

## **The Maryland Transportation Institute credentials**

The Maryland Transportation Institute (MTI) unites scholars with diverse expertise to develop innovative solutions for pressing transportation challenges. At MTI, our specialization lies in delivering data-driven independent research to bolster responsible policymaking. Each of our experts is equipped with state-of-the-art tools and resources to support their work. Since its establishment in 2018, MTI has consistently prioritized bridging the divide between research and action, remaining our central imperative in all the projects we undertake.

Some examples of previous and ongoing projects in the realm of accessibility to public transportation and equity include a study assessing the potential impact of fare reduction and enhanced service on public transit utilization, research exploring how technology can mitigate pedestrian and cyclist fatalities, and continuous efforts on understanding the influence of Complete Streets on the inclination to walk, bike, and use public transportation. These studies have received support from reputable organizations such as the National Science Foundation (NSF), Maryland State Highway Administration (SHA), and the US Department of Transportation (USDOT).

We envision that the study about MobilityLink Paratransit Service Improvements, will be conducted collaboratively by Dr. Cinzia Cirillo and Dr. Paul Schonfeld and their research teams.

### **Qualifications of Cinzia Cirillo for Paratransit Project**

Cinzia Cirillo holds the position of Professor at the University of Maryland (USA), where she serves as the Interim Director of the Maryland Transportation Institute and the Director of the USDOT Center for Multi-Modal Mobility. Her research, backed by funding from esteemed public institutions such as the National Science Foundation, the European Commission, the US Department of Transportation, the Maryland Highway Administration, and the Metropolitan Washington Council of Governments, has significantly contributed to the field. Beyond academia, Dr. Cirillo also acts as an expert for scientific panels, a technical advisor for agencies worldwide, and a consultant for private companies.

Significant contributions to the comprehension of public transportation usage include multi-modal choice models, predicting and explaining market shares for various modal alternatives (e.g., metro, bus, tram, train); investigation into the willingness to adopt new services, such as new metro lines, high-speed rail, and on-demand services, along with studies on the willingness to pay for these services; and an investigation of accessibility to jobs and services through public transportation.

She is also deeply dedicated to exploring transportation systems with a focus on equity. She has developed methods that facilitate the examination of population characteristics at a very granular geographical or domain level. For example, these methods can predict the locations of low-income populations or people with disabilities and identify their specific transportation needs. A recent model, based on real data, has highlighted the necessity to enhance pedestrian safety, particularly among children and the low-income population in Baltimore City.

Dr. Cirillo has extensive international experience working on large-scale projects, encompassing data collection, model estimation, and policy analysis. She is actively involved in designing the Household Travel Survey for Dubai and is currently gathering behavioral data on the willingness to use bus and metro services in the Dubai metropolitan area. The team is also studying various

policies related to public transportation services, access modes to public transport, and parking facilities.

### **Relevant publications in peer reviewed journals**

1. Javier Bas, Mohammad B. Al-Khasawneh, Sevgi Erdogan, Cinzia Cirillo. "How the design of Complete Streets affects mode choice: Understanding the behavioral responses to the level of traffic stress", *Transportation Research Part A: Policy and Practice*, 2023, 173, 103698.
2. Mohammad Motalleb Nejad, Sevgi Erdogan, Cinzia Cirillo. "A Statistical Approach to Synthetic Population Generation as a Basis for Carless Evacuation Planning". *Transportation Geography*, 2021, 90, 1029.
3. Nayel Urena Serulle, Cinzia Cirillo, "Transportation needs of low income population: A policy analysis for the Washington D.C. metropolitan region", *Public Transport*, 2016, 8(1), pp. 103-123.
4. Pratt Hetrakul, Cinzia Cirillo, "Customer heterogeneity in revenue management for railways services", *Journal of Revenue and Pricing Management*, 2015, 14(1), pp. 28-49
5. Yangwen Liu, Cinzia Cirillo, "Measuring transit service impacts on vehicle ownership and use", *Public Transport*, 2015, 7(2), 203-222.
6. Pratt Hetrakul, Cinzia Cirillo, "A latent class choice based model system for railway optimal pricing and seat allocation", *Transportation Research Part E*, 2014, 61(1), pp.68-83.

