUS data for a selected year and enables users to examine detailed behavioral patterns for customized population segments. The between-year analysis module enables users to examine the temporal evolution of selected metrics over a user-defined time period for customized population segments. The cross-segment analysis module enables users to compare a selected metric of interest across multiple user-defined population segments simultaneously. Across all analytical modules, users can customize analyses using a wide range of socio-economic, demographic, and travel-related attributes.

This report presents the design, development, and analytical capabilities of T3D. The following section introduces the ATUS dataset and describes the data processing framework developed for the dashboard. The subsequent section presents the structure, design, and analytical capabilities of the dashboard, including its visualization framework and user interface. The report then presents selected analytical findings generated through T3D, followed by concluding remarks and future research directions.

2. DATA

This section describes the primary data source used throughout T3D and the analytical framework developed to support the dashboard. The section first introduces the American Time Use Survey (ATUS) and its activity diary structure, followed by the activity and travel classification framework used throughout the dashboard. The section then describes the three topical areas implemented in T3D – Time Use, Travel, and Telework. Finally, additional behavioral concepts incorporated into the dashboard and the annual ATUS sample sizes used throughout the study period are presented.

2.1. American Time Use Survey (ATUS)

The primary data source for T3D is the American Time Use Survey (ATUS), the only federally administered survey that provides nationally representative information on how Americans allocate their time across daily activities. The ATUS is conducted annually by the U.S. Bureau of Labor Statistics (BLS) and has been fielded continuously since 2003 (2). Survey respondents are selected from the outgoing rotation groups of the Current Population Survey (CPS), ensuring that the ATUS sample is representative of the civilian, non-institutionalized population of the United States aged 15 years and older. Each year, the survey collects information from approximately 10,000 respondents, with diary days distributed across all days of the week and months of the year to ensure representative estimates of typical daily behavior patterns. Survey weights provided by the BLS are applied throughout T3D to produce nationally representative estimates. T3D incorporates ATUS data from 2003 through survey year 2024, providing more than two decades of continuous and comparable time use records.

ATUS provides two major components used throughout T3D: respondent-level socio-economic and demographic characteristics and a detailed 24-hour activity diary. The respondent characteristics, inherited from the CPS, include variables such as gender, age, race and ethnicity, educational attainment, employment status, household income, household size, presence of children, and household location. The activity diary records all activities conducted during a 24-hour period beginning at 4:00 AM on the diary day and ending at 4:00 AM on the following day. For each activity episode, the survey records the activity type, start and end time, activity location, and accompanying persons. Travel is recorded as a separate activity category with associated trip purpose and transportation mode information. All activity episodes for a respondent sum to exactly 1,440 minutes per day.

2.2. Activity and Travel Classification

ATUS activities are organized using a three-level hierarchical lexicon that enables analyses at both aggregate and highly detailed activity levels. At the highest level, activities are grouped into 18 major categories, including personal care, household activities, work and work-related activities, education, socializing and leisure, sports and recreation, eating and drinking, traveling, and other daily activities. Each category is further disaggregated into increasingly detailed subcategories within the ATUS coding structure.

The hierarchical structure of the ATUS lexicon is particularly important for the travel-related analyses implemented in T3D. Travel activities are classified by both trip purpose and transportation mode, enabling detailed analyses of daily travel behavior patterns. Because the ATUS also records the location associated with each activity episode, activities can be differentiated as occurring in-home or out-of-home. This distinction forms a central component of both the Time Use and Telework modules within T3D.

2.3. Topical Areas

T3D organizes the ATUS data series into three primary topical areas corresponding to the three major dashboard modules: Time Use, Travel, and Telework. Each module is designed to support interactive analyses of behavioral patterns using ATUS data from 2003 through 2024.

The *Time Use* module visualizes time allocation patterns across the 18 major ATUS activity categories. Because the ATUS records activity locations, T3D further differentiates activities based on whether they occur in-home or out-of-home. The module, therefore, enables analyses of both activity participation and activity location patterns, along with their evolution since 2003.

The *Travel* module focuses on travel episodes recorded within respondents' daily diaries. Travel episodes are aggregated to the person-day level to derive daily travel behavior measures, including trip-making frequency, total travel duration, travel mode shares, and trip purpose distributions. The module also tracks zero trip-making behavior, defined as diary days during which respondents report no travel activity episodes.

The *Telework* module examines daily work arrangements using the location information associated with work activity episodes recorded in the ATUS diary. Workers reporting no work activity on the diary day are classified as workers with zero work. Among respondents reporting work activity, workers whose work episodes occur exclusively at home are classified as in-home only workers, those whose work episodes occur exclusively outside the home are classified as commuters only, and those reporting work activity both at home and outside the home on the same diary day are classified as multi-site workers. Because this classification is derived directly from observed daily activity diaries, the Telework module captures actual daily work behavior rather than self-reported usual work arrangements.

2.4. Additional Behavioral Concepts

T3D additionally incorporates two behavioral concepts derived from the ATUS activity diaries: time poverty and zero trip-making. Both concepts extend beyond traditional activity and travel measures by capturing broader dimensions of individual wellbeing, mobility, and daily behavioral constraints. These concepts have become increasingly important in the context of changing work arrangements, evolving activity participation patterns, and growing concerns regarding social exclusion and quality of life.

Time poverty is defined as the condition in which individuals do not have sufficient discretionary time available for leisure and other non-obligatory activities, and is associated with diminished wellbeing. Unlike conventional economic poverty measures, time poverty focuses on limitations in available discretionary time resulting from necessary and committed daily activities. To identify time poor individuals, activities are first classified into necessary and committed activity groups, including personal care, household activities, caregiving, and work-related activities, with the remaining activities treated as discretionary. The discretionary time available to each respondent is then calculated based on the remaining time within the 24-hour activity diary. Following prior work (Batur et al., 2023; Batur, 2024), individuals are classified as time poor if their discretionary time falls below 60 percent of the median discretionary time observed for the full ATUS sample in a given year. Incorporating time poverty into T3D enables analyses of disparities in discretionary time availability across years and population segments.

The second concept incorporated in T3D is zero trip-making, defined as diary days during which respondents report no travel activity episodes. Zero trip-making behavior reflects situations in which individuals do not leave home during the diary day and serves as an indicator of reduced mobility and potential social exclusion. The concept has become increasingly relevant in recent years due to the growth of telework, online activity participation, changing travel behavior patterns, and broader shifts in daily lifestyles.

2.5. Sample Sizes

Table 1 presents the annual ATUS sample sizes used throughout T3D for the 2003–2024 analysis period. Sample sizes gradually declined over time, decreasing from 20,454 respondents in 2003 to 7,608 respondents in 2024.

Table 1. ATUS Sample Sizes by Year (2003–2024)

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Number of respondents	20,454	13,790	12,894	12,787	12,102	12,553	12,873	12,984	12,238	12,249	11,228
Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Number of respondents	11,440	10,776	10,384	10,114	9,506	9,333	8,695	8,992	8,048	8,455	7,608

3. DASHBOARD DESIGN AND CAPABILITIES

T3D is developed as a web-based interactive platform designed to improve the accessibility, interpretability, and usability of ATUS data for researchers, planners, policymakers, and the general public. T3D is publicly available at https://tomnetutc.github.io/t3d/ and designed to support both exploratory analyses and detailed longitudinal investigations while minimizing the technical barriers typically associated with working directly with raw ATUS data.

T3D is organized around three primary topical modules corresponding to the major behavioral dimensions examined in the platform: Time Use, Travel, and Telework. Each module incorporates interactive visualizations, summary indicators, and downloadable data products that allow users to examine behavioral patterns across different years, day types, and user-defined population segments. All analyses are dynamically updated based on user-selected filters and segmentation criteria, enabling flexible exploration of ATUS data without requiring advanced programming or statistical expertise.

Across all topical modules, T3D implements a common analytical framework consisting of within-year, between-year, and cross-segment analyses. Together, these analytical modes enable users to examine behavioral patterns within years, across years, and comparatively across different population groups. Representative screenshots from the platform interface and analytical components are included throughout this section.

3.1. T3D Analytical Capabilities

The *within-year analysis* mode provides a comprehensive cross-sectional view of behavioral patterns for a selected survey year and day type, including all days, weekdays, or weekends. This mode enables users to examine detailed behavioral metrics and visualizations for customized population segments defined using combinations of socio-economic, demographic, household, and travel-related characteristics. The within-year analysis mode is designed to provide an integrated

overview of activity participation, travel behavior, and work arrangements for a selected population group within a specific year.

The *between-year analysis* mode enables users to examine the temporal evolution of selected behavioral indicators over user-defined time periods spanning the 2003–2024 ATUS data series. This mode supports longitudinal analyses of changing activity participation patterns, travel behavior, and work arrangements across different population segments and societal conditions. Trend visualizations and associated summary indicators allow users to identify long-term behavioral shifts, major disruptions, and evolving population-level patterns over time.

