

TRANSPORT FINDINGS

Trends in Twin Cities Travel Behavior, 1970–2023

David Levinson, Ph.D.¹ ¹ School of Civil Engineering, The University of Sydney

Keywords: transport trends, travel behaviour, travel time, activity duration

<https://doi.org/10.32866/001c.161447>

Findings

Restoring the Twin Cities Travel Behavior Inventory back to 1970 and extending analysis forward to 2023 changes the long-run interpretation of regional travel behavior. The main behavioral change is a relocation of work within the day. For adults who worked on the diary day, home time rises by 194.5 minutes between 1970 and 2023, daily travel falls by 16.1 minutes, and on-site work falls by 196.9 minutes. Once work-related destinations and observed telework are added back in, however, the modern series is better read as a shift in work location than as a collapse in total work: telework-aware total work reaches 500.9 minutes in 2019 and 513.7 minutes in 2023. A second result concerns commute travel times. The main auto commute series generally rise from 1970 through 2019 and then decline in 2021–2023, so the longer record supports a rise-to-2019 and post-COVID reversal story rather than a simple monotonic increase. The archival recovery of the 1970 survey, the handling of 1982, benchmark checks for 1990–2010, and remaining 2019–2023 comparability issues are documented in the Supplemental Information.

1. Questions

The Twin Cities travel surveys have long been used to test whether daily travel time and commute time are stable, rising, or reorganised as the region changes. Earlier studies covered shorter slices of the record: Zahavi and Ryan (1980) examined 1958–1970 through travel time budgets, Levinson and Wu (2005) compared 1990–2000 under the Rational Locator frame (Levinson and Kumar 1994), and Levinson et al. (2015) extended the series to 1990–2010.

Those studies frame two related questions. Travel time budget arguments emphasise the relative stability of daily time spent travelling, while time-allocation perspectives ask how travel competes with work, home, and other activities inside a fixed twenty-four-hour day. The Rational Locator argument shifted the commute question away from a universal travel-time law and toward the joint geography of homes, jobs, and opportunities. Extending the Twin Cities record back to 1970 and forward to 2023 makes it possible to revisit these questions over a longer period, including the post-2019 work-at-home shift.

Recovering the 1970 Travel Behavior Inventory (TBI) and extending the series to 2023 makes two substantive questions visible. First, how did daily time allocation vary across home, travel, on-site work, work-related activity, and telework? Second, did peak commute times rise steadily, or did the apparent rise reverse after the work-at-home shock of 2019–2023? A third contribution is methodological: the Supplemental Information documents how the 1970 survey was recovered and how far the legacy benchmark tables can be reproduced. The recovery of 1970 is an archival contribution that allows it to serve as a peer data source to later household travel surveys.

2. Methods

The analysis builds a harmonised adult diary-day series from the Twin Cities Travel Behavior Inventory, combining recovered historical waves with the recurrent 2019–2023 surveys. All trend estimates use a fixed seven-county geography and adults ages 18–65. For 1970–2010, person-days are reconstructed from linked trips; for 2019–2023, the recurrent day files provide the complete-day denominator and linked trips provide the activity timing, which retains zero-trip complete days in the modern waves. Survey administration changed substantially across the record. The 1970 TBI was a household home-interview survey: sampled households were assigned a 24-hour travel day, interviewers collected trips for household members age 5 and older, and the completed forms were coded and keypunched for machine processing (Mid-Continent Surveys, Inc. 1970a, 1970b). The 1982–2010 waves remain household travel-diary/interview waves in the legacy TBI lineage. The 2019–2023 recurrent TBI used address-based mail recruitment supplemented by targeted outreach, with diaries collected through the rMove smartphone app, web diaries, or a call center; smartphone households could provide multi-day diaries, while web/call-center households generally provided one-day diaries (RSG, Inc. 2024). These methodological changes are one reason the Supplemental Information keeps denominator, weighting, and modern-wave sensitivity checks explicit.

