UTAH ROAD AND TRANSIT COST STUDY

Technical Report

March 2022

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UTA

WASATCH FRONT REGIONAL COUNCIL

Table of Contents

Acronyms

BMI	Body Mass Index
BTS	Bureau of Transportation Statistics
EAC	Equivalent Annual Cost
FHWA	Federal Highway Administration
HTF	Highway Trust Fund
IRS	Internal Revenue Service
JHC	Joint Highway Committee
MAG	Mountainland Association of Governments
MPO	Metropolitan Planning Organization
NTD	National Transit Database
O and M	Operations and Maintenance
TIF	Transportation Investment Fund
UDOT	Utah Department of Transportation
UTP	Unified Transportation Plan
UTA	Utah Transit Authority
VMT	Vehicle Miles Traveled
WFRC	Wasatch Front Regional Council

Introduction

The purpose of the Road and Transit Cost Study is to provide agencies, policy makers, and the public with clear, neutral information on relative transportation costs as they discuss transportation options and trade-offs. Specific study elements include:

1. The level of investment required to provide different parts of Utah's transportation system;
2. The cost effectiveness of different parts of the system based on usage; and
3. Sources of funding for each part of the system.

While transportation has varying benefits and elements to consider, this Study focuses solely on the direct financial costs of providing Utah's roads and transit service as they are experienced by the public today. This cost information can be one part of the many considerations in the larger discussion of how to best meet people's travel and mobility needs. The Transportation Investment Considerations section of this Report covers indirect and cumulative costs and benefits that are not covered in this Report but should be considered for decision-making.

This is a joint study between the Mountainland Association of Governments, the Utah Department of Transportation (UDOT), the Utah Transit Authority (UTA), and the Wasatch Front Regional Council. This report serves as a technical report summarizing the assumptions and the methodology of the Study. Supplemental information about data and methodology are included in Appendix A, while information about key findings can be found in Appendix B.

Study Extent

The primary comparison in the Study is between annual road costs and transit costs averaged over the five-year period from 2015-2019. Road costs are analyzed at the state level and broken down by ownership and geography. Transit costs are analyzed for the Utah Transit Authority service area and are broken down by transit mode.

The different levels of analysis are due to data availability and the nature of each service area. Roads operate statewide, but UTA transit service operates only in select counties. Other transit providers were excluded because UTA provides the majority of transit service in the State and simplifies the data gathering process. Costs are normalized to generate statistics comparable despite the different geographic extents.

Table 1. Study Extent and Cost Breakdown

	ROADS	TRANSIT
Extent	Statewide	UTA service area
Cost Breakdown	Ownership: » Local » State Geography: » Rural » Urban (MPO)	Transit mode: » Bus (includes bus rapid transit) » Commuter bus (includes express bus) » Commuter rail » Demand response » Light rail » Vanpool

Costing Methods

The Study used two approaches to estimating the cost of each system to provide a full exploration, but only the simpler of the two approaches was selected for continued use. Results between the two approaches were similar enough that the added complexity of the second approach was deemed unnecessary for ongoing communication with non-technical audiences. These approaches are:

- **Ongoing Annual Costs**, which is the simpler of the two methods, ignores the sunk cost of historical investments and includes only continued expenditures by governments and individuals each year on each system. This approach looks at costs from the perspective of each part of the transportation system as it exists today.
- **Fully Allocated Cost** assessment represents a complete accounting of all resources required to provide a transportation service as it is experienced today, including historical investments currently in use. This accounts for the value currently being derived from past investments that are not reflected in an agency's ongoing annual expenditures.

The fully allocated cost approach was explored due to concerns that the road system was benefiting from decades of investment in capital stock that was still partially in use today that would not be accounted for by only assessing current agency spending. Transit, meanwhile, was much younger and the early investments were still being paid in UTA's ongoing annual expenditures. Calculating fully allocated costs provided an opportunity to examine the extent of this disparity and how it affects the discussion of costs.

However, results showed little difference in the relative costs of road and transit under the fully allocated analysis as compared with the ongoing annual cost analysis. This, combined with the fact that the ongoing annual costs analysis is much simpler and easier to communicate, led the research team to recommend moving forward with the costs under an ongoing annual cost approach.

In addition to these primary costing methods, a **joint cost allocation** method was applied within both approaches when there was shared use of infrastructure between the two major modes and when costs could not be attributed to a particular breakdown category.

1. **Shared Use of Infrastructure** – Where there was shared use of infrastructure, such as transit vehicles operating on roads. Transit's share of road costs are excluded from the road calculation and added to the transit costs. These allocations were made based on vehicle miles traveled (VMT).
2. **Non-attributable Costs** – When costs could not be attributed to a particular category, such as geography. In the urban-rural breakdown of costs, a portion of UDOT costs could not be attributed to a particular area. It is assumed that the remaining costs are administrative and other shared costs, which were allocated among all geographies according to each area's share of other costs.

Denominators

The Study applies three different denominators to look at costs and cost effectiveness in ways that uncover slightly different aspects of transportation efficiency.

- **Per Capita** measures give information on magnitude of spending that is relatable and comparable between the systems. When calculated for breakdown between categories, per capita unit costs use the same denominator across categories. As a result, the values should be added together to get the statewide number. Other metrics would be averaged.
- **Per Trip** measures tell us how expensive it is to make a standard trip on each system without regard for how long typical trips are on each mode. This allows for relative differences in each system's common or intended usage without being "penalized" for the difference. Trips can be looked at by vehicle trips, which does not account for average vehicle occupancy, or by person trips, which does include occupancy in the calculation.
- **Per Mile** measures take distance into account to look at the basic cost of moving people and vehicles through the same amount of space. As with per trip measures, there can be a vehicle miles measure or a person miles measure, which takes vehicle occupancy into account.

Literature Review

To ensure the Study would benefit from established methodologies used in similar studies, the team conducted an extensive literature review of agency and academic research papers related to the costs and efficiency of road and transit costs. No exactly comparable study was found of a US state comparing the cost effectiveness of road versus transit, and there was not a clear “standard” methodology for an analysis like this. Studies that were similar or held useful information and methodological approaches tended to be between 15-20 years old and were largely international.