The *cross-segment analysis* mode enables direct comparison of a select behavioral metric across multiple user-defined population segments simultaneously. Users can define and compare up to five distinct segments using combinations of socio-economic, demographic, household, and travel-related attributes. This analytical mode is particularly useful for examining behavioral differences across population groups and identifying variations in time use, mobility, and telework behavior.

3.2. Time Use Module

The Time Use module examines how Americans allocate their daily time across the 18 major activity categories defined within the ATUS activity lexicon. In addition to tracking activity participation, the module leverages the activity location information available in ATUS to differentiate between activities conducted in-home and out-of-home. This distinction is particularly important given the substantial changes in activity participation patterns associated with advances in information and communication technologies, the growth of e-commerce and telework, and broader societal shifts observed over the past two decades. By simultaneously examining activity type and activity location, the Time Use module provides a comprehensive view of how Americans spend their time and how these patterns have evolved from 2003 through 2024.

3.2.1. Time Use Module: Within-Year Analysis

The within-year analysis provides a comprehensive snapshot of daily time allocation patterns for a selected survey year and day type (all days, weekdays, or weekends). The primary visualization consists of a horizontal bar chart displaying average minutes per person per day devoted to each of the 18 activity categories, with each activity decomposed into in-home and out-of-home components. This visualization enables users to examine not only how time is distributed across activities, but also where those activities predominantly take place. A complementary donut chart summarizes the proportional distribution of time across activity categories.

In addition to activity distributions, the within-year analysis reports several summary indicators, including the share of the ATUS sample represented by the selected population segment, the time poverty rate, the average number of activities per person per day, and average daily out-of-home time. Together, these metrics provide a broad overview of activity participation patterns and daily lifestyles for the selected population segment. Figure 1 presents the within-year analysis interface for the Time Use module and the associated visualizations and summary indicators available to users.

3.2.2. Time Use Module: Between-Year Analysis

The between-year analysis examines how selected activity measures have evolved over the 2003–2024 period. Users may select any activity category and track changes in average daily participation over time, with separate trend lines reported for in-home and out-of-home activity durations. Additional trend indicators, including time poverty rates and aggregate daily out-of-home time, provide broader context for interpreting changes in activity participation patterns.

This analysis mode is designed to support longitudinal investigations of behavioral change, enabling users to identify long-term trends, major disruptions, and shifts in where and how daily activities are performed. By providing a consistent framework for examining activity participation over more than two decades, the between-year analysis facilitates the identification of persistent trends as well as major societal disruptions that have influenced daily behavior. Figure 2 illustrates the between-year analysis interface and the temporal trends available for selected activity measures.

3.2.3. Time Use Module: Cross-Segment Analysis

The cross-segment analysis enables direct comparison of selected activity measures across multiple user-defined population segments. Users may define up to five segments using combinations of socio-economic, demographic, household, and travel-related attributes and compare their activity participation patterns simultaneously.

For a selected activity category, trend lines display how average daily participation has evolved across all selected segments over time. This capability allows users to identify differences in time allocation patterns across population groups and examine how these differences have changed throughout the ATUS study period. The flexibility to define custom population segments enables analyses tailored to specific research, planning, and policy questions. Figure 3 presents the cross-segment analysis interface for comparing activity participation patterns across multiple user-defined population segments.

3.3. Travel Module

The Travel module examines daily travel behavior using the travel activity episodes recorded within the ATUS activity diaries. Travel episodes are aggregated to the person-day level to derive a variety of travel behavior measures, including daily trip frequency, travel duration, mode choice, trip purpose, and zero trip-making behavior. Together, these measures provide a comprehensive view of daily mobility patterns and how they have evolved over time. The module enables users to examine both aggregate travel trends and differences across population groups using the common analytical framework implemented throughout T3D.

3.3.1. Travel Module: Within-Year Analysis

The within-year analysis provides a comprehensive snapshot of travel behavior for a selected survey year and day type (all days, weekdays, or weekends). Summary indicators include the share of the ATUS sample represented by the selected population segment, the average number of daily trips per person, average daily travel duration, the trip-maker rate, and the zero trip-making rate. These indicators provide a concise overview of mobility patterns for the selected population segment.

The within-year interface also includes visualizations of travel mode shares and trip purpose distributions. Mode share visualizations summarize the distribution of trips across transportation

modes, including automobile, public transit, walking, bicycling, and other modes. Trip purpose visualizations summarize the distribution of travel across major activity purposes, including work, education, consumer purchases, social and leisure activities, and other purposes. Together, these visualizations provide insight into both the quantity and characteristics of daily travel. Figure 4 presents the within-year analysis interface for the Travel module.

3.3.2. Travel Module: Between-Year Analysis

The between-year analysis enables users to examine how travel behavior measures have evolved throughout the 2003–2024 study period. Users can explore trends in daily trip-making, travel duration, mode shares, trip purposes, and zero trip-making behavior using interactive longitudinal visualizations. These analyses provide insight into long-term changes in mobility patterns and allow users to examine the effects of major societal, technological, economic, and public health disruptions on travel behavior.

By presenting travel indicators consistently across years, the between-year analysis supports investigations of changing mobility trends and evolving travel preferences over time. Figure 5 illustrates the between-year analysis interface and the temporal trend visualizations available within the Travel module.

3.3.3. Travel Module: Cross-Segment Analysis

The cross-segment analysis enables direct comparison of travel behavior measures across multiple user-defined population segments. Users may define up to five segments using combinations of socio-economic, demographic, household, and travel-related attributes and compare their travel behavior simultaneously.

The analysis supports comparisons across a wide range of travel indicators, including average daily trips, travel duration, mode shares, trip purpose distributions, trip-maker rates, and zero trip-making rates. By examining these measures across multiple population groups, users can identify differences in mobility patterns and investigate how these differences have evolved over time. Figure 6 presents the cross-segment analysis interface for comparing travel behavior across multiple user-defined population segments.

3.4. Telework Module

The Telework module examines daily work arrangements using the location information associated with work activity episodes recorded in the ATUS activity diaries. As described in Section 2, work modality is derived directly from the location of work activities reported on the diary day. This diary-based approach captures actual daily work behavior rather than self-reported usual work arrangements, enabling detailed analyses of how work location patterns have evolved over time.

The module classifies workers into four primary work arrangement categories: workers with zero work, in-home only workers, commuters only, and multi-site workers. Together, these categories provide a comprehensive framework for examining the prevalence of remote work, traditional commuting, and hybrid work arrangements within the U.S. population. By leveraging more than two decades of ATUS data, the Telework module enables users to investigate both long-term trends and recent changes in work behavior.

3.4.1. Telework Module: Within-Year Analysis

The within-year analysis provides a comprehensive snapshot of work arrangements for a selected survey year and day type (all days, weekdays, or weekends). Visualizations summarize the distribution of workers across the four work arrangement categories and report associated summary statistics, including the proportion of the sample represented by workers and the corresponding sample size.

Additional visualizations examine average work durations by work arrangement, allowing users to compare daily work patterns across different modalities. Together, these indicators provide an overview of the composition of the workforce and the prevalence of different work arrangements for the selected year and population segment. Figure 7 presents the within-year analysis interface for the Telework module.

3.4.2. Telework Module: Between-Year Analysis

The between-year analysis enables users to examine how work arrangements have evolved throughout the 2003–2024 study period. Interactive visualizations track annual changes in the distribution of workers across the four work arrangement categories and support separate analyses for all days, weekdays, and weekends.

This analysis mode enables users to investigate long-term trends in telework adoption, commuting behavior, and hybrid work arrangements, as well as the impacts of major societal and technological disruptions on work location choices. By providing a consistent longitudinal framework, the module allows users to examine how the composition of work arrangements has changed over more than two decades. Figure 8 illustrates the between-year analysis interface and the associated trend visualizations.

3.4.3. Telework Module: Cross-Segment Analysis

The cross-segment analysis enables direct comparison of work arrangement distributions across multiple user-defined population segments. Users may define up to five segments using combinations of socio-economic, demographic, household, and travel-related attributes and compare work arrangement patterns simultaneously.

This analytical mode supports investigations of how telework participation, commuting behavior, and hybrid work arrangements vary across different population groups. By enabling customized comparisons across user-defined segments, the analysis facilitates exploration of differences in work behavior across demographic, socioeconomic, and household characteristics. Figure 9 presents the cross-segment analysis interface for comparing work arrangements across multiple user-defined population segments.

3.5. Additional Features

In addition to the three primary topical modules, T3D includes several supporting features designed to improve usability, transparency, and analytical flexibility. These features facilitate customized analyses, provide access to underlying data, and help users better understand the characteristics of the ATUS sample underlying all dashboard outputs.