[Table 1](#) classifies each adult diary day into three groups: worked that day, employed but did not work that day, and not employed, and reports combined on-site work. “Worked that day” includes any observed out-of-home workplace stay, out-of-home work-related stay, or separately observed telework/work-at-home on the diary day. Panels B and C should be read as diary-day status groups rather than as a causal decomposition of employment status. The available harmonized fields do not consistently separate full-time from part-time work, nor do they identify all reasons for non-employment, such as homemaking, schooling, unemployment, or early retirement, across every wave. The lower 1982 travel values for the nonworking panels should also be read cautiously because 1982 does not preserve a separate shopping bucket. The table therefore shows the descriptive diary-day allocation, while the interpretation is kept at the level supported by all waves.

Table 1. Diary-day work-status groups: harmonized daily time allocation, mean minutes per person-day, fixed 7-county, 1970–2023

Panel A. Worked that day							
Year	n	Home (min/day)	On-site work (min/day)	Shop (min/day)	Other (min/day)	Travel (min/day)	Note
1970	5523	908.2	419.6	14.1	27.6	70.5	–
1982	3014	809.4	427.4	0.0	119.5	83.7	–
1990	3774	798.7	485.2	10.8	61.3	84.0	–
<i>1990 printed</i>		796.5	475.5			82.5	<i>L&W 2005</i>
2000	4760	795.9	476.9	11.5	62.4	89.5	–
<i>2000 printed</i>		789.5	485.0			87.0	<i>L&W 2005</i>
2010	7910	866.5	427.6	9.0	53.4	83.5	–
2019	10583	895.4	390.4	12.0	51.5	90.7	–
2021	7537	1065.5	266.1	12.1	38.2	58.1	–
2023	2956	1102.7	222.7	13.2	47.0	54.4	–
Panel B. Employed but did not work that day							
Year	n	Home (min/day)	On-site work (min/day)	Shop (min/day)	Other (min/day)	Travel (min/day)	Note
1970	408	1223.8	0.0	39.3	105.6	71.2	–
1982	562	1223.4	0.0	0.0	185.2	31.4	–
1990	279	1158.3	0.0	37.1	167.2	77.4	–
2000	1295	1218.1	0.0	23.5	140.9	57.5	–
2010	1186	1282.3	0.0	20.0	89.0	48.7	–
2019	1405	1239.7	0.0	27.2	114.5	58.5	–
2021	1315	1302.3	0.0	26.4	68.4	42.9	–
2023	445	1307.0	0.0	17.7	77.0	38.3	–
Panel C. Not employed							
Year	n	Home (min/day)	On-site work (min/day)	Shop (min/day)	Other (min/day)	Travel (min/day)	Note
1970	678	1236.4	0.0	37.9	106.6	59.1	–
1982	1067	1284.2	0.0	0.0	134.0	21.8	–
1990	472	1177.2	0.0	43.0	145.1	74.6	–
2000	1054	1227.2	0.0	29.6	123.3	59.9	–
2010	2012	1276.7	0.0	10.7	113.3	39.3	–
2019	1931	1284.8	0.0	33.6	73.3	48.3	–
2021	2135	1327.0	0.0	21.6	54.0	37.4	–
2023	941	1349.5	0.0	11.9	51.4	27.3	–

Rows use the fixed 7-county geography, adults ages 18–65, and diary-day work-status groups. ‘Worked that day’ means any observed workplace time, work-related time, or separately observed telework/work-at-home on the diary day. ‘Employed but did not work that day’ means currently employed adults without observed work on that diary day. ‘Not employed’ means adults classified as nonworkers. ‘n’ is the unweighted person-day sample count. Across all years, person-days with any trip duration greater than 120 minutes are excluded from the harmonized activity tables, consistent with the extreme-duration screen used in the earlier TBOT replication work. ‘On-site work’ combines primary workplace and work-related minutes; the decomposition is reported in [Table 3](#) and [Figure 2](#). In 1982, the surviving purpose field does not preserve a separate shopping bucket, so ‘Shop’ is absorbed into ‘Other’, and the combined 1982 on-site work total is more reliable than the internal split. Legacy zero-trip person-days are retained as all-home days where the person tables survive (1982, 2000, and 2010), but the surviving 1970 and 1990 archives do not preserve an equivalent zero-trip denominator. In Panel A, the italicized rows beneath 1990 and 2000 align the printed ‘H/W/T’ values from Levinson and Wu (2005).