From this small batch of relevant literature, the team decided to implement a few key methodological approaches. First were some basic approaches to sharing joint costs, such as bus use of roads, based on VMT. Another method used by several studies addressed different levels of historical investment by estimating the current value of all infrastructure and annualizing them. This is what led the Study team and Steering Committee to develop the Fully Allocated Cost method to address this concern in the Utah context.

Findings

The Study calculated cost effectiveness in five ways: per capita, per vehicle trip, per person trips, per vehicle mile, and per person mile. This section includes a summary of the Study's findings. Additional information can be found in Appendix A and Appendix B. An overall total cost results summary for all roads and the UTA transit system are shown in Table 2. For more detail, please refer to Appendix A - Technical Cost Analysis.

Table 2. Total Costs Results

	AVERAGE ANNUAL ROAD COST	AVERAGE ANNUAL TRANSIT COST
Total	**$20,141,158,763**	**$517,725,489**
Per Capita	$6,470.13	$249.98
Per Vehicle Trip	$6.39	-
Per Person Trip	$3.00	$11.45
Per Vehicle Mile	$0.64	-
Per Person Mile	$0.30	$1.41

Note: Both vehicle- and person-level statistics are used for roads, as both perspectives are often considered in different planning contexts. Vehicle statistics are less meaningful on the transit side for this Study's purpose so they are not included.

Table 3. Cost Breakdown: Public and Private Expenditure

	PER PERSON TRIP COST			PER PERSON MILE COST		
MODE	PRIVATE AND PUBLIC EXPENDITURES	PUBLIC EXPENDITURE	PRIVATE EXPENDITURE	PRIVATE AND PUBLIC EXPENDITURES	PUBLIC EXPENDITURE	PRIVATE EXPENDITURE
Road	**$3.00**	**$0.30**	**$2.70**	**$0.30**	**$0.03**	**$0.27**
Transit	**$11.45**	**$10.29**	**$1.16**	**$1.41**	**$1.26**	**$0.15**

Note: Public expenditure is spending by governments to build, maintain, and operate the transportation system and includes user fees (except transit fares) and general funds. User fees are government revenue based on system usage and general funds are government revenue from activity unrelated to system usage.

Private expenditure is spending by individuals to access and use the transportation system,such as owning and operating a vehicle and transit fares.

The Study further broke down roads by local and state ownership, as shown in Table 3, and rural and urban location, as shown in Table 4.

Table 4. Cost Breakdown: Local and State Roads

	LOCAL ROAD COST	STATE ROAD COST
Total	**$6,889,524,546**	**$13,251,634,217**
Per Capita	$2,213.19	$4,256,95
Per Vehicle Trip	$6.25	$6.47
Per Person Trip	$2.93	$3.04
Per Vehicle Mile	$0.62	$0.65
Per Person Mile	$0.29	$0.30

Table 5. Cost Breakdown: Rural and Urban Roads

	RURAL ROAD COST	URBAN ROAD COST
Total	**$5,059,526,549**	**$15,081,632,213**
Per Capita	$1,625.32	$4,844.81
Per Vehicle Trip	$8.63	$5.63
Per Person Trip	$4.05	$2.65
Per Vehicle Mile	$0.86	$0.56
Per Person Mile	$0.41	$0.26

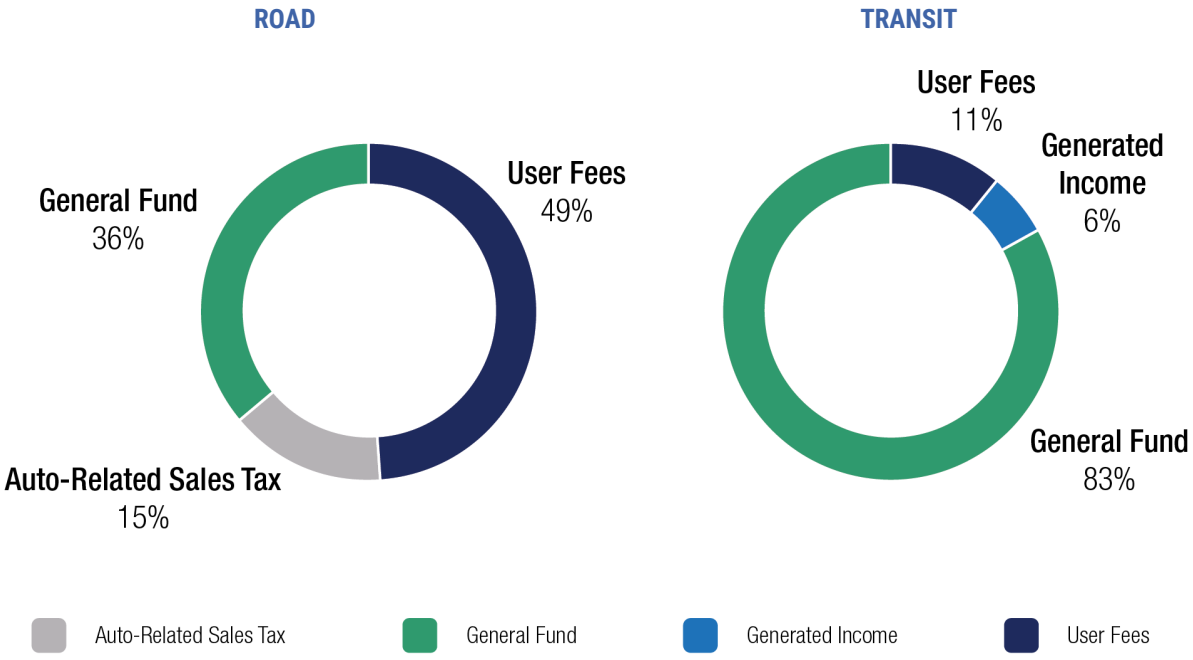
Finally, the Study further aggregated the data by transit mode in the UTA system.

