PI-0387 Redesigning Outcomes Researching the Redesign of California's Metro Systems

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The Caltrans Division of Research, Innovation and System Information (DRISI) receives and evaluates numerous research problem statements for funding every year. DRISI conducts Preliminary Investigations on these problem statements to better scope and prioritize the proposed research in light of existing credible work on the topics nationally and internationally. Online and print sources for Preliminary Investigations include the National Cooperative Highway Research Program (NCHRP) and other Transportation Research Board (TRB) programs, the American Association of State Highway and Transportation Officials (AASHTO), the research and practices of other transportation agencies, and related academic and industry research. The views and conclusions in cited works, while generally peer reviewed or published by authoritative sources, may not be accepted without qualification by all experts in the field. The contents of this document reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the California Department of Transportation, the State of California, or the Federal Highway Administration. This document does not constitute a standard, specification, or regulation. No part of this publication should be construed as an endorsement for a commercial product, manufacturer, contractor, or consultant. Any trade names or photos of commercial products appearing in this publication are for clarity only.

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Executive Summary

Background

California's metro systems are undergoing significant shifts in how services are structured, driven largely by evolving urban needs and influenced by the principles set out by Jared Walker in "Human Transit." Over the past decade, agencies such as Los Angeles Metro (LA Metro), Alameda-Contra Costa Transit District (AC Transit), San Francisco Municipal Railway (MUNI), and smaller ones like Clovis Transit have embarked on comprehensive frequency and network redesigns. These redesigned systems favor higher-frequency routes with fewer stops, prioritizing efficient network coverage and requiring passenger transfers, often marking the first significant network changes since the streetcar era. Despite these changes, there has yet to be a thorough assessment of the impacts on service quality, ridership outcomes, and overall transportation equity. Key questions remain about the effectiveness of these redesigns in achieving improved urban mobility, increased ridership, and overall satisfaction of public transit users. The primary objective of this project is to conduct a comprehensive evaluation of recent transit network redesigns in California.

Summary of Findings

The research proposal was requested by the Division of Data and Digital Services to look to systematically identify the specific redesigns that have been undertaken, assess their effects on operational efficiency, ridership trends, and equity outcomes, and produce guidebook to help agencies implement effective network redesigns based on lessons learned. The request seeks to establish a set of best practices and develop a framework for making transit networks more effective and responsive to community needs. This in-house preliminary investigation was conducted to ascertain whether credible national or international work on the scope of the proposal has already been completed or is currently in progress.

Related Research and Resources

TCRP Synthesis 140 titled, “Comprehensive Bus Network Redesigns” (2019) captures the many components that are needed to successfully plan and implement a transit network redesign. TCRP Synthesis 10 titled, “Bus Route Evaluation Standards” (1995) discusses the prevalence and contents of documented bus route standards by transit agencies. Meanwhile the research, “Learnings from Urban Bus Network Change” by César Trapote-Barreira, Francesc. Robusté, Hugo Badia-Rodríguez, and Miquel Angel Estrada-Romeu (2016) presents strategies used to improve bus services in Lledia, Spain while also saving resources by implementing a bus network redesign. The authors discuss the objectives of the network redesign, the public engagement process, network evaluation criteria, and the phases of implementation. The Workshop, “Untangling Transit: Bus Network Redesign” by TransitCenter (2013) shares lessons learned based on the input of more than 30 transit agencies at varying stages of system redesigns. From fully implemented to those considering significant changes to their bus networks.

TCRP Report 95 “Traveler Response to Transportation System Changes Handbook (3rd Edition)” (2004) contains in chapter 10 a report on overview of how riders tend to react, on average, to different types of bus routing and coverage changes. The authors discuss many different types of service changes, including “service restructuring,” which is the closest type of change to what this report considers a comprehensive bus network redesign. The handbook provides transit managers some guidance on how

riders might react to a service restructuring based on several case studies. The TRB presentation “Impact of Public Transit Bus System Redesign on Baltimore City Public School Students” by Fathy Elgendi, Young-Jae Lee, Celeste Chavis (2021) researched how the transit service redesign impacted the students.

Gaps in Findings

Although there is some existing research out there on how to perform transit redesigns, there seems to be little to no research on the impact of those redesigns have. The limited research on the impacts of the redesigns is not extensive enough to establish a set of best practices and develop a framework for making transit networks more effective and responsive to community needs

Next Steps

The recommendation is to find a researcher that can perform the following:

- Systematically identify the specific redesigns that have been undertaken.
- Assess their effects on operational efficiency, ridership trends, and equity outcomes.
- Produce a guidebook to help agencies implement effective network redesigns based on lessons learned.