3.5.1. Population Segmentation

A key feature of T3D is its flexible population segmentation framework. Across all topical modules

and analytical modes, users can define customized population segments using a wide range of socio-economic, demographic, household, and travel-related attributes. Segment definitions are specified through an interactive filtering interface and are applied dynamically across all visualizations and summary indicators.

Available segmentation attributes include gender, age group, race and ethnicity, educational attainment, employment status, household income, household size, household composition, metropolitan status, and other respondent characteristics available within the ATUS dataset. The segmentation framework enables users to tailor analyses to specific populations of interest and supports direct comparisons across multiple user-defined groups.

3.5.2. Data Download

All visualizations within T3D include data export functionality that allows users to download the underlying processed data in comma-separated value (CSV) format. Downloaded files contain the values displayed in the corresponding visualization along with associated metadata necessary for interpretation. This functionality enables users to incorporate dashboard outputs into external analyses, reports, presentations, and research workflows while maintaining transparency regarding the underlying data.

3.5.3. Survey Sample Page

T3D includes a dedicated Survey Sample page that provides detailed information regarding the composition of the ATUS sample used throughout the platform. The page enables users to examine both weighted and unweighted sample characteristics across all survey years included in the dashboard.

The Sample Composition Between Years component visualizes how the distribution of selected demographic and socioeconomic characteristics has evolved across annual ATUS waves from 2003 through 2024. Available characteristics include age, race and ethnicity, educational attainment, employment status, household income, household size, and metropolitan status. The Sample Composition Within Year component provides detailed tabulations for a selected survey year, including respondent counts as well as weighted and unweighted percentages for all available categories. Figures 10 and 11 present an example of the Survey Sample page and its associated visualizations.

3.5.4. About Page and Data Dictionary

T3D also includes an About page that provides documentation regarding the dashboard, data sources, methodological definitions, and analytical concepts implemented throughout the platform. The page includes a comprehensive data dictionary describing all variables, metrics, classifications, and segmentation attributes available within T3D. This documentation is intended to improve transparency and facilitate consistent interpretation of dashboard outputs by users with varying levels of familiarity with the ATUS data series.

4. CONCLUSIONS

Understanding how individuals allocate their time, participate in activities, travel, and work is fundamental to understanding transportation systems and their evolution. Over the past two decades, rapid advances in information and communication technologies, changing demographics and lifestyles, evolving economic conditions, and major societal disruptions have fundamentally altered daily behavior patterns in the United States. These changes have important implications for transportation demand, accessibility, workforce participation, and quality of life. The American Time Use Survey (ATUS) provides a unique opportunity to examine these behavioral changes through its detailed and nationally representative record of daily activity participation. However, the complexity of the ATUS data has historically limited its accessibility and broader use.

This project addressed these challenges through the development of the Time Use, Travel, and Telework Dashboard (T3D), an interactive web-based platform designed to facilitate exploration and analysis of ATUS data from 2003 through 2024. By organizing the data into dedicated Time Use, Travel, and Telework modules and implementing within-year, between-year, and cross-segment analytical capabilities, T3D enables users to examine behavioral patterns from multiple perspectives while tailoring analyses to population groups of interest. The platform transforms a complex and highly detailed dataset into an accessible analytical resource that can be readily used by researchers, planners, policymakers, and the general public.

The dashboard enables users to examine substantial changes in how Americans spend their time, travel, and work. The findings illustrate the growing importance of in-home activities, declining levels of daily travel, the emergence and persistence of telework and hybrid work arrangements, and considerable variation in behavioral patterns across population groups. More broadly, the platform highlights the value of examining time use, travel, and work arrangements as interconnected dimensions of daily behavior rather than as independent phenomena. Such an integrated perspective is increasingly important for understanding the behavioral impacts of technological innovation, changing lifestyles, and future societal disruptions.

T3D is publicly available at https://tomnetutc.github.io/t3d/ and provides researchers, planners, policymakers, and the general public with direct access to a comprehensive set of analytical tools for exploring ATUS data. By reducing the technical barriers associated with ATUS data and providing intuitive tools for exploration and visualization, the platform expands opportunities for interdisciplinary research and evidence-based decision-making.

REFERENCES

Batur, I., Dirks, A. C., Bhat, C. R., Polzin, S. E., Chen, C., and Pendyala, R. M. (2023). Analysis of Changes in Time Use and Activity Participation in Response to the COVID-19 Pandemic in the United States: Implications for well-being. Transportation Research Record, 03611981231165020. https://doi.org/10.1177/03611981231165020

Batur, I. (2023). Understanding and Modeling the Nexus of Mobility, Time Poverty, and Wellbeing (Doctoral dissertation, Arizona State University). https://hdl.handle.net/2286/R.2.N.189319

TBD National Center. Time Use, Travel, and Telework Dashboard (T3D) — Project Scope (Exhibit D, Grant # 69A3552344815 and 69A3552348320). Arizona State University, Tempe, AZ, 2024. Available at: https://tbd.ctr.utexas.edu/research-product/time-use-travel-and-telework-dashboard-t3d/

Bureau of Labor Statistics. American Time Use Survey User's Guide. U.S. Department of Labor, Washington, DC, 2024. Available at: https://www.bls.gov/tus/

FIGURES

Figure 1. Time Use Module – Within-Year Analysis Interface.