[Table 3](#) shows that the 2019 worked-that-day workplace level still reflects a modern purpose-classification shift, not only a behavioral break.

Peak-travel estimates in [Table 2](#) are worker-only trip means for direct home-to-work and work-to-home commute trips by mode. To standardize the directional comparison as much as possible, all years use the same fixed departure windows: 06:00–08:59 for the AM home-to-work direction and 15:00–18:29 for the PM work-to-home direction. Transit combines bus, light rail, and commuter rail where present. The table reports mean minutes and unweighted trip counts in separate columns. Published benchmarks are reported where available. Very sparse directional cells are suppressed in the main-text table.

The Supplemental Information documents the archival recovery, validation checks, and remaining wave-specific compromises in full.

3. Findings

In [Table 1](#) Panel A, time at home rises from 908.2 minutes in 1970 to 1102.7 in 2023, an increase of 194.5 minutes per day. Over the same period, travel falls from 70.5 to 54.4 minutes, while combined on-site work falls from 419.6 to 222.7 minutes, a decline of 196.9 minutes. Relative to 2019, worked-that-day home time rises by 207.3 minutes by 2023, travel falls by 36.3 minutes, and on-site work falls by 167.7 minutes.

Panels B and C show employed adults who did not work on the diary day are distinct. In 2019, travel averages 58.5 minutes for employed adults who did not work that day and 48.3 minutes for adults who were not employed.

The 2019 worked-that-day workplace level still reflects a modern purpose-classification shift, not only a behavioral break. In the harmonized worked-that-day comparison, workplace minutes fall from 416.2 in 2010 to 290.8 in 2019, but work-related minutes rise from 11.4 to 99.6. The modern public files explicitly separate primary workplace from work-related destinations such as meetings, deliveries, and worksites, so part of the apparent 2010-to-2019 drop reflects category reallocation within work activity rather than a clean apples-to-apples fall in time at work. The combined on-site measure therefore falls from 427.6 in 2010 to 390.4 in 2019, which is materially smaller than the workplace line alone suggests.

It should be noted that even though the 7-county geography is retained for analysis, typical workers in 2023 lived much farther from the Minneapolis or St. Paul central business districts than their 1970 counterpart as the metro area increased population from about 1.7M to 3.0M for this geography over the period, and outer counties suburbanized, and many more commuters live outside these 7 counties.

The longer record still does not support a clean monotonic-rise story for commute travel times, and the directional split makes that clearer. [Table 2](#) reports worker-only trip means for direct AM home-to-work and PM work-to-home commute trips by mode under one common AM/PM window for

Table 2. Workers only: directional peak commute travel times by mode, mean minutes per commute trip under common fixed windows, fixed 7-county, 1970–2023

Panel A. AM peak: Home to work									
Year	Mean (Auto-1)	n	Mean (Auto-2)	n	Mean (Auto-3)	n	Mean (Transit)	n	Note
<i>1958 printed</i>			<i>Car-only 19.8</i>				30.0		<i>Z&R 1980</i>
1970	20.6	2199	19.4	481	30.9	232	Supp.	3	–
<i>1970 printed</i>			<i>Car-only 17.4</i>				32.4		<i>Z&R 1980</i>
1982	21.6	1142	20.2	170	29.5	90	Supp.	2	–
1990	21.5	1895	26.9	71	21.2	133	27.5	104	–
<i>1990 printed</i>	22.6		23.1		24.2		32.9		<i>L&W 2005</i>
2000	25.6	2267	22.6	134	24.0	25	37.4	98	–
<i>2000 printed</i>	27.2		24.6		23.8		42.0		<i>L&W 2005</i>
2010	25.7	3145	27.0	79	24.0	141	32.4	118	–
2019	27.0	2807	24.2	205	27.4	41	42.5	360	–
2021	22.8	1458	20.3	84	Supp.	13	Supp.	24	–
2023	21.4	523	Supp.	24	Supp.	8	38.2	61	–
Panel B. PM peak: Work to home									
Year	Mean (Auto-1)	n	Mean (Auto-2)	n	Mean (Auto-3)	n	Mean (Transit)	n	Note
<i>1958 printed</i>			<i>Car-only 19.8</i>				30.0		<i>Z&R 1980</i>
1970	22.4	2011	20.5	434	36.8	255	Supp.	3	–
<i>1970 printed</i>			<i>Car-only 17.4</i>				32.4		<i>Z&R 1980</i>
1982	21.7	700	22.3	136	31.7	74	–	–	–
1990	23.5	1369	30.9	56	22.8	101	32.9	84	–
<i>1990 printed</i>	22.6		23.1		24.2		32.9		<i>L&W 2005</i>
2000	29.0	1728	27.1	98	27.6	21	46.4	91	–
<i>2000 printed</i>	27.2		24.6		23.8		42.0		<i>L&W 2005</i>
2010	28.9	2304	35.1	41	29.7	108	43.1	135	–
2019	30.2	2159	24.4	155	19.7	26	47.2	291	–
2021	25.7	1102	24.6	56	Supp.	16	Supp.	33	–
2023	24.9	613	18.0	43	Supp.	11	48.5	64	–