### **Qualifications of Paul Schonfeld for Paratransit Project**

Prof. Paul Schonfeld, has over 40 years of experience in analyzing public transportation services, especially flexible-route paratransit services and their integration with other transportation systems. He has B.S. and M.S. degrees from MIT and a Ph.D. from the University of California at Berkeley. He has advised the relevant theses of numerous students, including 23 who received faculty appointments at research universities. He has directed 118 funded research projects, published over 230 peer-reviewed journal papers, and served as Editor of the *Journal of Advanced Transportation* and of ASCE's *Journal of Transportation Engineering*. He is a Fellow of the Maryland Transportation Institute (MTI), ASCE and ITE. He received ASCE's 2018 James Laurie Prize for career achievements in transportation engineering.

In various projects Dr. Schonfeld and his students developed methods for designing and operating efficient several types of flexible-route transportation services, focusing especially on spatial allocation of services, fleet selection, routing, scheduling, assignment of riders to vehicles and, in some cases, coordinating various types of paratransit and fixed-route services. The coordination often involved using flexible-route services to feed passengers to other transportation modes or to minimize delays at transfer terminals by optimizing vehicle schedules, providing appropriate reserve factors in the schedules and controlling dispatching decisions in real-time when some vehicle arrivals at transfer stations were delayed.

In a series of projects, Dr. Schonfeld collaborated with private paratransit operators to develop operating systems and software for operating ridesharing systems, including those serving ADA passengers, and particularly dealing with variability and surprising events, such as demand fluctuations, unexpected traffic congestion, vehicle breakdowns and missing drivers or passengers. Data resulting from actual operations were used to frequently test and refine the operating systems. For example, when due to unusual traffic congestion, the services ran the risk of failing to satisfy the promised delivery time windows, passengers were reassigned to reliever

ridesharing vehicles, or even transferred to taxis. Some “outlier” passengers, with remote origins or destinations, were sometimes served individually by taxis.

Some of work on flexible-route ridesharing services is documented in the 46 journal papers listed below, as well as numerous project reports and graduate student theses which are not listed here.

**Some relevant projects directed or co-directed by Dr. Paul Schonfeld:**

1. **Non - motorized Transportation for Asian Cities**, World Bank, 1991 - 92.
2. **Adaptive Control of Transit Operations**, Federal Transit Administration, 1993 - 1995.
3. **Evaluation of DARTS Transportation Services**, Charles County Department of Community Services, 1995 - 1996.
4. **Integration of Conventional Transit and Paratransit Services**, USDOT, Nov. 2009 – Nov. 2011.
5. **Development and Testing of Ridesharing Algorithms**, IT Curves, Jan. 2011 – Jan. 2012, Co-directed with Dr. E. Miller-Hooks.
6. **Smart Ridesharing Algorithms**, Maryland Industrial Partnerships Program and Information Technology Curves, July 2011 – June 2012, Co-directed with Dr. E. Miller-Hooks.
7. **Flexibility and Responsiveness in Public Transportation Systems**, USDOT, Oct. 2011 – Oct. 2012.
8. **Improved Methods for Operating Public Transportation Services**, Mid-Atlantic University Transportation Center, Jan. – Dec. 2012.
9. **Integration of Multi-modal Public Transportation Systems**, Mid-Atlantic University Transportation Center, June 2012 – May 2013.
10. **Next Generation Algorithms and Decision Support Tools for Managing Ridesharing Services**, Maryland Industrial Partnerships Program and Information Technology Curves, July 2012 – June 2013, Co-directed with Dr. E. Miller-Hooks.
11. **Integration of Multimodal Transportation Services**, Mid-Atlantic University Transportation Center, May 2013 – June 2015, \$76,550, Co-directed with Dr. E. Miller-Hooks.
12. **Smarter Algorithms for Managing Ridesharing Services**, Maryland Industrial Partnerships Program and Information Technology Curves, July 2013 – Sept. 2014, \$135,000, Co-directed with Dr. E. Miller-Hooks.
13. **Optimization with Data Acquisition in Transportation Engineering**, National Science Foundation, Aug. 2017 – July 2018, \$150,000.
14. **Innovative Methods for Delivering Fresh Foods to Underserved Populations**, Urban Mobility and Equity Center, Oct. 2017 – Sept. 2018, \$140,000, Co-directed with Drs. Hyeon-Shic Shin and Young-Jae Lee of Morgan State University.
15. **Deployment of Personalized and Dynamic Travel Demand Management Technology**, Federal Highway Administration and Metropolitan Washington Council of Governments, Nov. 2020 – Nov. 2023, \$1,673,097.
16. **User Preference Analysis for Mobility-as-a-Service (MaaS) and Its Impact in Maryland**, Urban Mobility and Equity Center, Oct. 2021 – June 2023, \$120,000, Co-directed with Drs. Young-Jae Lee and Hyeon-Shic Shin.
17. **Development of Advanced Multimodal Travel Demand Management and Continuous Operations of incenTrip Smartphone Technology in Maryland**, Maryland Dept. of Transportation, Nov. 2022 – Aug. 2023, \$150,000.
18. **Optimized Development of Multi-modal Transportation Networks**, CMMM Center, Sept. 2023 – Aug. 2024 \$100,000.

