

Appendix E: Methodology to represent programmatic funding

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Summary

In a typical Regional Transportation Plan update, there are often network changes to regionally significant projects. These are reflected in the Denver Regional Council of Governments Focus Model for each staging year. This year staff is also proposing to make further updates to model inputs and factors to better reflect observed, real-world changes and future categories of “programmatic investments” included in the draft 2022 Updated 2050 RTP.

As adopted in April 2021, DRCOG’s fiscally constrained 2050 RTP contains over \$15 billion in programmatic funding. These programmatic investments are shown as a lump sum and individual projects are not yet identified in these programs. Specific projects within these programmatic investments will be determined through the Transportation Improvement Program process as regional and local priorities evolve over the 30-year life of the plan.

Programmatic funding categories include transit investments, active transportation, safety/Vision Zero, transportation demand management and intelligent transportation system investments, all of which are key strategic investments in improving the region’s multimodal transportation system while also reducing emissions. Despite representing a significant portion of the total investments in the fiscally constrained 2050 RTP, DRCOG has not historically reflected how the programmatic funding may influence future travel behavior in the Focus travel model.

In the context of the Colorado Department of Transportation’s Regulation Governing Statewide Transportation Planning Process and Transportation Planning Regions, DRCOG is now evaluating methodologies to represent these programmatic funds in the travel model in coordination with the North Front Range Metropolitan Planning Organization and CDOT. Through this coordinated effort, we hope to achieve a transparent and consistent methodology to reflect the effects these types of investments could make in future travel within the DRCOG region. DRCOG staff believe that reflecting these programmatic funds in the modeling will result in a more complete and accurate depiction of the total investments included in the 2050 RTP.

The details of model outputs, such as bicycle and pedestrian trips at localized and regional levels, better reflect future increased investments supporting those travel modes in relation to recent observed land use changes. This document details the methodology used to estimate available funding, the specific adjustments made to the model and the reasoning behind those adjustments.

Methodology

DRCOG staff evaluated the categorical and programmatic 2050 RTP funding and estimated the approximate percentage of total funds in each pool associated with additional projects and investments not yet reflected in the travel model. The results are shown in Table 1, which has been reviewed by DRCOG’s Transportation Advisory Committee, Regional Transportation Committee and Board workshop committees.

The percentage of the total funds, by category, was estimated by evaluating historic and intended uses of funding for infrastructure and services with the potential to reduce greenhouse gas emissions. The intention was to determine funding and/or enhancements in the use of funds for new infrastructure investments, services or components of projects that were not reflected in the previous 2050 RTP model, such as bicycle/pedestrian infrastructure supporting a bus rapid transit corridor.

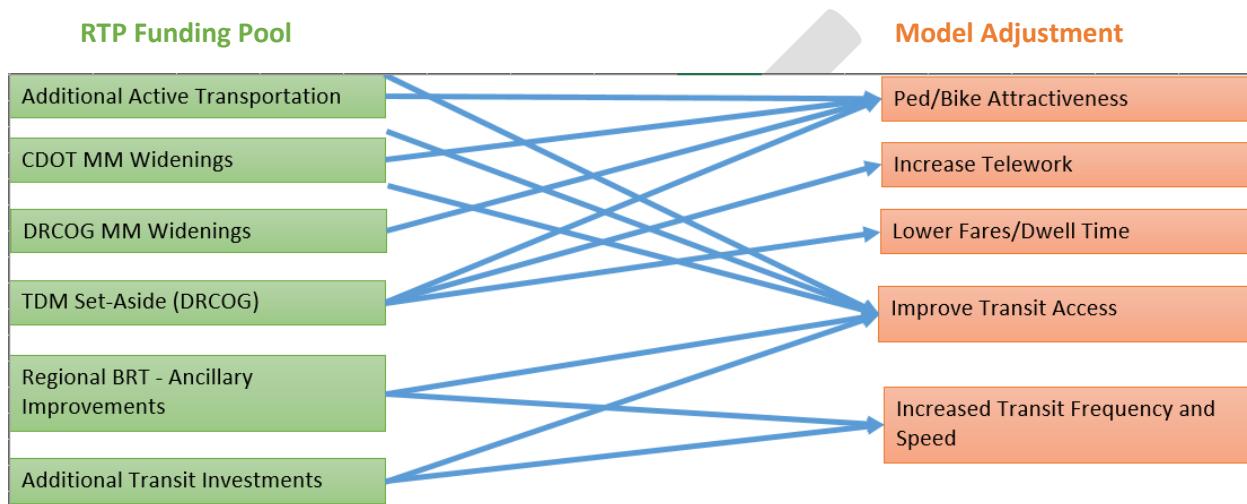
The resulting funding estimates will be used along with an estimated cost per unit to approximate the quantity of infrastructure (i.e., new multi-use paths) or service levels (i.e., increased transit service) to be reflected or mimicked in the travel model.