Table 6. Cost Breakdown: Transit Modes

	BUS	COMMUTER BUS	COMMUTER RAIL	DEMAND RESPONSE	LIGHT RAIL	VANPOOL
Total	**$183,524,382**	**$8,498,621**	**$119,323,736**	**$183,524,382**	**$166,138,264**	**$12,580,923**
Per Capita	$88.61	$4.10	$57.61	$12.55	$80.22	$6.07
Per Person Trip	$9.37	$14.99	$24.53	$66.76	$8.95	$10.04
Per Person Mile	$2.13	$0.67	$0.93	$5.94	$1.81	$0.28

Graphics 1 and 2 show the percent of each funding source (auto-related sales tax, general fund, generated income, private user spending, and user fee) in the overall total cost by public revenue only and public revenue and private spending combined[1].

Graphic 1. Funding Source Comparison: Public Revenue Only

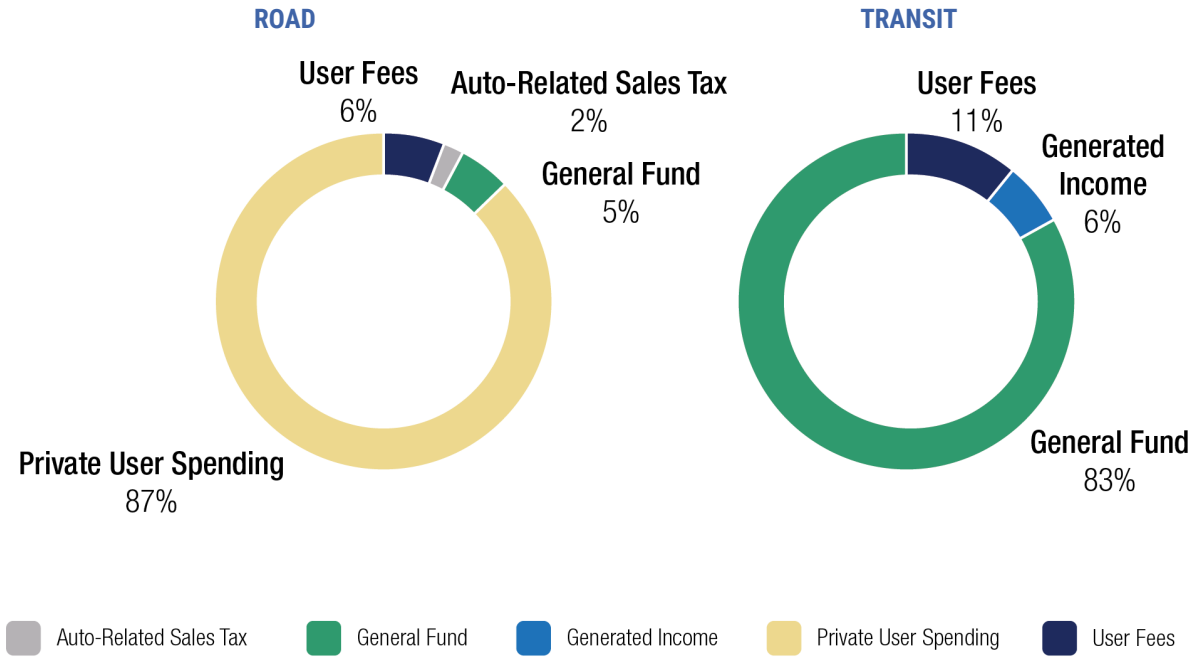


Note: For road public revenue, both general fund and user fees contain federal funds. For transit public revenue, general fund contains federal funds.

[1] The primary sources of funding for transportation fall into three large categories:

- **User Fees:** Public revenues that come from defined economic activity stemming from transportation system usage, such as gas taxes and registration fees.
- **General Funds:** Public revenues that come from taxpayers who may not be system users for economic activity unrelated to transportation system usage, such as sales tax or property taxes.
- **Private Costs:** Spending by individual system users necessary to use the transportation system, which do not flow through public agencies, such as automobile purchase and operation costs

Graphic 2. Funding Source Comparison: Public Revenue and Personal User Spending



Methodology: Data Collection

The Study team, including MAG, UDOT, UTA, WFRC, and the consultant team, decided early in the project to utilize the Unified Transportation Plan (UTP) financial model, which contains historic transportation funding data, as the primary source of data for the analysis. This source provided the majority of cost data for both travel modes and across breakdown categories, as well as for some of the denominator data on VMT and regional population. All data is averaged over the five-year period 2015-2019. This period was selected because it is the period for which all data was available. Costs from earlier years were inflated to 2019 dollars.

Data not in the Unified Plan financial model was obtained from the following sources:

Table 7. Data Sources

DATA SOURCE	DATA
Highway Statistics Series	Lane miles by ownership, functional class, and geography, total VMT
Internal Revenue Service (IRS)	Mileage reimbursement rate
National Transit Database (NTD)	Modal breakdown of spending, UTA population area, ridership data
UDOT Asset Management Team	Detailed financial data on transit operation, debt, and interest rates
UTA	Detailed financial data on transit operation, debt, and interest rates
Utah Travel Study	Share of VMT on state roads, average vehicle occupancy, average trip length

The below sections outline the sources of data in more detail.

Cost Data: State-Owned Roads

Costs for the state-owned road network came from the 2019 Unified Transportation Plan Financial Model's line items for UDOT expenditures. The UDOT line items are broken out by major funding source, with a separate line item for funds that are transferred to localities for use on the local road network. These local funds, referred to as "B and C Funds," were subtracted from the other UDOT expenditures and only counted in the local network expenditures (below). The analysis also assumed that funds in the category "Metropolitan Planning Organization (MPO) and Joint Highway Committee (JHC)" funds are spent on the local system.