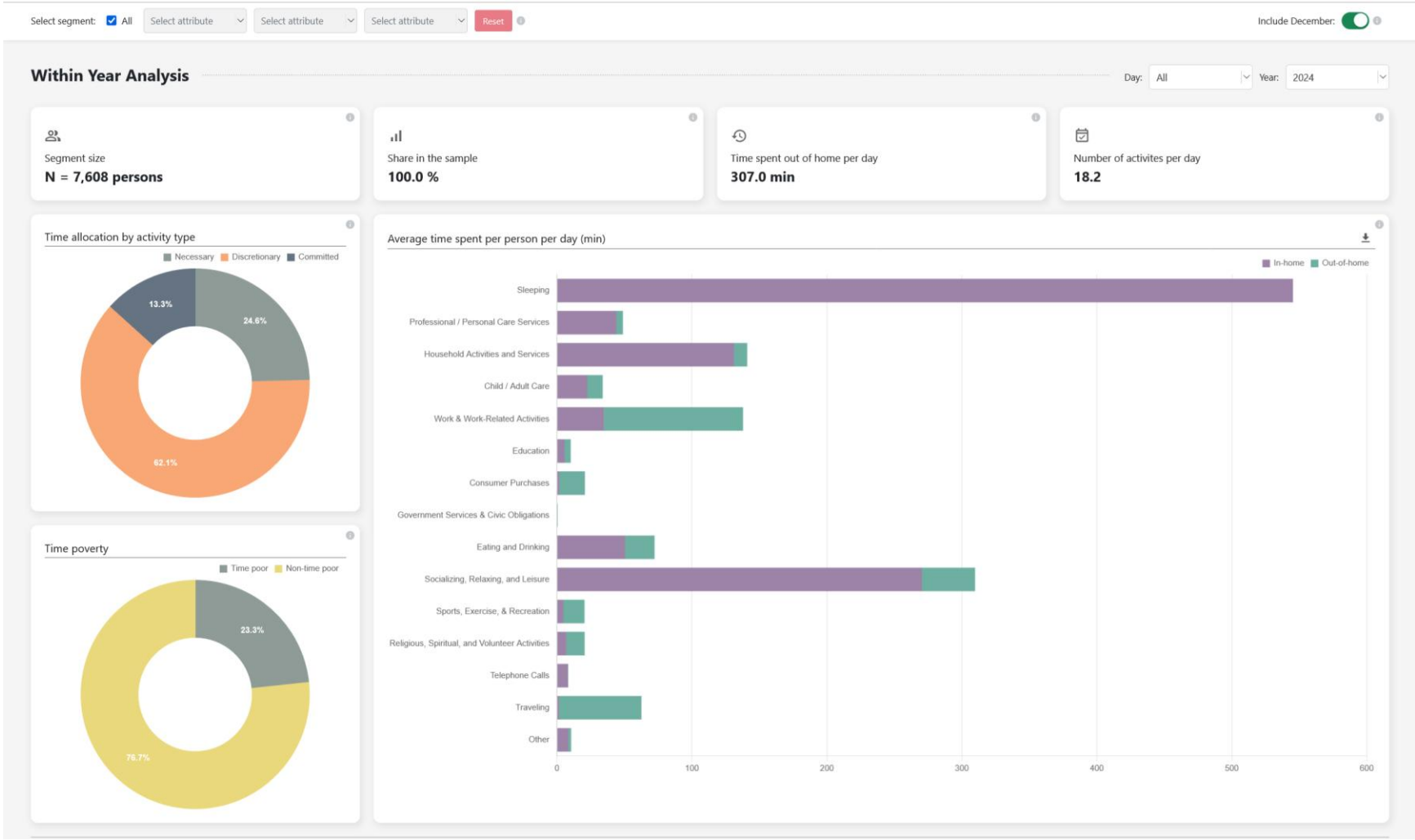
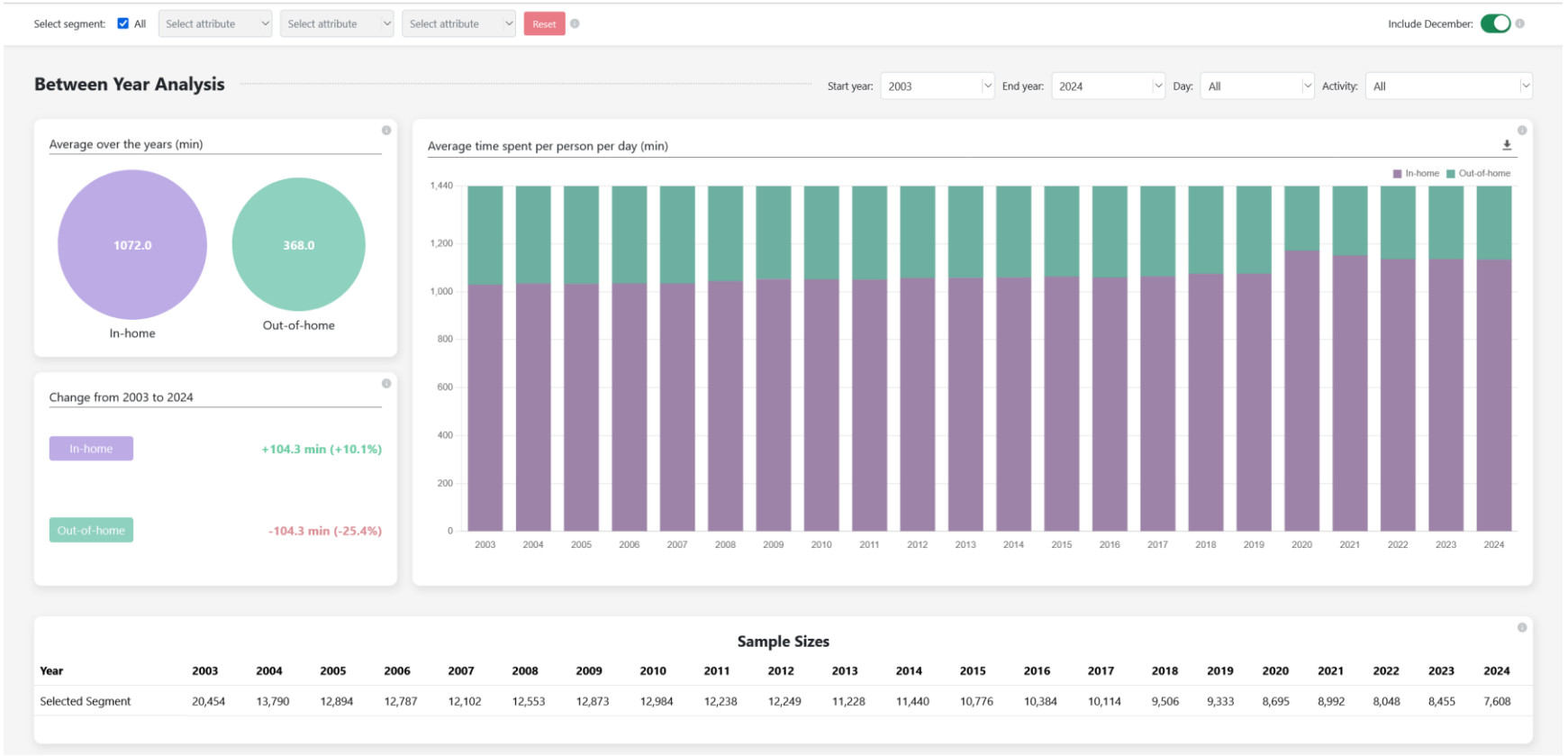
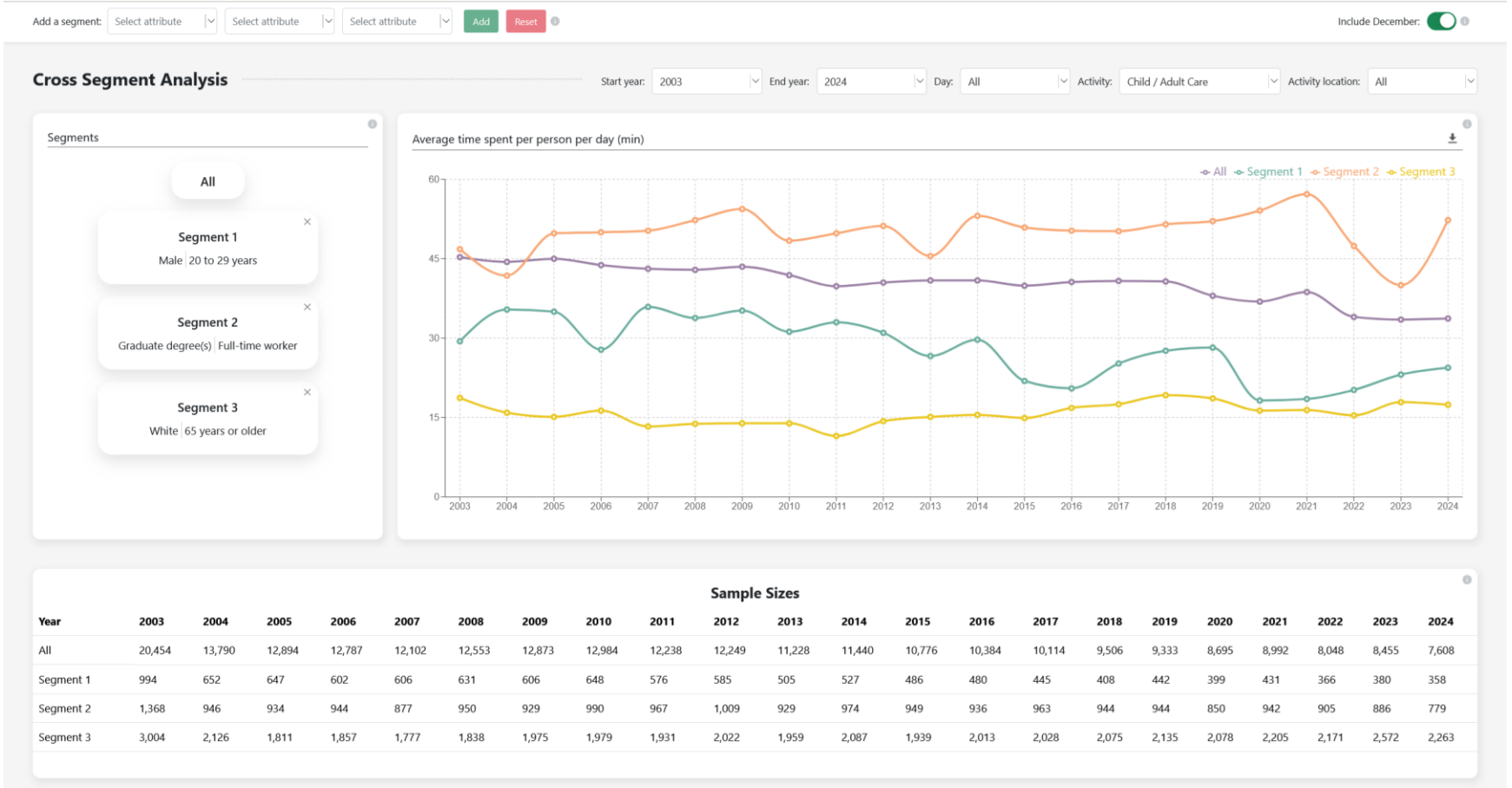


Figure 2. Time Use Module – Between-Year Analysis Interface.



Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Selected Segment	20,454	13,790	12,894	12,787	12,102	12,553	12,873	12,984	12,238	12,249	11,228	11,440	10,776	10,384	10,114	9,506	9,333	8,695	8,992	8,048	8,455	7,608

Figure 3. Time Use Module – Cross-Segment Analysis Interface.