Table 11. 2050 RTP funding associated with additional greenhouse gas reduction

2050 RTP Investment Categories	Total Investment 2020 Dollars (\$M)				Estimated % of total funds associated with GHG benefits	Investments Associated with GHG Benefits 2020 Dollars (\$M)			
	2021-2030	2031-2040	2041-2050	RTP Total Funds		2021-2030	2031-2040	2041-2050	Total Funds Associated with GHG Benefits
Additional Transit Investments	\$62	\$379	\$261	\$702	90%	\$56	\$341	\$235	\$632
Regional BRT - Ancillary Improvements	\$629	\$256	\$298	\$1,183	5%	\$31	\$13	\$15	\$59
Additional Active Transportation	\$52	\$36	\$92	\$180	100%	\$52	\$36	\$92	\$180
Multimodal Components of DRCOG Funded Widening Projects	\$221	\$748	\$630	\$1,599	10%	\$22	\$75	\$63	\$160
Multimodal components of CDOT Funded Widening Projects	\$3,144	\$1,360	\$1,550	\$6,054	5%	\$157	\$68	\$78	\$303
DRCOG TDM Set-Aside	\$34	\$34	\$34	\$102	10%	\$3	\$3	\$3	\$10
TOTAL:	\$4,143	\$2,813	\$2,865	\$9,821		\$322	\$536	\$486	\$1,344

Next, DRCOG staff evaluated how to represent these pools of funds, either in the focus travel model, or through an off-model evaluation. DRCOG staff leaned heavily on the methodologies used during a scenario planning exercise from early 2020, as well as methodologies used by CDOT in defining the greenhouse gas targets. DRCOG staff linked each type of 2050 RTP categorical funding with the types of model factors that could be adjusted based on the intended use of the funds. Figure 1 shows how several of the 2050 RTP funding pools are associated with various adjustments in the model.

Figure 1. Model adjustments associated with programmatic funding pools



For funding pools that are associated with multiple types of model adjustments, total funds were divided evenly between model adjustment categories. The total funding available, by model adjustment category, by staging year, is shown in Table 2.

Table 2. Total programmatic funding available by model category

Model Adjustment	2021-2030 Funds	2031-2040 Funds	2041-2050 Funds	Total Funds
Ped/Bike Attractiveness	\$ 159.5	\$ 266.2	\$ 241.2	\$ 666.9
Increase Telework	\$ 1.1	\$ 1.1	\$ 1.1	\$ 3.4
Lower Fares/ Reduced Dwell Time	\$ 43.7	\$ 177.0	\$ 124.9	\$ 345.6
Improve Transit Access	\$ 1.2	\$ 1.2	\$ 1.2	\$ 3.5
Increased Transit Frequency and Speed	\$ 116.9	\$ 90.3	\$ 117.4	\$ 324.6
Grand Total	\$ 322.4	\$ 535.8	\$ 485.8	\$ 1,343.9

2020 Dollars (\$M)

DRCOG staff then estimated the level of adjustment to each model component, based on the funding available, scaled in proportion to estimates used in DRCOG's scenario costing work as well as the methodologies used in CDOT's cost/benefit document developed in relation to the state's greenhouse gas rulemaking.

Model adjustments

The model adjustments, reasoning and funding summaries that support the adjustments are documented below. DRCOG staff will continue to perform research and monitor travel trends to ensure the model adjustments reflect real world conditions into the future.

Share of work at home

Table 3- Model adjustments associated with work at home

Increase telework	2030	2040	2050
Work at home rate for workers	25%	25%	25%
Funding per staging period	\$1.1 million	\$1.1 million	\$1.1 million

- Multiple factors influence work location choice and work trips. Previously, DRCOG targeted 20% of workers working at home on a given day. Current conditions lead DRCOG staff to believe 20% is now an underestimate. An increase to 25% is warranted because of the new way of work we are seeing in the world changed by the pandemic along with increased efforts in travel demand management programs and interest in policies to encourage more working from home at the state and local level.
- It is important to know what “work at home” encompasses. It does not just include telework, or office workers working remotely. Work from home also includes part time workers, self-employed small businesses, home offices, flexible/hybrid working schedules and people who work alternative schedules such as three 12-hour shifts a week, could be doing on a sample day.
- It is also important to note that people that work from home may still take trips, whether it's for personal reasons or work-related.
- Following the pandemic, there has been an increase in businesses, schools, agencies or other communities turning towards a four-day week compressed work week model.
- Before the pandemic, observed data demonstrated a significant increase in people working from home in the Denver region. Post-pandemic we continue to observe elevated levels of remote working or working at home some days of the week.