Table 8. State-Owned Roads Cost Data Sources

FUNDING	DATA SOURCE
UDOT Federal Expenditures	UTP Financial Model, "UDOT" tab
UDOT Transportation Fund, State-Owned (B & C Funds excluded)	UTP Financial Model, "UDOT" tab
UDOT Transportation Investment Fund (TIF)	UTP Financial Model, "UDOT" tab

Cost Data: Local-Owned Roads

Expenditures are preferred to represent the costs of each system, but only the revenues provided to counties and cities are documented in the Unified Transportation Plan Financial Model. The model does not have confirmation from these localities on how they expended the funds. The assumption is therefore required that 1) localities spent all the funds provided to them as revenues in each year, and that 2) the funds were spent on the local system. The research team and Steering Committee deemed these assumptions reasonable.

Local revenues are outlined in the Unified Transportation Plan Financial Model by the State's four MPOs and combined rural areas based on sales tax and other sources of revenues at the county level as well as at the local municipal level. State Transportation Fund B & C Funds are included in these county and local line items. MPO & JHC funds are added to this from UDOT line items.

Table 9. Local-Owned Roads Cost Data Sources

FUNDING	DATA SOURCE
Total County Revenues	UTP Financial Model, Cache, Dixie, MAG, Rural, and WFRC tabs
Local Revenues (B & C Funds included)	UTP Financial Model, Cache, Dixie, MAG, Rural, and WFRC tabs
UDOT MPO & JHC Funds	UTP Financial Model, "UDOT" tab

Cost Data: Transit

Total transit expenditures came from the Unified Transportation Plan Financial Model, which are broken down into debt service, operations and maintenance (O and M), and capital expenditures, as well as further into more detailed line items within each category. Breakdowns of spending on each mode came from the National Transit Database (NTD) Annual Profiles for UTA.

There were slight differences in the total amounts from the two sources, so total costs were based on the Unified Transportation Plan Financial Model, with the NTD profile guiding only the modal breakdown. The major difference is that the NTD expenditures do not include debt service, so the total debt service amounts from the Unified Transportation Plan Financial Model was divided among light rail and commuter rail based on confirmation by UTA that these are the only modes for which debt was incurred. The remaining small discrepancy in the total values from the two sources was divided among the six modes based on the share of capital expenditures from the NTD modal breakdown.

Table 10. Transit Cost Data Sources

FUNDING	DATA SOURCE
UTA O & M Expenditures	UTP Financial Model, "UTA" tab
UTA Capital Expenditures	UTP Financial Model, "UTA" tab
UTA Debt Service	UTP Financial Model, "UTA" tab
UDOT TIF	UTP Financial Model, "UDOT" tab

Denominator Data

The denominators in the analysis included population, number of vehicle and person trips, and number of vehicle and person miles traveled. Each of these was broken down by road ownership network and geography for roads, and for transit mode for transit. The needed travel statistics came from a diversity of sources, and many were calculated based on other statistics. The below table covers the data sources and calculation methods used to derive all denominators used in the analysis.

Table 11. Highway Travel Denominator Data Sources

DENOMINATOR	SOURCE & NOTES
VMT and Person Miles of Travel	
Total Utah VMT	Federal Highway Administration (FHWA) Highway Statistics
Average Vehicle Occupancy	Utah Travel Study, Table 1.21
Total Person Miles Traveled (PMT)	*Calculated: VMT * Average Occupancy*
VMT by Ownership	
State Road VMT Share	2012 Utah Travel Study, Figure 3 "State roads carry 65% of travel"
State Road VMT	*Calculated: VMT * State Road VMT Share*
Local Road VMT	*Calculated: Total VMT - State Road VMT*
VMT by MPO and Non-MPO Regions	
VMT by MPO and non-MPO Regions	From UTP spreadsheet, 2017 Population Estimates tab
Calculation Note:	*Regional VMT was only available for 2015 and 2016. First, these were adjusted to match the total state VMT used in other parts of the analysis. Second, years 2017-2019 were estimated by applying the same growth rate to each region as was experienced statewide.*
Trip Length	
Average Trip Length, Statewide	BTS, National Household Travel Survey "1.1 billion trips per day, 11 billion miles per day"
Average Trip Length, Urban (MPO)	Utah Travel Study Table 1.17, 2012 Average Trip Lengths
Average Trip Length, Rural	Utah Travel Study Table 1.17, 2012 Average Trip Lengths
Number of Trips	
Number of Vehicle Trips	*Calculated: Total VMT/Average Trip Length*
State-Owned	*Calculated: State-Owned Network VMT/Average Trip Length*
Local-Owned	*Calculated: Local-Owned Network VMT/Average Trip Length*
Number of Person Trips	
State-Owned	*Calculated: Vehicle Trips*Average Occupancy*
Local-Owned	*Calculated: Vehicle Trips*Average Occupancy*

Table 12. Transit Usage Denominator Data Sources

DENOMINATOR	SOURCE & NOTES
Unlinked Passenger Trips	UTA NTD Annual Profile
Total Passenger Miles	UTA NTD Annual Profile
Transit Road Miles (for cost sharing)	UTA NTD Annual Profile *Calculated: Sum of vehicle miles for Bus, Commuter Bus, Demand Response, and Vanpool Service*
Calculation Note:	*Each metric is available by modal breakdown in the NTD Annual Profile.*

Table 13. Population Denominator Data Sources

DENOMINATOR	SOURCE & NOTES
Statewide Population	From UTP spreadsheet, "2017 Population Estimates" Tab
Population by MPO and non-MPO Regions	From UTP spreadsheet, "2017 Population Estimates" Tab
UTA Service Area Population	UTA NTD Annual Profile
Calculation Note:	*The UTA service area in the NTD profile is from the 2010 Census. To get an updated estimate of the service area population, the share of UTA service area population to total 2010 state population (66.5%) was applied to current statewide population estimates.*

Private Vehicle Costs

The cost of owning and operating a private vehicle is included in the analysis to capture all direct costs of using each mode of travel. It is based on the IRS rate for mileage deductions, which is calculated based on all costs of ownership including depreciation, registration fees, insurance, maintenance, and fuel costs.

