

SAE =DGE=™
RESEARCH REPORT

**Unsettled Issues
Regarding First- and
Last-mile Transport**

Jody E. Muelaner, PhD

Currently in preview, click to buy full version

Unsettled Issues Regarding First- and Last- mile Transport

Jody E. Muelaner, PhD
Muelaner Engineering Ltd.

EDGE DEVELOPMENT TEAM

Kevin Mayne, *Cycling Industries Europe*
Jos Sluijsmans, *Fietsdiensten.nl*
Charlie Ford, *Hatah Solutions*
Richard Grigsby, *Iceni Cycles Ltd*

Laurence Wilse-Samson, PhD, *Bird Rides, Inc*
Isabelle Clement, *Wheels for Wellbeing*
Heidi Russenberger, *Wheels for Wellbeing*





About the Publisher

SAE International® is a global association of more than 128,000 engineers and related technical experts in the aerospace, automotive and commercial-vehicle industries. Our core competencies are life-long learning and voluntary consensus standards development. Visit sae.org

SAE EDGE™ Research Report Disclaimer

SAE EDGE™ Research Reports focus on topics that are dynamic, in which knowledge is incomplete, and which have yet to be standardized. They represent the collective wisdom of a group of experts and serve as a practical guide to the reader in understanding unsettled subject matter. They are not meant to provide a recommended practice or protocol. The experts have assembled as a community of practitioners to contribute and collectivize their thoughts and points of view. These are not the positions of the institutions or businesses with which they are affiliated, nor is one contributor's perspective advanced over others. SAE EDGE™ Research Reports are the property of SAE International and SAE alone is responsible for their content.

About This Publication

SAE EDGE™ Research Reports provide state-of-the-art and state-of-industry examinations of the most significant topics in mobility engineering. Contributors to SAE EDGE™ Research Reports are experts from academia, government, industry, and research who have come together to explore and define the most critical advancements, challenges,

and future direction in areas such as vehicle automation, unmanned aircraft, cybersecurity, advanced propulsion, advanced manufacturing, Internet of Things, connectivity, and quantum technology.

Related Resources

SAE EDGE™ Research Report: Unsettled Issues in Electrical Demand for Automotive Electrification Pathways
by Jody E. Muelaner, PhD
<https://saemobilus.sae.org/content/EPR2019004>

SAE EDGE™ Research Report: Unsettled Technology Domains for Pathways to Automotive Decarbonization
by Jody E. Muelaner, PhD
<https://saemobilus.sae.org/content/EPR2020014/>

J3194: Taxonomy and Classification of Powered Micromobility Vehicles
https://saemobilus.sae.org/content/J3194_201911/

Data Sharing Goals and Metrics for Shared Micromobility
<https://saemobilus.sae.org/content/MDC00002202004/>

SAE Team

Francisco Machaca, Chief Growth Officer
Michael Thompson, Director of Standards, Information and Research Publications
Mônica Nogueira, Director of Content Acquisition
Beth Ellen Dibeler, Product Manager
William Kucinski, Managing Technical Editor

Copyright © 2021 SAE International. All rights reserved.

No part of this publication may be reproduced, stored in a retrieval system, distributed, or transmitted, in any form or by any means without the prior written permission of SAE International. For permission and licensing requests, contact SAE Permissions, 400 Commonwealth Drive, Warrendale, PA 15096-0001 USA; e-mail: copyright@sae.org; phone: +1-724-772-4028; fax: +1-724-772-9765.

Printed in USA

Information contained in this work has been obtained by SAE International from sources believed to be reliable. However, neither SAE International nor its authors guarantee the accuracy or completeness of any information published herein and neither SAE International nor its authors shall be responsible for any errors, omissions, or damages arising out of use of this information. This work is published with the understanding that SAE International and its authors are supplying information but are not attempting to render engineering or other professional services. If such services are required, the assistance of an appropriate professional should be sought.

EPR2021024

ISSN 2641-3336

e-ISSN 2640-3344

ISF 3-1-1686-0386-6

To purchase bulk quantities, please contact: SAE Customer Service

E-mail: CustomerService@sae.org

Phone: 877-606-7323 (inside USA and Canada)

+1-724-776-4970 (outside USA)

Fax: +1-724-776-0790

<https://www.sae.org/publications/edge-research-reports>

About the Editor



Dr. Jody E. Muelaner is a chartered mechanical engineer with a background in metrology, aerospace manufacturing, and machine design. He now specializes in writing about technical topics in a way that the target audience can easily understand.