All years use the same departure windows: AM 06:00–08:59 and PM 15:00–18:29. Rows are worker-only direct home-to-work and work-to-home trip means by mode; ‘min’ is the weighted mean trip duration and ‘n’ is the unweighted trip count. The same all-year extreme-duration screen used in the activity tables excludes worker person-days with any trip duration greater than 120 minutes. Transit combines bus, light rail (from 2010), and commuter rail (from 2010) where present. Cells marked ‘Supp.’ are suppressed because they fail the paper-facing stability screen of effective sample size below 10 or relative standard error above 25%. The italicized rows report published comparison values. For 1990 and 2000, Levinson and Wu (2005) provides non-directional work-trip means for Auto-1, Auto-2, Auto-3, and Transit; those values are repeated in both panels as comparison anchors rather than directional AM/PM cells. For 1958 and 1970, Zahavi and Ryan (1980) reports all-purpose ‘car-only’ and ‘transit-only’ average trip times rather than occupancy-specific work-trip means, so those contextual values are shown as ‘Car-only’ across the auto columns and as Transit in the transit column.

every year, with sample sizes shown. For drive-alone travelers (Auto 1), the AM series rises from 20.6 minutes in 1970 to 25.6 in 2000, rises again to 27.0 in 2019, and then falls back to 21.4 in 2023 as congestion dissipates with the rise in work-at-home, and more scheduling flexibility in general. The PM Auto 1 return-commute series is even clearer, moving from 22.4 in 1970