This project seeks to establish a set of best practices and develop a framework for making transit networks more effective and responsive to community needs.

The customer reached out to various researchers and Brian Taylor and Jacob Wasserman responded that they were interested in performing the requested work. The recommendation is to develop a scope of work and proposal with Taylor and Wasserman.

Detailed Findings

This Preliminary Investigation conducted a cursory review of Final Reports related to transit network redesign through internet searches primarily available in the Division of Research, Innovation and System Information and Transportation Review Board (TRB) databases (e.g., NCHRP). The reports are listed below with hyperlinks. Abstracts are also provided for the reports believed by the author to be most relevant to the objective/goals of this preliminary investigations study.

TCRP Synthesis 140: Comprehensive Bus Network Redesigns, TCRP, 2019.
https://nap.nationalacademies.org/catalog/25487/comprehensive-bus-network-redesigns
From the summary on Page 1, "This synthesis captures the many components that are needed to successfully plan and implement a redesign and carefully considers the goals and objectives that agencies set forth when they began that process, helping them determine whether a redesign even made sense for the agency at that point in time."

"Learnings from Urban Bus Network Change", César Trapote-Barreira, Francesc. Robusté, Hugo Badia-Rodríguez, and Miquel Angel Estrada-Romeu, 2016.
https://trid.trb.org/view/1394487

The paper presents the strategies used to improve bus service in Lleida, Spain while also saving resources by implementing a bus network redesign. The authors discuss the objectives of the network redesign, the public engagement process, network evaluation criteria, and the phases of implementation.

Untangling Transit: Bus Network Redesign Workshop Proceedings, TransitCenter, July 2013.
https://transitcenter.org/wp-content/uploads/2018/01/Proceedings-3.pdf
This workshop proceedings document from the July 13, 2017 workshop shares lessons learned based on the input of more than 30 transit agencies at varying stages of system redesigns, from fully implemented to those considering significant changes to their bus networks. The report summarizes discussions from the event into a guide of best practices for transit agencies and others to use as they consider whether and how to update their bus route networks.

TCRP Synthesis 10: Bus Route Evaluation Standards, TCRP, 1995.
https://onlinepubs.trb.org/onlinepubs/tcrp/tsyn10.pdf
This synthesis report discusses the prevalence and contents of documented bus route standards by transit agencies, including standards for route, corridor, and bus stop spacing; limitations on route deviations and branches; route proximity to residences and non-residences, and requirements for population and employment density, among other factors. The research did not specifically address network design standards as a concept; however, transit agencies did have standards for network connectivity, limitations on the number of passenger transfers, and service area coverage—all of which influence a bus network's overall design.

TCRP Report 95: Traveler Response to Transportation System Changes Handbook (3rd ed.), TCRP, 2004
https://www.trb.org/Publications/TCRPReport95.aspx
Excerpt Chapter 10 Bus Routing and Coverage, Richard Pratt, John Evans, 2004
https://nap.nationalacademies.org/catalog/23330/traveler-response-to-transportation-system-changes-handbook-third-edition-chapter-10-bus-routing-and-coverage

Chapter 10 of TCRP Report 95 provides an overview of how riders tend to react, on average, to different types of bus routing and coverage changes. The authors discuss many different types of service changes, including “service restructuring,” which is the closest type of change to what this report considers a comprehensive bus network redesign. The handbook provides transit managers some guidance on how riders might react to a service restructuring based on several case studies.

“Impact of Public Transit Bus System Redesign on Baltimore City Public School Students”, Fathy Elgendi, Young-Jae Lee, Celeste Chavis, TRB, 2021
https://trid.trb.org/View/1759426
Baltimore City Public School System (BCPSS) follows an open choice model for middle and high schools, and student transportation is provided by the Maryland Transit Administration (MTA). Studies have shown that BCPSS students traveling by public transit have travel times longer than Baltimore residents' work commutes. Public transit routes are designed for access to jobs that were historically located in the Central Business District (CBD) and not to serve students and schools which are more dispersed throughout the city. The objectives of this research is to evaluate the effect of the MTA transit service redesign on BCPSS students. This was achieved by performing a travel time analysis to schools pre and post network redesign and identifying residential locations (aggregated to traffic analysis zones (TAZs)) and school pairs with insufficient service based on key performance metrics.