**Some relevant articles in peer-reviewed journals:**

1. Chang, S.K. and Schonfeld, P. “Optimization Models for Comparing Conventional and Subscription Bus Feeder Services,” *Transp. Science*, 25-4, Nov. 1991, 281-298.
2. Chang, S.K. and Schonfeld, P. “Multiple Period Optimization of Bus Transit Systems,” *Transp. Research Part B: Methodological*, 25B-6, Dec. 1991, 453-478.

3. Lee, K.T. and Schonfeld, P. "Optimal Slack Times for Timed Transfers at a Transit Terminal," *J. of Advanced Transp.*, 25-3, Fall 1991, 281-308.
4. Chang, S.K. and Schonfeld, P. "Integration of Fixed and Flexible Route Bus Systems," *Transp. Research Record 1308*, 1991, 51-57.
5. Chang, S.K. and Schonfeld, P. "Optimal Dimensions of Bus Service Zones," *J. of Transp. Engineering*, ASCE, 119-4, July/Aug. 1993, 567-585.
6. Chang, S.K. and Schonfeld, P. "Welfare Maximization with Financial Constraints for Bus Transit Systems," *Transp. Research Record 1395*, Aug. 1993, 48-57.
7. Spasovic, L.N. and Schonfeld, P. "A Method for Optimizing Transit Service Coverage," *Transp. Research Record 1402*, Oct. 1993, 28-39.
8. Lee, K.T. and Schonfeld, P. "Real - time Dispatching Control for Coordinated Operations in Transit Terminals," *Transp. Research Record 1433*, Sept. 1994, 3-9.
9. Lee, K.T., Kuo, H.F. and Schonfeld, P. "Optimal Mixed Bus Fleet for Urban Operations," *Transp. Research Record 1503*, July 1995, 39-48.
10. Chien, S. and Schonfeld, P. "Joint Optimization of a Rail Transit Line and its Feeder Bus System," *J. of Advanced Transp.*, 32-3, Fall 1998, 253-284.
11. Ting, C.J. and Schonfeld, P. "Schedule Coordination in a Multiple - hub Transit Network," *J. of Urban Planning and Development*, ASCE, 131-2, June 2005, 112-124.
12. Ting, C.J. and Schonfeld, P. "Dispatching Control at Transfer Stations in Multi-Hub Transit Networks," *J. of Advanced Transp.*, 41-3, Fall 2007, 217-243.
13. Luo, Y. and Schonfeld, P., "A Rejected-Reinsertion Algorithm for the Static Dial-A-Ride Problem", *Transp. Research - Part B: Methodological*, 41B-7, Aug. 2007, 736-755.
14. Zhou, Y., Kim, H.S., Schonfeld, P. and Kim, E., "Subsidies and Welfare Maximization Tradeoffs in Bus Transit Systems," *Annals of Regional Science*, 42-3, Nov. 2008, 643-660.
15. Luo, Y. and Schonfeld, P. "Online Rejected-Reinsertion Heuristics for the Dynamic Multi-Vehicle Dial-a-Ride Problem," *Transp. Res. Record 2218*, Sep. 2011, 59-67.