Table 14. Private Vehicle Cost Data Source

COST	SOURCE & NOTES
Per-Mile Vehicle Cost	IRS Mileage Rate

Replacement Value of System Data

Additional data was used for the Fully Allocated Cost analysis on the value of the total transportation system if it were rebuilt today. UDOT's Asset Management team already had the "total replacement cost" calculated for state-owned roads. UTA had previously calculated this for the transit system based on records of investments in infrastructure. Local roads estimates required additional analysis, outlined more fully in the Analysis section below.

Table 15. Total System Replacement Value

SYSTEM ASSET	SOURCE & NOTES
State Roads Replacement Value	UDOT Asset Management team estimates
Transit System Value	UTA Investment Records
Local Roads Replacement Value	Study team calculation
Average Useful Life of Assets	UDOT Asset Management/UTA estimates

Methodology: Analysis

Ongoing Annual Costs

Data collection and deciding how each category's costs are defined is the bulk of the work for the Ongoing Annual Cost analysis. Once costs and denominators are defined, obtaining the cost efficiency metrics is simple arithmetic:

Cost / Usage (people, trips, or miles)

Fully Allocated Costs

Based on the findings of the literature review and discussion with Steering Committee members to date, the research team decided to pursue a fully allocated cost analysis that would capture the extent of historic capital investments. Reasons include:

- Based on the literature found by the team, this approach is frequently used in other transportation cost estimation studies.
- Estimates of this historical capital value already exist for both the road and transit side, at least for state-owned roads.
- A concern in the current study was how to treat different levels of historic and ongoing capital investment between roads and transit, and this approach addresses this.

This analysis is more complex than the Ongoing Annual Cost analysis, including additional data sources, assumptions, and analytical methods.

Additional Data

- Replacement value for each system
- Expected useful life for each asset
- Inflation rate
- Cost of debt (interest rate)

Local Roads Replacement Value Estimation

UDOT's Asset Management team already had the replacement value for the state-owned road network developed for other work that had been reviewed and vetted by experts. UTA had recently conducted a similar estimation using investment records for their system, which are comprehensive and reliable data. No such existing estimate existed for the local road network, so the team conducted an analysis to derive this estimate.

Local Road Mileage

Local road mileage was gathered from FHWA's Highway Statistics table HM-50, Length by Functional Class and Ownership. Length was converted to lane miles using Table HM-60, Lane Miles by Functional Class to get average number of lanes by functional class. Combined they produced locally owned lane miles by functional class.

Share of road length that is paved, gravel, or dirt comes from the Unified Transportation Plan spreadsheet's data on B & C roads. Gravel and dirt roads were taken out of the calculations using paved road costs.

Road Construction Costs

Paved road costs were gathered from FHWA's Conditions and Performance Report Appendix A, which provides per-mile estimates for new road construction in different settings (large to small urban, rural flat, rural mountainous, etc.) The table does not provide estimates for Minor Collector and Local road construction, so it was assumed that construction costs for these roads were 80 percent of the cost to construct Minor Arterials.

Local Road Analysis

The team made high-level assumptions on the miles of each road type in each setting from the Conditions and Performance Report based on the share of mileage by region and the share of the State that is mountainous. Dirt and gravel roads were assumed to be rural.

Bridge Assets

Data on locally owned bridges came from UDOT's 2017 Annual Bridge Report, which reports total square footage for all local bridges, but no square footage breakdown of type. The number of local bridges are broken down by type.

Bridge Costs

Estimated bridge costs by deck area and bridge type came from a 2014 Florida DOT estimate of average bridge types. The 2014 costs were inflated to 2019 dollar values.

Local Bridge Analysis

The team applied the per square foot cost of each bridge type to the area calculated from the UDOT Annual Bridge Report.

Assumptions and Analytical Choices

- The capital asset valuation represents the replacement cost of the system if it were built from the ground up in 2019.
- This total replacement cost was annualized over each asset's expected useful life.
- A method called "Equivalent Annual Cost" (EAC) was applied to annualize the total system value costs. It represents the annual cost of owning, operating, and maintaining an asset over its entire

life, and is a method used to compare the cost-effectiveness of assets that have unequal lifespans.[2]

***EAC** = (Asset Price x Discount Rate) / (1 – (1 + Discount Rate)^-n)**

n = number of periods, or lifespan of the asset

Discount Rate = Cost of Capital

» The discount rate used was the agency's interest rate on debt, which is a common approach for public sector discount rates.[3]

Funding Sources

The primary sources of funding for transportation fall into three large categories:

» **User Fees:** Public revenues that come from defined economic activity stemming from transportation system usage, such as gas taxes and registration fees.
» **General Funds:** Public revenues that come from taxpayers who may not be system users for economic activity unrelated to transportation system usage, such as sales tax or property taxes.
» **Private Costs:** Spending by individual system users necessary to use the transportation system, which do not flow through public agencies, such as automobile purchase and operation costs.

Road Funding Sources

Identifying how much of each funding type is going to each mode required researching how each funding program derives its funds. This includes accounting for the realities of funding rather than just the prescribed formula for funding. There are two road funding sources that are made up of multiple funding sources: Federal Funds and Utah's TIF.

The Highway Trust Fund (HTF) supplies federal funding to states like Utah, and is derived from the federal gas tax, which would count as 100 percent user fee. In the past, however, infusions from general revenues have been made to make up for the shortfall in the HTF. The last transfer of $70 billion occurred in 2015 and is partly used each year. The Study team estimated that this accounted for 17.4 percent of annual highway outlays over this time period. Federal Funds are therefore counted as 82.6 percent user fee, and 17.4 percent general funds.

The TIF is made up of Utah motor fuel taxes (five percent) and Utah vehicle registration fees (12 percent) that are unambiguously user fees, but the remaining 83 percent of the fund comes from a Utah state sales tax. Sales taxes are generally treated as general funds as they are not directly related to system usage, but in Utah this revenue source came about by an analysis showing that 17 percent of all sales are transportation-related. The case was therefore made that this revenue can be seen as a user fee as individuals purchase things necessary for their cars and other travel. (Note: the 17 percent of sales being related to transportation is different from the 17 percent of the TIF that comes from other user fees. The amounts being the same is purely coincidence.)