Bicycle and pedestrian attractiveness

The regional travel model does not have a bicycle and pedestrian network and, thus, specific identified projects cannot be coded. To reflect the programmatic investments in the model, bicycle and pedestrian attractiveness factors are used to represent the additional investments.

Table 4- Model adjustments associated with bicycle and pedestrian attractiveness

Bicycle and pedestrian attractiveness model component	2030	2040	2050
Increase sidewalk density by the following factor	8%	16%	25%
Increase walk and bicycle operating speeds	4 mph / 11 mph	5 mph / 12 mph	5 mph / 12 mph
Modify person-specific penalties	Remove penalties for gender and ages 11-75	Remove penalties for gender and ages 11-75	Remove penalties for gender and ages 11-75

Amount invested per staging period	\$52 million	\$36 million	\$92 million
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Increase sidewalk density

- One of many factors correlated with the attractiveness of active transportation modes is “sidewalk density.” As a pre-process to running the travel model, each transportation analysis zone is assigned a sidewalk density value based on the quantity of sidewalks and shared use paths within that zone, divided by the area. Sidewalk density is one factor which represents the ease and comfort of active transportation modes in specific geographic areas.
- To reflect the funds dedicated to active transportation infrastructure in each staging period, DRCOG is proposing to incrementally increase the sidewalk density values for urban and suburban area types over the life of the plan.
- The increased values do not represent an absolute increase in sidewalks, but rather represents select, strategic projects effectively increasing the density by focusing on key gaps and missing links. Through planimetric data and local government data collection and sharing efforts, we can optimize the addition of new sidewalk mileage to create more complete, connected networks.
- The value increases over the staging period because these infrastructure investments are additive over the years.

Increase walking and bicycle operating speeds

- When the walk or bike modes are assigned in the model, they are given an operational travel speed which reflects the average speed for the trip, including, for example, wait time at intersections. Walk speeds were 3 mph and bike speeds 8 mph.
- DRCOG is proposing to increase walk and bicycle speeds incrementally in future staging years, as described in the table above.
- The increase in speed for walk and bicycle modes represent:
 1. The electrification of active modes through the adoption of e-bikes¹ and e-scooters². Not only does electrification increase the speed of these modes, but it may make the mode more attractive.
 2. The speed increase also represents additional priority being provided to active modes through legislation and infrastructure such as: cyclists given their own right of way and priority signal treatments; legal permissions for traversing intersections; improved sidewalk conditions; new key connections completed; and the perception of faster travel time that occurs when a walking journey is comfortable and on a well-connected network.

¹ <https://denverite.com/2022/05/06/denvers-e-bike-rebates-are-already-gaining-traction-with-residents/>

² <https://www.9news.com/article/news/local/next/scooter-bike-share-denver-released-public/73-1d0e03e1-43fa-4ea7-bc3c-f024ec8db6b4>

Modify person-specific negative attractiveness factors for bike and pedestrian mode choice

- In both real life and in the model, an individual's propensity to walk or bike is influenced by their age and their gender. Based on travel survey data from 2010, the model was calibrated to make walking and bicycling less attractive for women and older adults to reflect the observed data.
- To reflect the buildup of, and enhancements to the region's active transportation system, observed cultural changes, and electrification providing additional mobility to older adults, DRCOG staff removed the negative factors applied to individuals in the model based on gender and adjusted the age where negative factors as described in the table above. This is motivated by the belief that the enhanced multimodal facilities will reduce some barriers for cycling for older people and women.
- Examples of enhancements that might affect the attractiveness of biking and walking include lighting on paths, safe crossings with appropriate time to cross, all new paths having appropriate widths – and added space at potential conflict points. DRCOG staff also know local governments are working to build bike facilities based on comfort for all ages and abilities and targeting key connections to make high comfort complete routes.
- There is research³ to show the perception of increased safety in numbers. For example, knowing other cyclists and walkers will be on a path can help it feel safer for some users or knowing drivers are used to seeing cyclists aids in comfort and sense of safety.