16. Kim, M. and Schonfeld, P. "Conventional, Flexible and Variable-type Bus Services," *J. of Transp. Engineering*, ASCE, 138-3, March 2012, 263-273.
17. Markovic, N. and Schonfeld, P. "Stochastic Scheduling for a Single-Terminal Transfer System with Poisson Arrivals," *Strojnicki Vestnik (Slovenian J. of Mechanical Eng.)*, 59-9, Sept. 2013, 564-572.
18. Kim, M. and Schonfeld, P. "Integrating Bus Services with Mixed Fleets," *Transp. Research Part B: Methodological*, 55B, Sept. 2013, 227-244.
19. Juster, R. and Schonfeld, P. "Personal Rapid Transit as Urban Transportation," *Transp. Res. Record 2350*, Dec. 2013, 128-135.
20. Markovic, B., Milinkovic, S., Schonfeld, P. and Drobnjak, Z. "Planning Dial-a-Ride Services: Statistical and Metamodeling Approach," *Transp. Res. Record 2352*, Dec. 2013, 120-127.
21. Kim, M. and Schonfeld, P. "Integration of Conventional and Flexible Bus Services with Timed Transfers," *Transp. Research Part B: Methodological*, 68B-2, Oct. 2014, 76-97.
22. Feng, L., Miller-Hooks, E., Schonfeld, P. and Mohebbi, M. "Optimizing Ridesharing Services for Airport Access," *Transp. Res. Record 2467*, Dec. 2014, 157-176.
23. Markovic, N., Nair, R., Schonfeld, P., Miller-Hooks, E. and Mohebbi, M. "Optimizing Dial-a-Ride Services in Maryland: Benefits of Computerized Routing and Scheduling," *Transp. Res. Part C: Emerging Technologies*, vol. 55, Jan. 2015, 156-165.
24. Markovic, N., Milinkovic, S., Tikhonov, K.S. and Schonfeld, P. "Analyzing Passenger Train Arrival Delays with Support Vector Regression," *Transp. Res. Part C: Emerging Technologies*, vol. 56, July 2015, 251-262.
25. Kim, M. and Schonfeld, P. "Maximizing Net Benefits for Conventional and Flexible Bus Services," *Transp. Research Part A: Policy and Practice*, v80, Oct. 2015, 116-133.
26. Sun, Y. and Schonfeld, P. "Optimization Models for Public Transportation Operations under Subsidization and Regulation," *Transp. Res. Record 2530*, Dec. 2015, 44-54.
27. Chen, L., Schonfeld, P. and Miller-Hooks, E. "Welfare Maximization for Bus Transit Systems with Timed Transfers and Financial Constraints," *J. of Advanced Transp.* 50-4, June 2016, 421-433.
28. Markovic, N., Kim, M. and Schonfeld, P. "Statistical and Machine Learning Approach for Planning Dial-A-Ride Services," *Transp. Res. Part A: Policy and Practice*, v89, July 2016, 41-55.
29. Sun, Y., Shi, J. and Schonfeld, P. "Identifying Passenger Flow Characteristics and Evaluating Travel Time Reliability by Visualizing AFC Data: A Case Study of Shanghai Metro," *Public Transport*, v8,