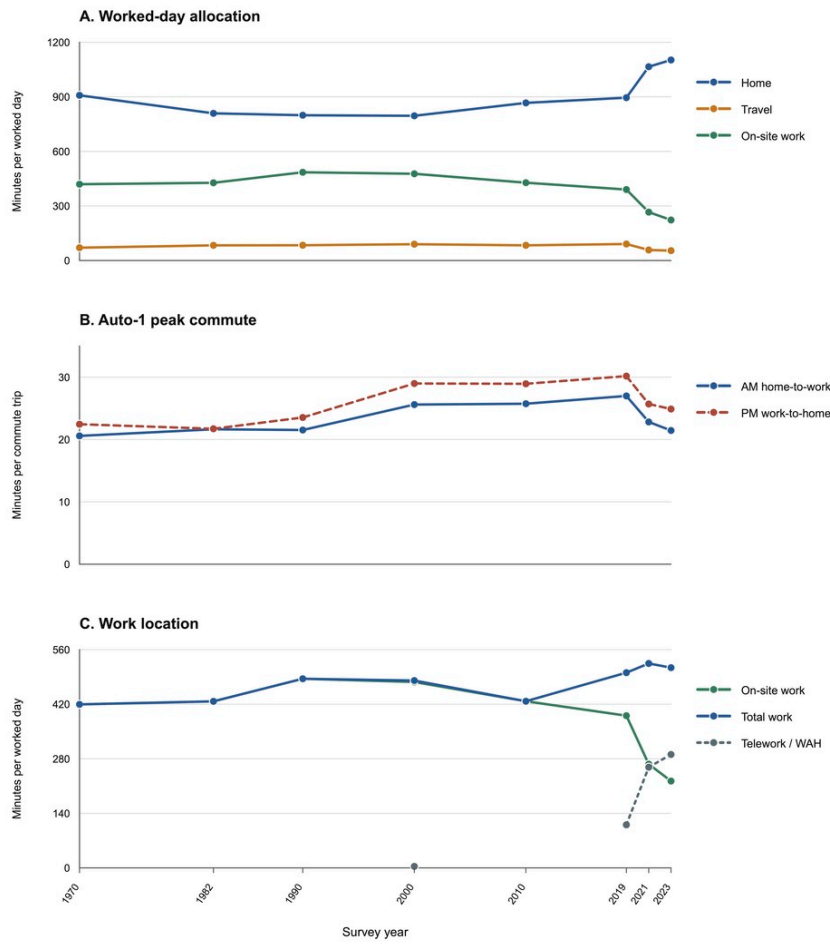


Figure 1. Summary of the two main findings. Panel A reports mean minutes per worked diary day for home, travel, and on-site work. Panel B reports mean minutes per Auto-1 commute trip in the common AM and PM peak windows. Panel C reports mean minutes per worked diary day for on-site work, telework, and telework-aware total work.

to 29.0 in 2000, staying near 28.9 in 2010, rising to 30.2 in 2019, and then falling to 24.9 in 2023. Carpool with one passenger (Auto 2) shows the same broad pattern.

The post-2019 (i.e. post-COVID) decline is consistent with lower peak congestion, more schedule flexibility, and the removal of some commute trips through work-at-home, but this table cannot observe the counterfactual commute lengths of workers who stayed home.

The post-2019 phase shift is easier to interpret by disaggregating primary workplace, work-related, and telework. [Figure 2](#) and [Table 3](#) show that workplace minutes fall from 416.2 in 2010 to 290.8 in 2019, but work-related minutes rise from 11.4 to 99.6 over the same interval. The 2019 break is therefore not only behavioral; it also reflects a reallocation within the modern purpose taxonomy. The combined on-site measure of workplace plus work-related falls from 427.6 in 2010 to 390.4 in 2019, which is a much smaller drop than the workplace line alone suggests.

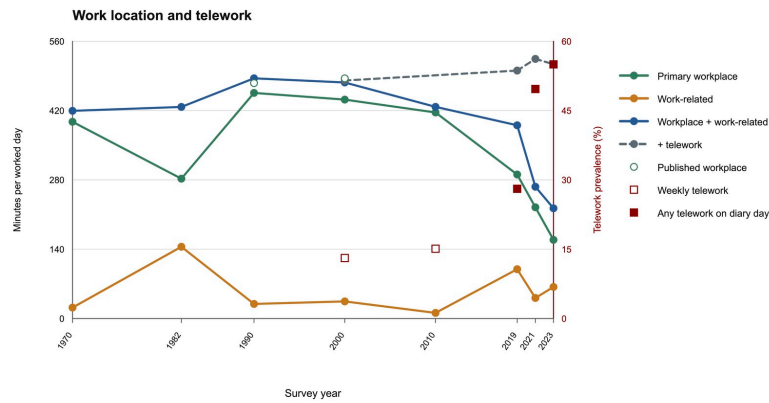


Figure 2. Worked-that-day series: workplace, work-related, and telework-aware work totals. The line series use the left axis and the square markers use the right axis. Open circles mark published 1990/2000 worker workplace benchmarks from Levinson and Wu (2005). Open squares on the right axis show the published TBOT one-worker-household telecommuters working from home at least once per week in 2000 and 2010 (Levinson et al. 2015); filled squares show recurrent-TBI employed-adult any-telework diary-day shares in 2019–2023. The 2000 total is additive because recovered work-at-home minutes are removed from the 2000 workplace bucket before being added back as telework.