Sample Sizes

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
All	20,454	13,790	12,894	12,787	12,102	12,553	12,873	12,984	12,238	12,249	11,228	11,440	10,776	10,384	10,114	9,506	9,333	8,695	8,992	8,048	8,455	7,608
Segment 1	994	652	647	602	606	631	606	648	576	585	505	527	486	480	445	408	442	399	431	366	380	358
Segment 2	1,368	946	934	944	877	950	929	990	967	1,009	929	974	949	936	963	944	944	850	942	905	886	779
Segment 3	3,004	2,126	1,811	1,857	1,777	1,838	1,975	1,979	1,931	2,022	1,959	2,087	1,939	2,013	2,028	2,075	2,135	2,078	2,205	2,171	2,572	2,263

Figure 4. Travel Module – Within-Year Analysis Interface.

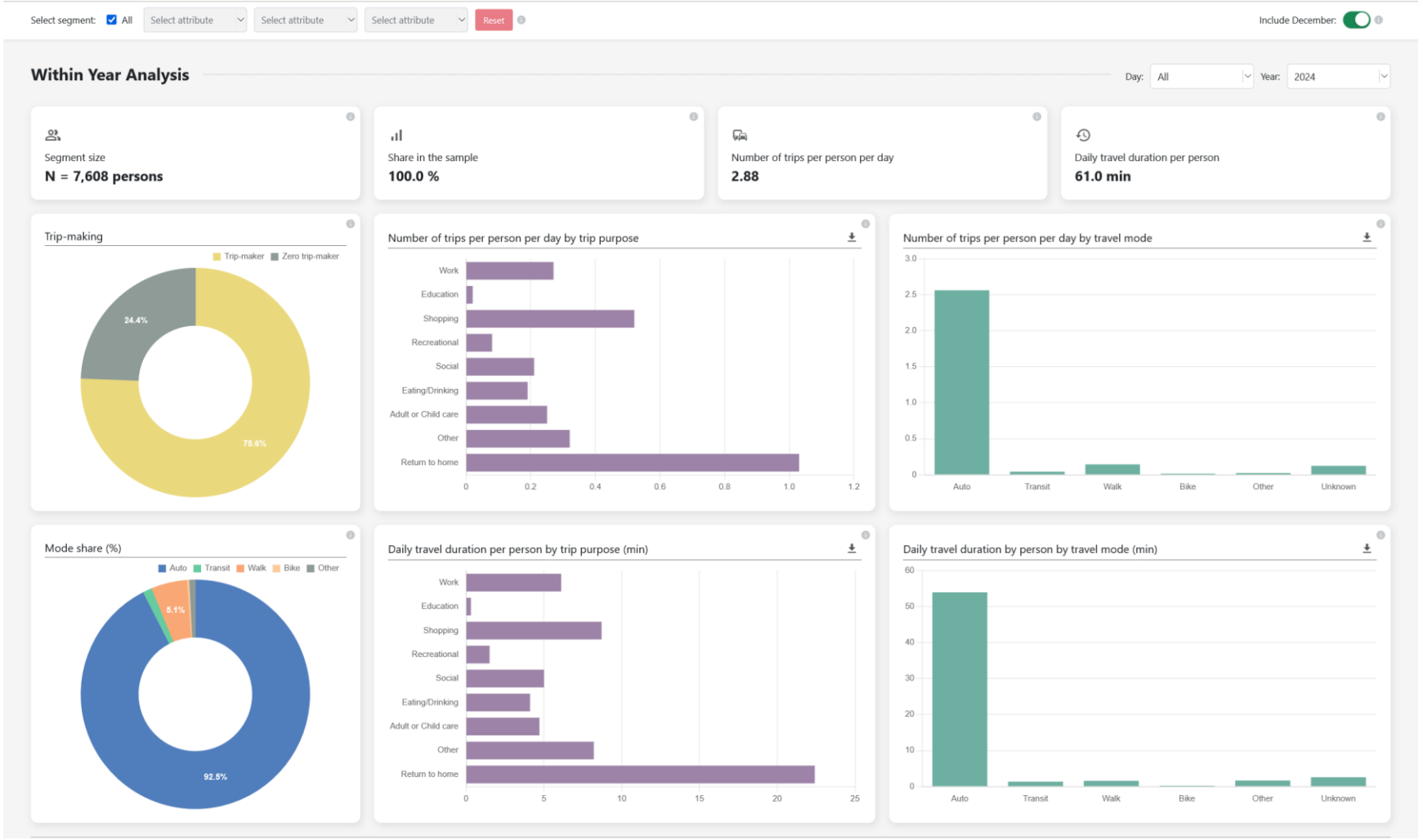


Figure 5. Travel Module – Between-Year Analysis Interface.

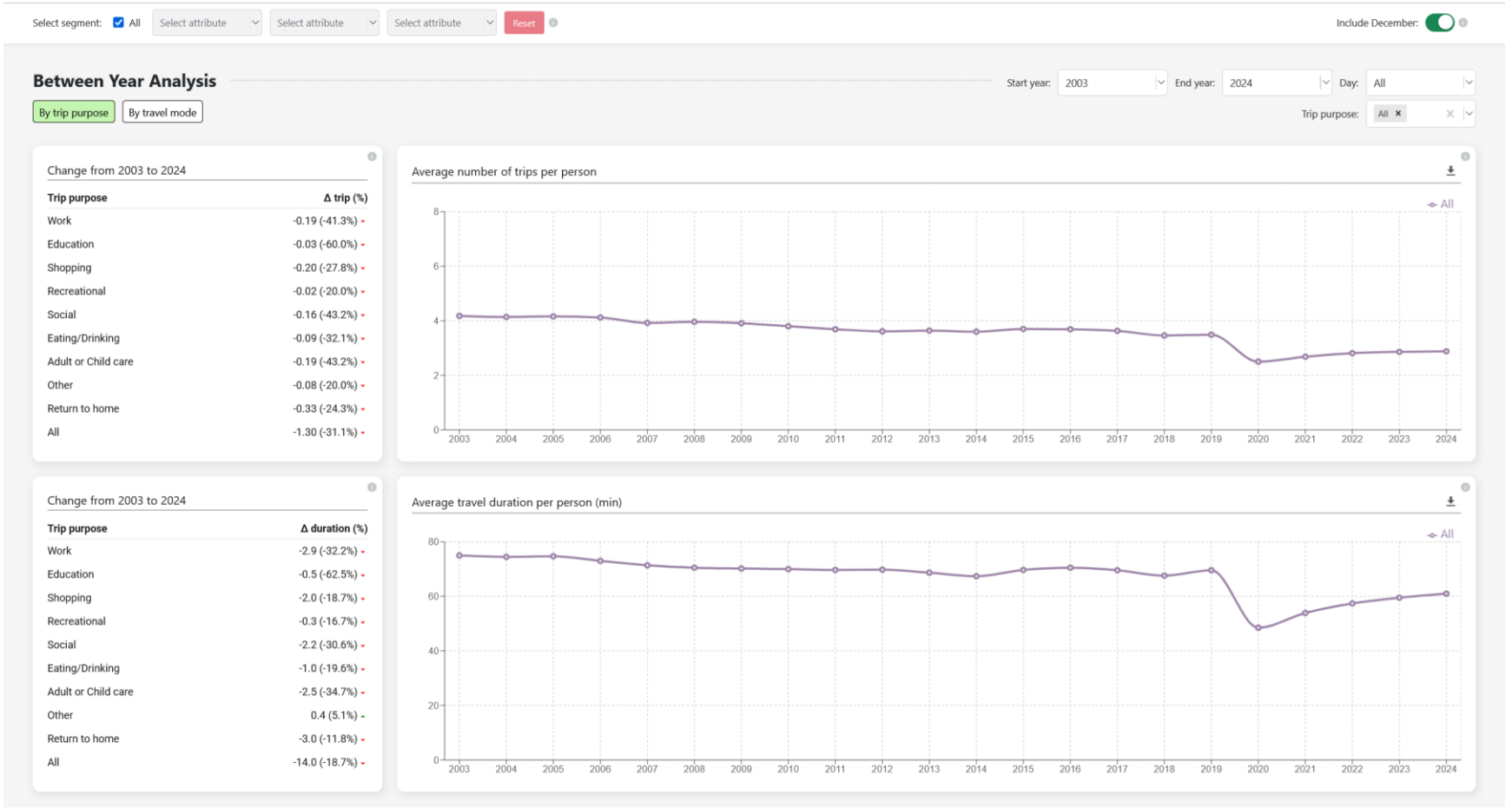
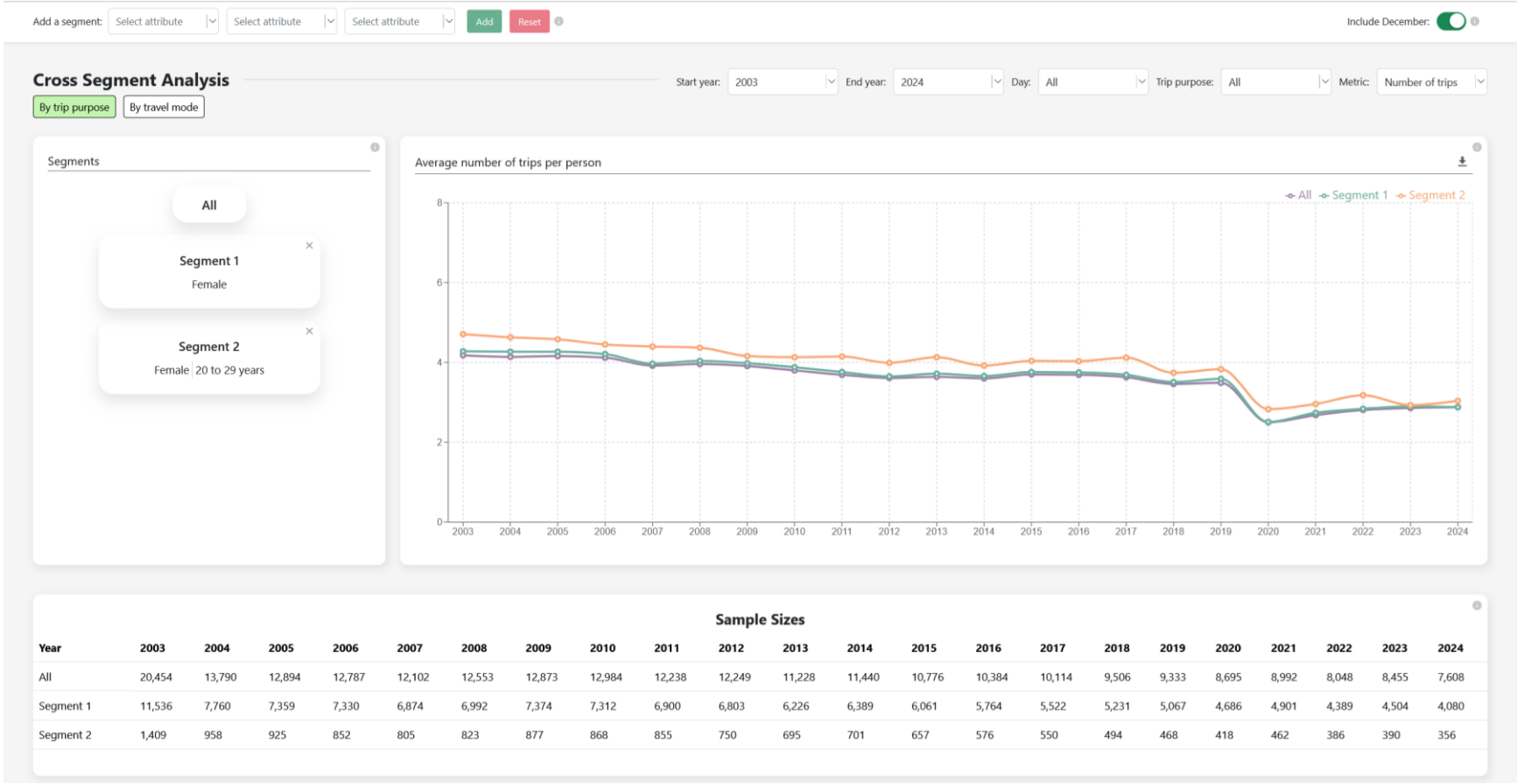