[2] Investopedia https://www.investopedia.com/terms/e/eac.asp
[3] https://www.nber.org/system/files/chapters/c14364/revisions/c14364.rev1.pdf

Table 16. Road Funding Sources

PROGRAM	USER FEE	GENERAL FUNDS	PRIVATE SPENDING
Federal Funds	82.6%	17.4%	
Transportation Fund	100%		
Transportation Investment Fund	17%	83%*	
Local Registration Fees	100%		
Local Sales and Property Taxes		100%	
Developer Investment			100%
Vehicle Costs			100%

**There is debate within Utah as to whether the TIF sales tax revenue counts as a user fee or general funds. In the presentation of results this portion of funding is left as a stand-alone category with a note of explanation.*

Because user fees like gas tax and vehicle registrations are included in both the public sector spending and in calculations of private vehicle costs, the user fee portion of public funds were removed from the private cost calculation to avoid double counting.

Transit Funding Sources

Transit sources were determined through an examination of the line items in the Unified Transportation Plan Financial Model's UTA revenue tables, and an assignment made for each line item. While user fees and general funds remain the primary split in funding sources, a unique category termed "Generated Income" was added to account for revenue from advertising ,investment income, etc. A generalization of the assignments is below.

Table 17. Transit Funding Sources

Passenger and Special Service Fares	User Fee
Sales Taxes, Federal Funds, Subsidies	General Funds
Advertising, Investment Income	Generated Income

Transportation Investment Considerations

When deciding to invest in one transportation option over another, there are several factors a community needs to consider. This study is intended to provide Utah's transportation leadership and state policymakers with unbiased information on one of these considerations: cost. The results of the Road and Transit Cost Study should be integrated with quality information on the full range of considerations, which are outlined below.

Cost Efficiency

With public sector transportation agencies facing tighter budgets, cost is often a foremost consideration in selecting investments. The results of this Study show that transit travel is between two and five times more expensive on a per trip and per mileage basis.

Space Efficiency

Decisions to expand transportation services must consider the space available for network expansion. Roads require five to ten times the amount of space to achieve the same person throughput as transit[4] and requires additional space for parking.

Marginal Capacity Potential

Roads and transit each have different expansion options that can provide varying degrees of marginal capacity increases for varying costs. For example, road capacity expansion can include operational strategies to increase existing road capacity and transit can add capacity with increased frequency, skip stopping, or larger vehicles.

Table 18. Marginal Capacity Potential

EXPANSION TYPE	ROADS	TRANSIT
Low-Cost, Small Capacity Increase	Operational or technology strategies to increase the capacity of existing roadways	Add more passengers to existing service vehicles
Mid-Cost, Medium Capacity Increase	Adding a travel lane	Add new vehicles to existing routes
High-Cost, High Capacity Increase	New road construction	New route construction

[4] National Association of City Transportation Officials, https://nacto.org/publication/transit-street-design-guide/introduction/why/designing-move-people/

Improvements to cost efficiency can be made in two different ways: building less expensive transportation facilities or increasing the usage of existing facilities. If current infrastructure has capacity at peak usage that can be utilized with little to no expansion, efforts can be made to increase usage of the mode to increase person throughput and cost efficiency.

Safety

Nationally, there are 36,096 highway fatalities each year, compared with 267 transit-related fatalities[5]. This translates to 45 deaths per million passenger miles for passenger vehicles, five deaths 5 per million passenger miles for buses, and 0.5 per million passenger miles for passenger trains.[6]

Equity

Private vehicle and associated ownership and fuel costs constitute more than 80 percent of total road usage costs, according to this Study. Populations who cannot afford car ownership, as well as segments of the population who cannot drive, such as youth, the aging, and the disabled, have mobility options with transit access.

Environment

Today's primary air quality benefit of transit along the Wasatch Front is reducing vehicle congestion and pollution in the peak AM and PM commuting periods. The TRAX Blue and Red lines are great examples of this.

UTA's new, electric OGX Bus Rapid Transit in Ogden is scheduled to open in 2023, UTA's Future of FrontRunner Study is considering electrification, and UTA has been working to reduce emissions on the existing FrontRunner locomotives. UTA is developing a bus fleet replacement plan to replace a significant portion of diesel buses with electric-battery-powered vehicles. UTA has also signed a contract to purchase 35 battery vehicles. This contract also allows for the purchase of up to 90 vehicles in the future.

However, the diesel buses and diesel locomotives currently in use by UTA emit more NOx than the passenger car trips they eliminate. When the number (30% according to the Wasatch Front travel demand model) of transit patrons that drive to or are dropped off (including a cold start) at transit stations is considered, the emission benefits of transit are further reduced. There is an opportunity to expand the bus network and improve active transportation routes to these transit stations which would eliminate cold starts. Changes in UTA's fleet composition will dramatically improve UTA's environmental impact going forward.

Diesel engines emit less CO, but more NOx than gasoline engines. In 2020, Salt Lake was designated attainment for CO by the Environmental Planning Agency, and Ogden and Provo are soon to follow. Cleaner fuels and engines have aided in improving CO in the Region. The Wasatch Front's air quality issues are caused by PM2.5 and Ozone - a key ingredient to both of these issues are NOx emissions from diesel fuel.

[5] Bureau of Transportation Statistics, https://www.bts.gov/content/transportation-fatalities-mode
[6] Bureau of Transportation Statistics, https://www.bts.gov/content/transportation-fatalities-mode

Freight

Highway infrastructure is critical to the transport and delivery of goods, and Utah has higher than average freight volumes due to being the “Crossroads of the West” (I-15, I-70, I-80, and I-84). UDOT is required to build stronger roads to accommodate the weight of freight vehicles on pavement. Freight trips and their associated infrastructure costs are included in this Study. On the rail side of freight, while there are some examples of shared track agreements on heavy rail corridors in Utah, transit and freight largely operate on different facilities.