Table 3. Worked-that-day series: workplace, work-related, and telework-aware work totals, mean minutes per worked diary day, fixed 7-county, 1970–2023

Year	Primary workplace (min/day)	Work-related (min/day)	On-site work (min/day)	Telework / WAH (min/day)	Total work (min/day)
1970	397.5	22.1	419.6	–	419.6
1982	282.5	144.9	427.4	–	427.4
1990	455.8	29.4	485.2	–	485.2
2000	442.2	34.6	476.9	3.9	480.7
2010	416.2	11.4	427.6	–	427.6
2019	290.8	99.6	390.4	110.5	500.9
2021	224.7	41.4	266.1	258.3	524.4
2023	158.9	63.8	222.7	291.1	513.7

When telework is added back in, 2019 no longer looks low relative to the earlier benchmark years. Telework averages 110.5 minutes in 2019, so the telework-aware total reaches 500.9 minutes, above the 2000 value of 480.7 and well above the Global Financial Crisis-affected 2010 on-site total of 427.6. By 2021 and 2023, total work reaches 524.4 and 513.7 minutes respectively.

Published telecommuting frequencies point in the same direction before the recurrent waves. In one-worker households, telecommuters working from home at least once per week rise from 13.1% in 2000 to 15.1% in 2010 (Levinson et al. 2015). The recurrent TBI then shows employed-adult diary-day telework shares of 28.1% in 2019, 49.7% in 2021, and 55.0% in 2023. The main modern change is therefore where work happens. Travel-derived workplace presence falls sharply, but much of that decline reflects substitution toward telework rather than less total work. That interpretation

is also consistent with the recurrent TBI public report, which separately tracks telework, teleconferencing, and no-travel work-at-home behavior (RSG, Inc. 2024).

Data Availability

The archival recovery steps, reconstructed series, benchmark comparisons, and wave-specific caveats are documented in the Supplemental Information. Data and code supporting the paper are available in the public GitHub repository at: <https://github.com/dlevinson/TBOT> (<https://dx.doi.org/10.5281/zenodo.19842361>).

AI Acknowledgment

The author used OpenAI ChatGPT/Codex as an editorial and computational assistant during writing and revision, for figure styling, replication-package organization, and drafting support. The author reviewed, verified, and takes full responsibility for all analyses, interpretations, text, figures, and submitted materials. The 1970 data recovery also made extensive use of ChatGPT as described in the Supplemental Information.

Submitted: March 23, 2026 AEST. Accepted: April 29, 2026 AEST. Published: May 13, 2026 AEST.



This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CCBY-SA-4.0). View this license's legal deed at <https://creativecommons.org/licenses/by-sa/4.0> and legal code at <https://creativecommons.org/licenses/by-sa/4.0/legalcode> for more information.

REFERENCES

- Levinson, David, and Ajay Kumar. 1994. “The Rational Locator: Why Travel Times Have Remained Stable.” *Journal of the American Planning Association* 60 (3): 319–32. <https://doi.org/10.1080/01944369408975590>.
- Levinson, David, Greg Lindsey, Yingling Fan, et al. 2015. *Travel Behavior over Time*. MN/RC 2015-23. Minnesota Department of Transportation.
- Levinson, David, and Yao Wu. 2005. “The Rational Locator Reexamined: Are Travel Times Still Stable?” *Transportation* 32 (2): 187–202. <https://doi.org/10.1007/s11116-004-5507-4>.
- RSG, Inc. 2024. *Travel Behavior Inventory 2018–2024 Summary Report*. Metropolitan Council.
- Zahavi, Yacov, and James M. Ryan. 1980. “Stability of Travel Components over Time.” *Transportation Research Record* 750: 19–26.

SUPPLEMENTARY MATERIALS

Supplemental Information

Download: <https://findingspress.org/article/161447-trends-in-twin-cities-travel-behavior-1970-2023/attachment/342068.pdf>

SI fig 1

Download: <https://findingspress.org/article/161447-trends-in-twin-cities-travel-behavior-1970-2023/attachment/342071.jpg>

SI fig 2

Download: <https://findingspress.org/article/161447-trends-in-twin-cities-travel-behavior-1970-2023/attachment/342070.jpg>