Figure 6. Travel Module – Cross-Segment Analysis Interface.



Sample Sizes

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
All	20,454	13,790	12,894	12,787	12,102	12,553	12,873	12,984	12,238	12,249	11,228	11,440	10,776	10,384	10,114	9,506	9,333	8,695	8,992	8,048	8,455	7,608
Segment 1	11,536	7,760	7,359	7,330	6,874	6,992	7,374	7,312	6,900	6,803	6,226	6,389	6,061	5,764	5,522	5,231	5,067	4,686	4,901	4,389	4,504	4,080
Segment 2	1,409	958	925	852	805	823	877	868	855	750	695	701	657	576	550	494	468	418	462	386	390	356

Figure 7. Telework Module – Within-Year Analysis Interface.

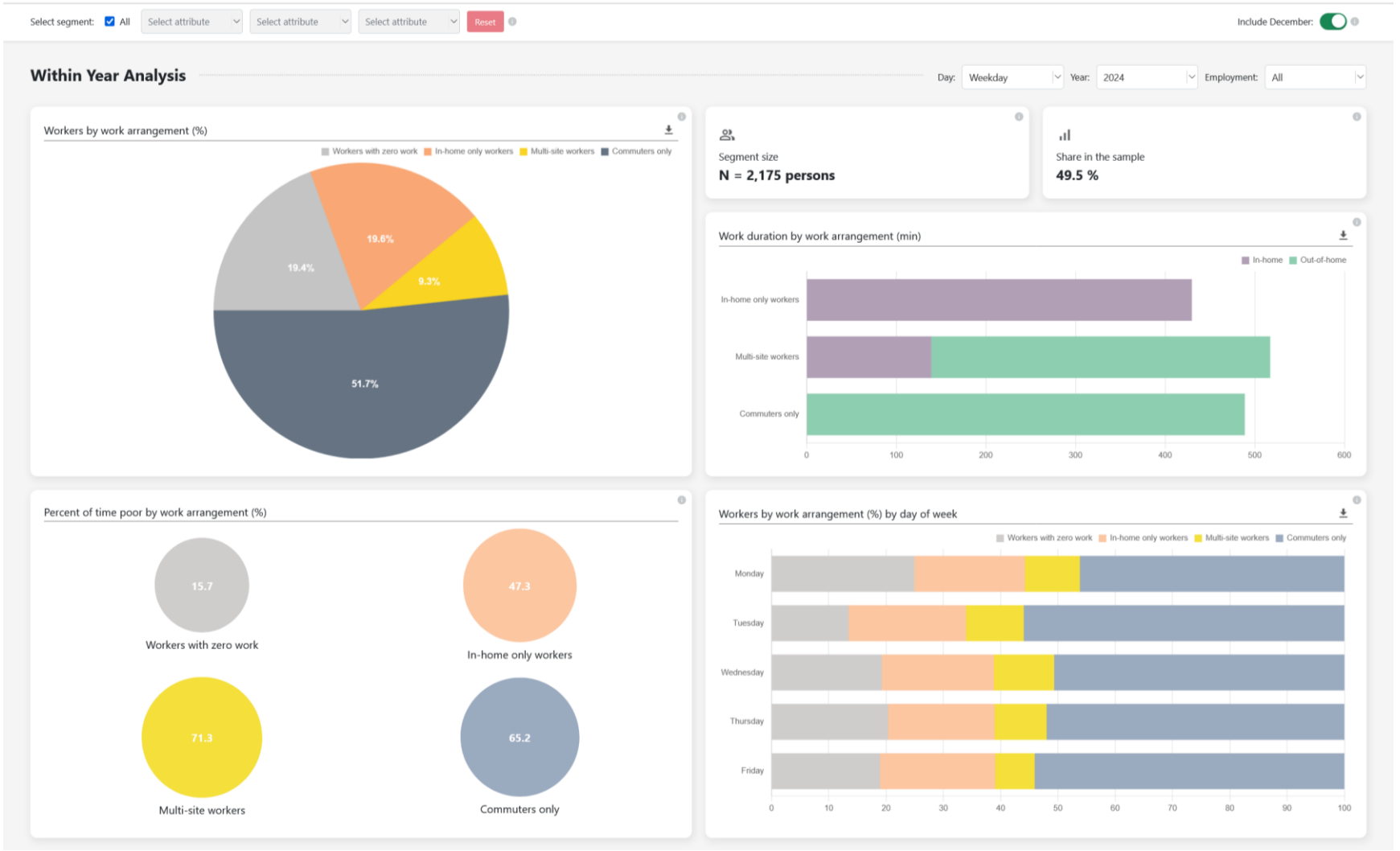
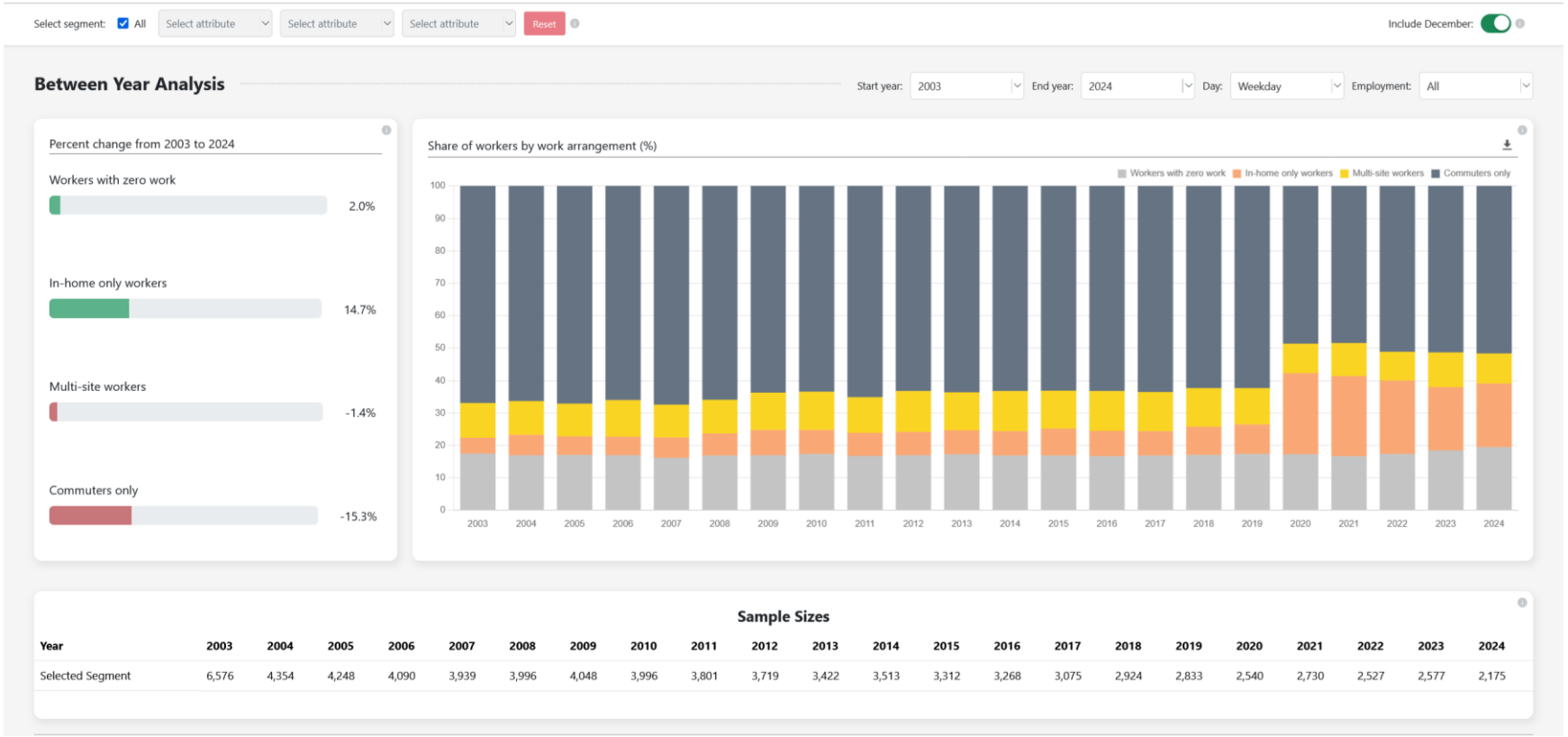