- Aug. 2016, 341-363.
30. Sun, Y., Guo, Q., Schonfeld, P. and Li, Z. "Implications of the Cost of Public Funds in Public Transit Subsidization and Regulation," *Transportation Research Part A: Policy and Practice*, v91, Sep. 2016, 236-250.
  31. Sun, Y. Guo, Q., Schonfeld, P. and Li, Z. "Evolution of Public Transportation Modes in a Commuter Corridor," *Transp. Research Part C: Emerging Technologies*, v75, Feb. 2017, 84-102.
  32. Guo, Q., Chow, J.Y.J. and Schonfeld, P. "Stochastic Dynamic Switching in Fixed and Flexible Transit Services as Market Entry-exit Real Options," *Transp. Research Part C: Emerging Technologies*, v23, 2017, 380-399.
  33. Guo, Q., Chen, S., Schonfeld, P. and Li, Z. "How Time-Inconsistent Preferences Affect Investment Timing for Rail Transit," *Transp. Research Part B: Methodological*, v118, Dec. 2018, 172-192.
  34. Peng, Y., Li, Z. and Schonfeld P. "Development of Rail Transit Network over Multiple Time Periods," *Transp. Research Part A: Policy and Practice*, v121, March 2019, 235-250.
  35. Kim, M., Levy, J. and Schonfeld, P. "Optimal Zone Sizes and Headways for Flexible-Route Bus Services," *Transp. Research Part B: Methodological*, v130, Dec. 2019, 67-81.
  36. Shi, Z., Zhang, N., Schonfeld, P. and Zhang, J. "Short-term Metro Passenger Flow Forecasting Using Ensemble Learning with Chaos Support Vector Regression," *Transportmetrica A: Transport Science*, 16-2, Feb 2020, 194-212.
  37. Liu, S. and Schonfeld. P. "Effects of Driverless Vehicles on the Competitiveness of Bus Transit Services," *J. of Transportation Engineering, Part A: Systems*, 146-4, April 2020, 12 pages.
  38. Sun, Y., Gong, H., Schonfeld, P., Guo, Q. and Li, Z. "Regulating a Public Transit Monopoly under Asymmetric Cost Information," *Transp. Research Part B: Methodological*, v139, Sept. 2020, 496-522.
  39. Choi, Y., Schonfeld, P., Lee, Y. and Shin, H. "Innovative Methods for Fresh Food Deliveries to Underserved Populations," *J. of Transportation Engineering, Part A: Systems*, 147-1, 04020140, Jan. 2021, 14 pages.
  40. Choi, Y. and Schonfeld, P. "A Comparison of Optimized Deliveries by Drones and Trucks," *Transp. Planning & Technology*, 44-3, March 2021, 319-336.
  41. Guo, Q., Sun, Y., Schonfeld, P. and Li, Z. "Time-dependent Transit Fare Optimization with Elastic and Spatially Distributed Demand," *Transp. Research Part A: Policy and Practice*, v148, June 2021, 353-378. <https://doi.org/10.1016/j.tra.2021.04.002>
  42. Choi, Y. and Schonfeld, P. "Review of Length Approximations for Tours with Few Stops," *Transportation Research Record*, 2676-3, published Oct. 28, 2021. [doi.org/10.1177/03611981211049433](https://doi.org/10.1177/03611981211049433)
  43. Chen, Y., Markovic, N., Ryzhov, I. and Schonfeld, P. "Data-driven Robust Resource Allocation with Monotonic Cost Functions," *Operations Research*, 70-1, Jan. 2022, 73-94; winner of INFORMS TSL 2022 best paper award. <https://doi.org/10.1287/opre.2021.2145>
  44. Wu, F. and Schonfeld, P. "Optimized Two-directional Phased Development of a Rail Transit Line," *Transp. Research Part B: Methodological*, v155, 2022, 424-447.
  45. Chen, L. and Schonfeld, P. "Optimized Zone Sizes and Headways for Flexible-route Bus Services - A Two Zone Case," *KSCE J. of Civil Engineering*, 26(7) July 2022, 3136-3149; DOI 10.1007/s12205-022-1381-x
  46. Kim, M., Schonfeld, P. Roche, A. and Raleigh, C. "Optimizing Service Zones and Frequencies for Flexible-route Freight Deliveries," *Transp. Research Part A: Policy and Practice*, v159, May 2022, 182-199.