Transit

Table 5- Model adjustments associated with transit

Transit	2030	2040	2050
Reduce fares	20%	20%	20%
Reduce dwell time	20%	20%	20%
Reduce headways	5%	5%	5%
Cap on waiting time	Maximum 15 minutes	Maximum 15 minutes	Maximum 15 minutes
Reduce transit walk-access time	Remove penalties	Remove penalties	Remove penalties
Increase speed on transit walk links	100%	100%	100%
Transit access improvements funding	\$1.2 million	\$1.2 million	\$1.2 million
Improve transit frequency and speed funding	\$117 million	\$90 million	\$117 million
Funds used for lower fares/reduced dwell time	\$44 million	\$177 million	\$125 million
Total additional transit funding	\$162 million	\$268 million	\$243 million

³<https://www.sciencedirect.com/journal/safety-science/vol/92/suppl/C> ;

<https://www.normalizecycling.com/safety-in-numbers/#:~:text=There%20is%20strong%20evidence%20of%20an%20association%20between,causes%20%28confounding%20factors%29%20that%20are%20not%20being%20measured>

Reduce transit fares

- In the travel model, the cost of a trip influences people's mode choice, as it does in real life. In the model, the cost of transit fare is a single value that represents what, in reality, is a complex pricing system including people with EcoPasses, discounted fares, monthly passes, fare zones and more.
- DRCOG is proposing to reduce this value by 20% for all staging years. This is not suggesting there will be a blanket reduction of 20% in fares, hitting Regional Transportation District revenues in the fare box, but rather it is intended to reflect the experience of users having a perception of lower fare through programmatic investments and strategic partnership, including:
 - Through transportation demand management efforts, more people in the region will be able to use transit at a free or reduced cost, through commuter benefits like EcoPass or other programs.
 - Ongoing efforts to increase eligibility for discounted fares, and this is intended to reflect that.
 - RTD's fare-revenue study is reviewing how to simplify the fare structure, which could reduce fares for some trips or psychologically reduce the cost for people by reducing confusion.⁴
 - SB22-180⁵ will pilot free transit for one month a year, which could influence future transit fare decisions.

Reduce transit dwell time

- In the travel model, transit buses have a dwell time based on the type of route. To reflect some of the ancillary benefits of enhanced transit investments, the dwell time was reduced by 20%.
- In general, this change is to reflect transit investments that enhance the travel time competitiveness of transit. The primary reason for this change is streamlined payment and faster boardings.
- It also reflects investment in transit signal prioritization equipment, that allows for a bus to travel through an intersection before or after a stop or more quickly re-enter the flow of traffic, which users can experience as additional dwell time.

Reduce headways

- The frequency of each transit route is included in the model. The time between buses or trains at a particular stop is considered the headway.
- The 5% decrease in headway for all staging years is to reflect an increase in vehicle revenue miles across the region. Because these model adjustments represent programmatic investments, DRCOG staff cannot model specific route changes because this is adaptable based on future needs of the region.

Cap waiting time for longer headway routes

- In the travel model, travelers are assigned a "wait time" equal to half of the transit route's headway for that time period. For all routes, the total wait time was capped at 15 minutes.
- Previously, the model assumed some people would arrive 30 minutes before their bus arrived. This significantly increased the travel time for some transit trips and did not reflect how most people use transit for long headway routes. This adjustment accounts for how smart phones and the

⁴ <https://www.rtd-denver.com/farestudy>

⁵ <https://leg.colorado.gov/bills/sb22-180>

investment in real time transit service information have changed how people will plan for their transit trip. Bus tracking specifically also allows people to plan to reduce wait time.

Reduce transit walk-access time

- The model includes information on how people get to transit. For trips where people access transit through active transportation modes the access time penalties were removed.
- This reflects the significant investment being made in active transportation access across the region and DRCOG's prioritization of pedestrian projects near transit. More direct walk routes and pedestrian infrastructure improvements increase the ease of accessing transit.

Increase speed on transit walk links

- The specific pedestrian links that have a distinct connection to transit have a defined user travel speed. Because of the investments in active transportation and the pedestrian environment near transit, this speed needed to be readjusted. The speed was doubled for these short links to reflect the enhancements in infrastructure, including things like sidewalks, lighting, and more.
- The idea is that more comfortable and direct infrastructure, such as pedestrian bridges over high volume roadways, allows people to travel faster and has a psychological impact on how people experience the length of a journey.