His writing has included technical reports for Rolls-Royce and Airbus, peer-reviewed journals, UK Government reports, as well as magazines and websites. He has published several hundred articles and received the Sage Best Paper Award in 2010.

Starting out in machine design, Dr. Muelaner initially worked on sawmill, waste processing machinery, domestic appliances, and medical devices. After moving into metrology, his research focused on modeling and optimizing uncertainty in manufacturing systems, enabling right-first-time assembly, and the design of innovative test instruments. He founded Muelaner Engineering Ltd. in 2018 to provide consultancy and technical writing services within advanced manufacturing and sustainable transport. Dr. Muelaner lives with his family in Bristol.

Currently in preview, click buy full version

contents

About the Editor

Unsettled Issues Regarding First- and Last-mile Transport **3**

 Introduction **4**
 Transport in Relation to Climate Objectives **4**
 Enabling Zero-emission Transport **4**
 Types of FLO-mile Transport **5**

 Convenience **6**
 Recommendations **7**

 Decarbonization and Resources **7**
 Recommendations **8**

 Health and Safety **8**
 Recommendations **9**

 Shared Mobility **9**
 Recommendations **10**

Micromobility for Freight **10**
 Recommendations **10**

Micromobility Infrastructure **11**
 Recommendations **11**

Accessibility of FLO-mile Transport **11**
 Recommendations **12**

Promoting Cultural Change **12**
 Recommendations **12**

Summary **12**
 SAE EDGE™ Research Reports **14**
 Next Steps for First- and Last-mile Transport **14**
 Recommendations **15**
 Definitions **15**
 Acknowledgments **15**
 References **15**
 Contact Information **18**



Unsettled Issues Regarding First- and Last-mile Transport

Abstract

Sustainable first/last/only-mile (FLO-mile) transport is the key to sustainable travel. It could directly replace private car use for short urban journeys, which account for 1% of global greenhouse gas emissions. More importantly, it could enable public transportation to be used for longer journeys, which account for 6% of emissions.

Active travel, such as walking and cycling, has the lowest emissions and—vitality—also gives huge economic benefits that pay for the required infrastructure many times over. When active travel is part of a society’s culture, people are far more likely to get regular exercise. This means less medical treatment and fewer unproductive years with chronic illness. In countries with established cycling cultures, these activity-related benefits boost gross domestic product by multiple percentage points. This alone could pay for the decarbonization of every other area of the economy.

Ridesharing is generally not a good solution: it currently involves very high emissions, and its electrification will be constrained by critical metal supply and congestion. However, ridesharing may have a limited role, such as enabling disabled users to access public transport. E-scooters have lower emissions than cars and many other forms of public transport while having higher emissions than active travel or electrified buses. They do not provide activity-related health benefits. However, e-scooters can have an important role in encouraging greater uptake of FLO-mile transport.

A mass switch to more sustainable modes of transport requires these modes to offer better perceived value. This involves a more convenient user experience at a lower cost. The first step is to end the hidden subsidies on unengaging forms of transport—whereby society covers the costs of reduced productivity, health care, and welfare for those made sick by inactivity, air pollution, and accidents. Infrastructure must then be created to provide comprehensive, efficient, and attractive routes for active travel.

Shared mobility services, both cycles and e-scooters, are becoming more popular and can help to encourage greater adoption. However, shared mobility involves much higher lifecycle emissions, including manufacture, redistribution, and service operations and station construction. Privately owned cycles should, therefore, be prioritized. A currently underexploited configuration is the privately owned folding e-bike. These can be readily taken with the user into buildings and onto public transport.

NOTE: SAE EDGE™ Research Reports are intended to identify and illuminate key issues in emerging, but still unsettled, technologies of interest to the mobility industry. The goal of SAE EDGE™ Research Reports is to stimulate discussion and work in the hope of promoting and speeding resolution of identified issues. SAE EDGE™ Research Reports are not intended to resolve the challenges they identify or close any topic to further scrutiny.

JODY E. MUELANER, PhD
Muelaner Engineering Ltd.

EDGE Development Team

Kevin Mayne, *Cycling Industries Europe*
 Jos Sluijsmans, *Fietsdiensten.nl*
 Charlie Ford, *Hatah Solutions*
 Richard Grigsby, *Iceni Cycles Ltd.*
 Laurence Wilse-Samson, PhD, *Bird Rides, Inc*
 Isabelle Clement, *Wheels for Wellbeing*
 Heidi Russenberger, *Wheels for Wellbeing*

ISSN 2640-3536