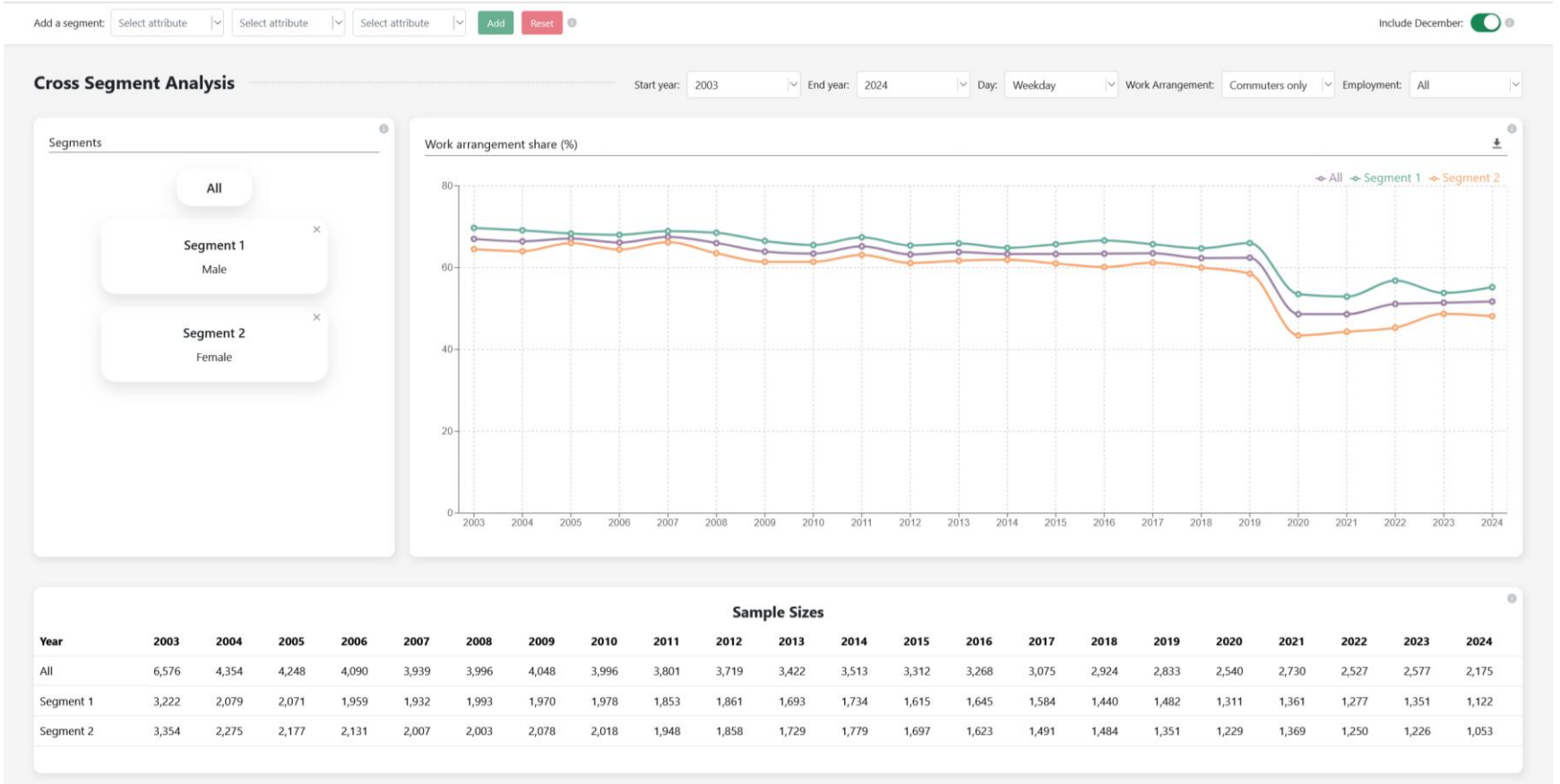
Figure 8. Telework Module – Between-Year Analysis Interface.



Sample Sizes

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Selected Segment	6,576	4,354	4,248	4,090	3,939	3,996	4,048	3,996	3,801	3,719	3,422	3,513	3,312	3,268	3,075	2,924	2,833	2,540	2,730	2,527	2,577	2,175

Figure 9. Telework Module – Cross-Segment Analysis Interface.



Sample Sizes

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
All	6,576	4,354	4,248	4,090	3,939	3,996	4,048	3,996	3,801	3,719	3,422	3,513	3,312	3,268	3,075	2,924	2,833	2,540	2,730	2,527	2,577	2,175
Segment 1	3,222	2,079	2,071	1,959	1,932	1,993	1,970	1,978	1,853	1,861	1,693	1,734	1,615	1,645	1,584	1,440	1,482	1,311	1,361	1,277	1,351	1,122
Segment 2	3,354	2,275	2,177	2,131	2,007	2,003	2,078	2,018	1,948	1,858	1,729	1,779	1,697	1,623	1,491	1,484	1,351	1,229	1,369	1,250	1,226	1,053

Figure 10. Survey Sample Page – Sample Composition Between Years Interface.