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Appendix A. Technical Cost Analysis

Appendix B. Background and Results Presentation

Utah Road and Transit Cost Study

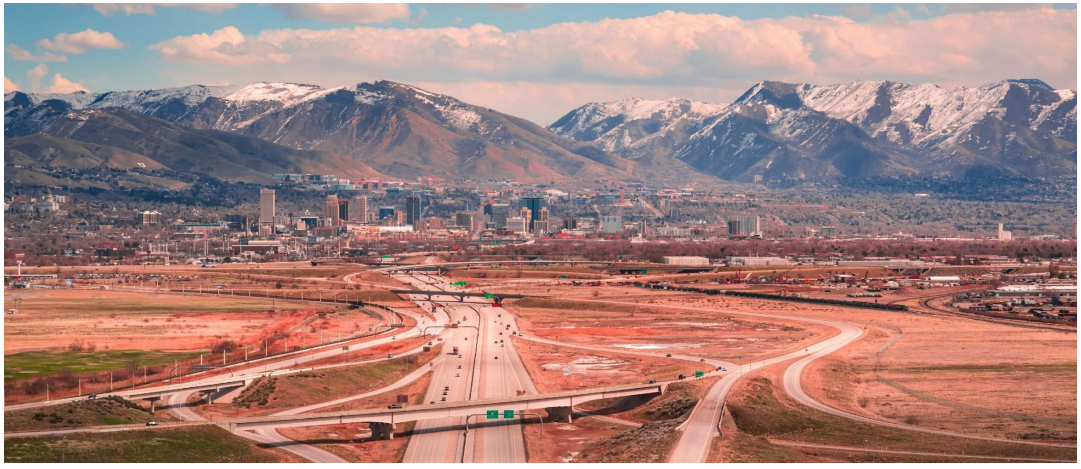
Background & Results
09/14/2021

WASATCH FRONT REGIONAL COUNCIL

UDOT Keeping Utah Moving

MAG Expert Resources. Enriching Lives.

UTA



Project Purpose

The purpose of the Road and Transit Cost Study is to understand:

1. The direct cost to provide and use different parts of Utah's transportation system;
2. The cost effectiveness of different parts of the system based on usage; and
3. Sources of funding for each part of the system.

Study Extent

Road

- Statewide
- By Ownership
  - State
  - Local
- By Geography
  - Urban (MPOs)
  - Rural

Transit

- UTA Service Area
- By Mode
  - Light Rail
  - Commuter Rail
  - Bus
  - Commuter Bus
  - Demand Response
  - Vanpool

All costs are annual, averaged over 2015-2019

Preliminary Research & Literature Review

The study began with an extensive literature review and research to find similar studies that could guide methodology decisions

Preliminary Research & Literature Review

- There was no exactly comparable study.
- Several studies used historical infrastructure investment to get a "fully allocated" cost.
- Different reference units (denominators) emphasize different aspects of cost:
  - *Per Capita* – compares magnitude of costs and investment
  - *Vehicle-miles* – reflect a traffic perspective
  - *Passenger-miles* – reflect a mobility perspective
  - *Per-trip* – reflects an access perspective that gives equal value to automobile, transit, cycling, walking, and telecommuting

Costing Methods

1. Ongoing Annual Costs

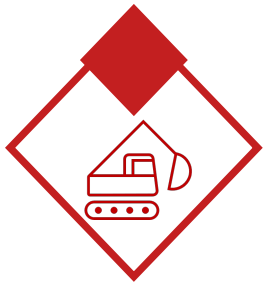
2. Fully Allocated Cost

Ongoing Annual Cost

Annual Expenditures

Agency maintenance, operations, admin costs
+
Additional private vehicle costs

Fully Allocated Cost



Capital Value

Replacement value today, annualized with a discount rate

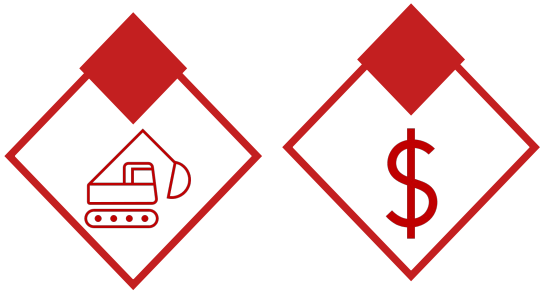
+

Annual Expenditures

Agency maintenance, operations, admin costs
+
Additional private vehicle costs

Costing Methods

Fully Allocated Costs



Vs.

Ongoing Annual Costs

- The ratio between road and transit costs is effectively unchanged

Costing Methods

Fully Allocated Costs

Ongoing Annual Costs

☐ Focus will be Ongoing Annual Costs

Ongoing Annual Expenditures

Road

- UDOT Spending
- Local Spending
- Private Spending
  (Vehicle ownership costs)

Transit

- UTA Spending
- Portion of road cost based on bus/van VMT

Usage Statistics

Road

- VMT estimates
- Average trip lengths
- Vehicle occupancy
- Utah population estimates

Transit

- Transit trip counts
- Trip lengths
- UTA service area population estimate

Data Sources

Expenditures

Primary:

- 2019 UTP Financial Model
- IRS Vehicle Costs

Other:

- NTD Modal Spending Breakdown

Data Sources

Usage

Road

- Highway Statistics
- Utah Travel Study
- Census
- UDOT & WFRC Estimates

Transit

- National Transit Database (NTD)
- UTA service area population estimate

Results: Total Costs

	Road Cost	Transit Cost
Total	$20,141,158,763	$517,725,489
Per Capita	$ 6,470.13	$ 249.98
Per Vehicle Trip	$ 6.39	
Per Person Trip	$ 3.00	$ 11.45
Per Vehicle Mile	$ 0.64	
Per Person Mile	$ 0.30	$ 1.41

*Both vehicle- and person-level statistics are used for roads, as both perspectives are often considered in different planning contexts. Vehicle statistics are less meaningful on the transit side for this study's purpose so they are not included.

Breakdown: Local vs. State Road Costs

	State Road Cost	Local Road Cost
Total	$13,251,634,217	$6,889,524,546
Per Capita	$4,256.95	$2,213.19
Per Vehicle Trip	$6.47	$6.25
Per Person Trip	$3.04	$2.93
Per Vehicle Mile	$0.65	$0.62
Per Person Mile	$0.30	$0.29

Breakdown: Urban vs. Rural Road Costs

	Urban Road Cost	Rural Road Cost
Total	$15,081,632,213	$5,059,526,549
Per Capita	$4,844.81	$1,625.32
Per Vehicle Trip	$5.63	$8.63
Per Person Trip	$2.65	$4.05
Per Vehicle Mile	$0.56	$0.86
Per Person Mile	$0.26	$0.41

Breakdown: Transit Modal Costs

	Light Rail	Commuter Rail	Bus
Total	$166,138,264	$119,323,736	$183,524,382
Per Capita	$80.22	$57.61	$88.61
Per Person Trip	$8.95	$24.53	$9.37
Per Person Mile	$1.81	$0.93	$2.13

	Commuter Bus	Demand Response	Vanpool
Total	$8,498,621	$183,524,382	$12,580,923
Per Capita	$4.10	$12.55	$6.07
Per Person Trip	$14.99	$66.76	$10.04
Per Person Mile	$0.67	$5.94	$0.28

Funding Source Analysis

Funding Sources - 2019

Public Revenue

Spending by governments to build, maintain, and operate the transportation system

Personal Spending

Spending by individuals to access and use the transportation system, such as owning and operating a vehicle

User Fees

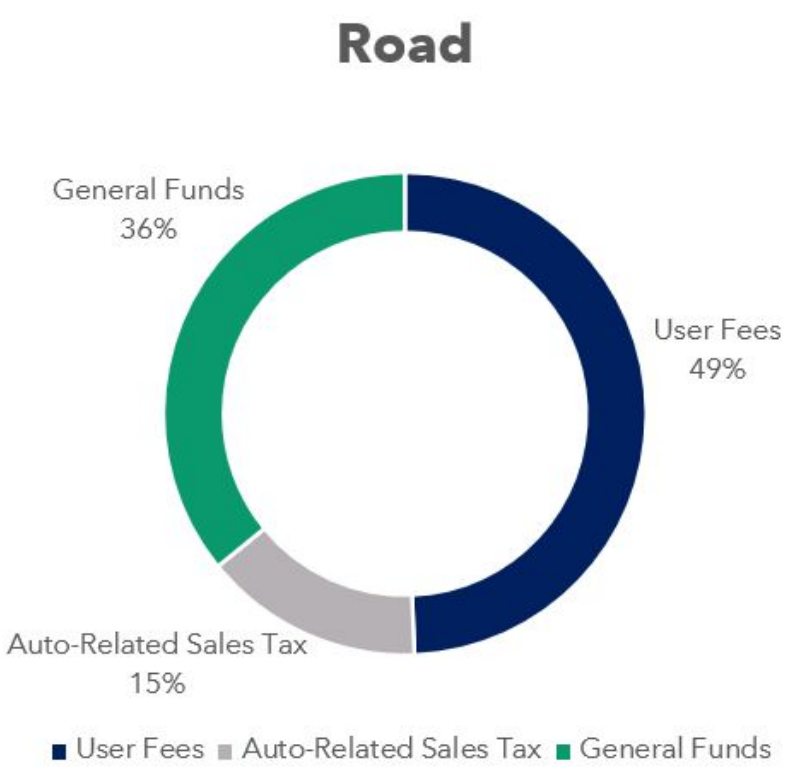
Government revenue based on system usage

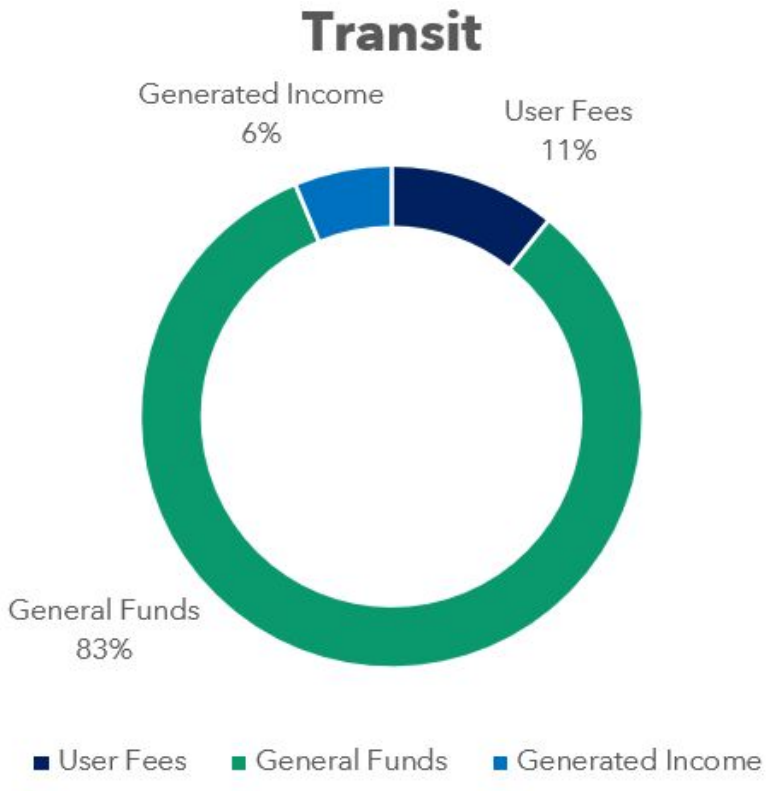
General Funds

Government revenue from activity unrelated to system usage

Funding Source Comparison

Public Revenue Only





Funding Source Comparison

Public Revenue + Personal User Spending