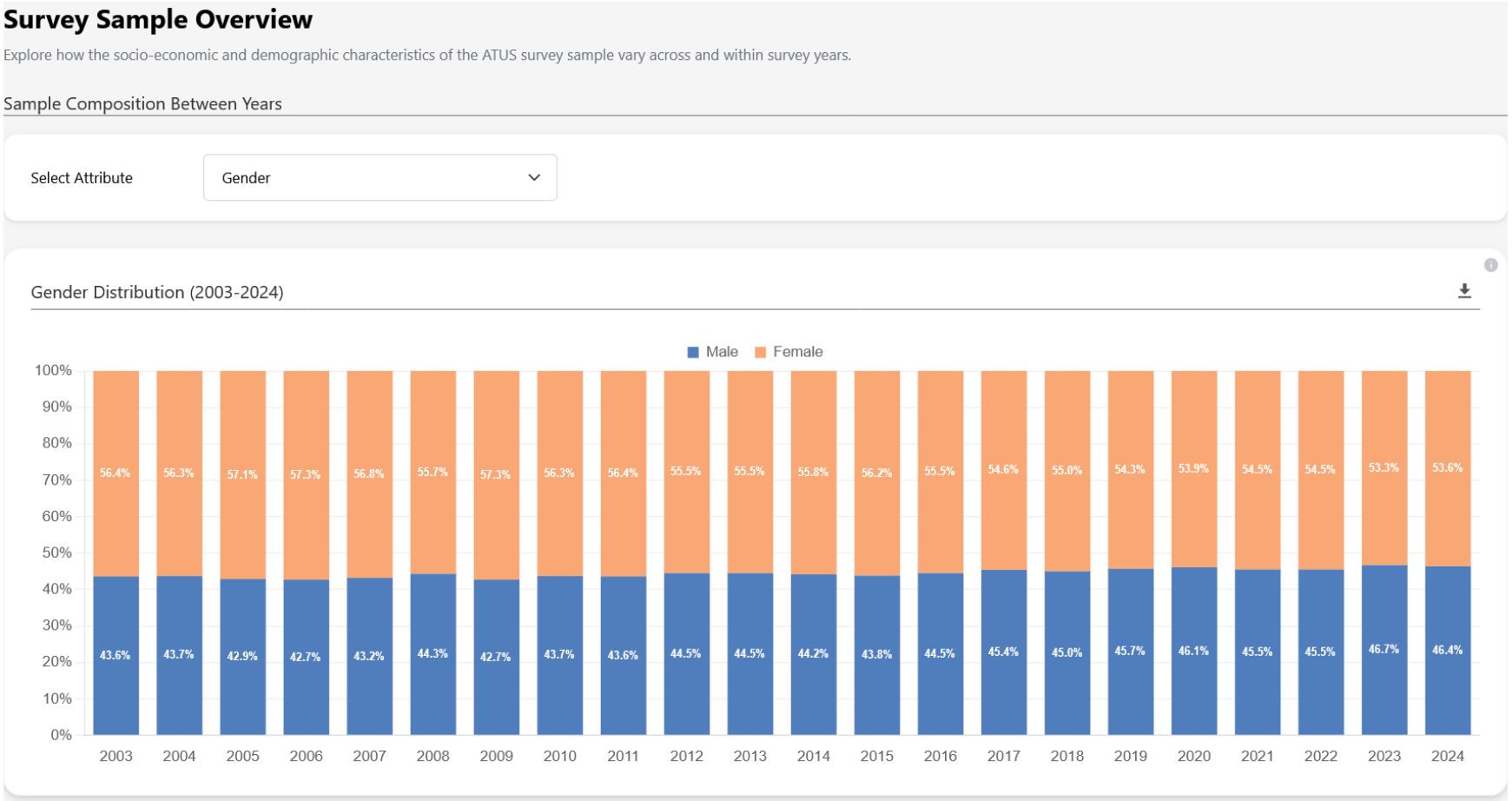
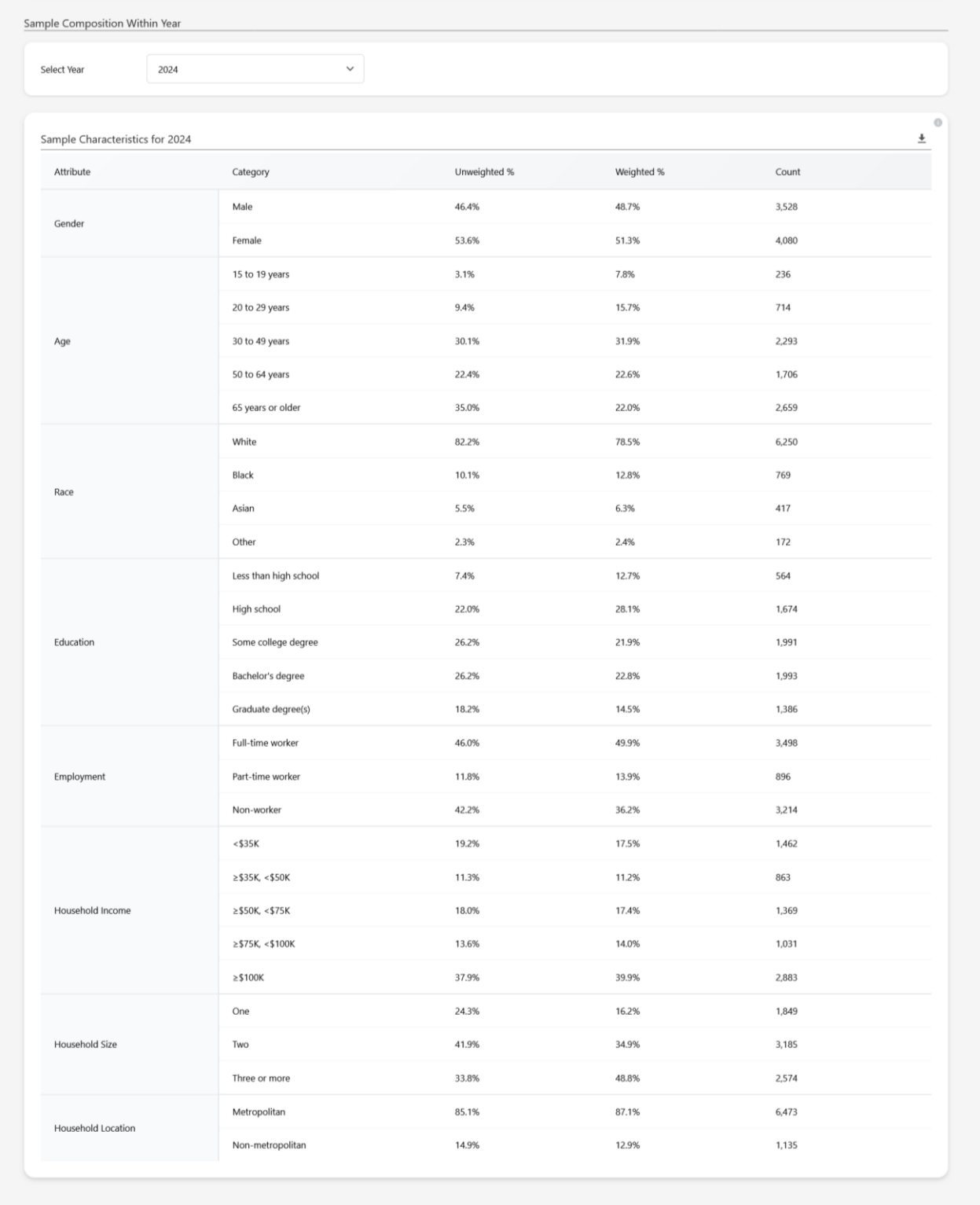


Figure 11. Survey Sample Page – Sample Composition Within Year Interface.



Sample Composition Within Year

Select Year: 2024

Sample Characteristics for 2024

Attribute	Category	Unweighted %	Weighted %	Count
Gender	Male	46.4%	48.7%	3,528
	Female	53.6%	51.3%	4,080
Age	15 to 19 years	3.1%	7.8%	236
	20 to 29 years	9.4%	15.7%	714
	30 to 49 years	30.1%	31.9%	2,293
	50 to 64 years	22.4%	22.6%	1,706
	65 years or older	35.0%	22.0%	2,659
Race	White	82.2%	78.5%	6,250
	Black	10.1%	12.8%	769
	Asian	5.5%	6.3%	417
	Other	2.3%	2.4%	172
Education	Less than high school	7.4%	12.7%	564
	High school	22.0%	28.1%	1,674
	Some college degree	26.2%	21.9%	1,991
	Bachelor's degree	26.2%	22.8%	1,993
	Graduate degree(s)	18.2%	14.5%	1,386
Employment	Full-time worker	46.0%	49.9%	3,498
	Part-time worker	11.8%	13.9%	896
	Non-worker	42.2%	36.2%	3,214
Household Income	<$35K	19.2%	17.5%	1,462
	≥$35K, <$50K	11.3%	11.2%	863
	≥$50K, <$75K	18.0%	17.4%	1,369
	≥$75K, <$100K	13.6%	14.0%	1,031
	≥$100K	37.9%	39.9%	2,883
Household Size	One	24.3%	16.2%	1,849
	Two	41.9%	34.9%	3,185
	Three or more	33.8%	48.8%	2,574
Household Location	Metropolitan	85.1%	87.1%	6,473
	Non-metropolitan	14.9%	12.9%	1,135