APPENDIX

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Photo credit: Jack Todd (photo contest finalist).

Environmental justice and equity analysis

On Feb. 11, 1994, President Clinton issued Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. The executive order requires each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority and low-income populations. The "Environmental justice and equity priorities" section of Chapter 4 highlights analysis of the 2050 Metro Vision Regional Transportation Plan based on the minority and low-income populations. This section expands the analysis to include additional vulnerable communities: older adults, individuals with disabilities, children, zero-vehicle households and households with limited English proficiency. The section also outlines analysis in greater detail.

The appendix describes the Environmental Justice Technical Analysis performed for the 2050 RTP. The first part of the analysis used demographic information from the Esri ArcGIS GeoEnrichment Service and the U.S. Census Bureau's 2015-2019 Five-Year American Community Survey to measure the following:

- Areas of concentrated low-income and minority vulnerable populations (*Esri 2020 data*).

- Means of transportation to work by race and income level (*Census American Community Survey 2019 data*).

- This second part of the analysis used demographic information from the Esri ArcGIS GeoEnrichment Service and the U.S. Census Bureau's 2014-2018 Five-Year American Community Survey to measure the relationship between many vulnerable

population groups (low-income, minority, disabled individuals, people over the age of 65, children age 5-17, households with no vehicle and households that speak limited or no English) and travel times using five measures:

- Percent of population close to a hospital.

- Percent of population close to a grocery store.

- Percent of population close to a college.

- Percent of population close to the Central Business District.

- Percent of population close to jobs.

Data required for methodology

All seven measures described rely on demographic information derived from both U.S. Census Bureau Five-Year American Community Survey data and the Esri ArcGIS GeoEnrichment Service, summarized to enhance DRCOG transportation analysis zone (TAZ) data.

For information on "Areas of concentrated low-income and minority vulnerable populations," the DRCOG TAZ geographies were enriched with 2020 data using the Esri ArcGIS GeoEnrichment Service.

For information on the "Means of Transportation to Work by Race and Income Level," DRCOG staff retrieved county level information from the U.S. Census Bureau's API for the 2015-2019 Five-Year American Community Survey.

For the travel time measures, the DRCOG TAZ geographies were enriched using multiple input sources. The 2020 minority, 2020 low-income, and 2018 disability data was pulled from the Esri ArcGIS GeoEnrichment Service. The 2018 data for individuals over the age of 65, children age 5-17, households with no vehicle and households that face English-language challenges or speak no English was derived from the DRCOG Vulnerable Populations dataset. The Vulnerable Populations dataset provides block group information from the U.S. Census Bureau's 2014-2018 Five-Year American Community Survey data. In order to apply this block group level information to the TAZ geographies, DRCOG staff created a Tract-to-TAZ equivalency table that was used to crosswalk the data based on population and housing totals. To build these tables, census block centerpoints were used to determine approximately what percentage of each block group's population (and/or households) falls inside of each TAZ. Using these equivalency layer percentages, data for vulnerable populations was added to the TAZ geographies assuming the same percentage totals.

The travel time measures also relied on the DRCOG Focus travel forecasting model. The travel forecasting model uses land use and transportation information to estimate travel times, patterns and volumes. The most current transportation modeling data for DRCOG is from 2020, but DRCOG also creates future horizon-year estimates for the year 2050. At DRCOG, future estimates assume growth in the transportation system. Travel model data is aggregated at TAZs for peak times, and for both automobiles and transit, resulting in four total scenarios used from the travel model. For the travel time measures, one-way times were used.

- Peak automobile 2020.

- Peak transit 2020.

- Peak automobile 2050.

- Peak transit 2050.

Finally, DRCOG staff also used Small-Area Forecast numbers in the travel time measures. The forecast does not provide any demographic breakdown, so the most recent percentage for population or households within each TAZ (based on the U.S. Census Bureau American Community Survey and Esri data) was applied to the forecast total households for 2020 and 2050 to create estimates.

DRCOG analyzed data for multiple measures, multiple demographic groups and multiple travel time scenarios. The following sections further describe the analysis and data used by each individual measure. It is significant to note that these analyses only covered the DRCOG planning region rather than the entire transportation modeling region.

Areas of concentrated vulnerable populations

To define areas of concentrated vulnerable populations, the TAZs were enriched with data using the Esri ArcGIS GeoEnrichment Service. Such data included the 2020 minority population per TAZ and the 2020 number of households living with an annual income below $25,000 per TAZ, which is the closest data bracket to the U.S. Department of Health and Human Services' Office of The Assistant Secretary for Planning and Evaluation 2020 poverty guideline of $26,200 for a family of four.

Next, the regional minority percentage of 35.9% and the regional low-income percentage of 12.5% were derived from the data totals of the enriched TAZs. The percentages were determined after omitting any TAZs with a population of zero. The percent minority and percent low-income were then determined for each TAZ. The percent minority and percent low-income per TAZ was compared to the regional average percent minority and percent low-income to flag areas with concentrated vulnerable populations. Any TAZs with a percentage higher than the regional average for minority or income were flagged as an Environmental Justice zone. The simple analysis resulted in almost one half of the region being marked as having a concentrated vulnerable population.

Means of transportation to work by race and income level

The measures showing means of transportation to work by race and income level were derived from U.S. Census Bureau 2015-2019 American Community Survey Five-Year Estimates, tables B08105 and B08119. The information was retreived from the U.S. Census API by county and excludes the Weld County portion of the Denver region.

Percent of population close to hospitals, grocery stores, colleges or the Central Business District

To determine the percent of each vulnerable population close to each destination type (hospitals, grocery stores, colleges or the Central Business District), first the TAZ data was combined with demographic information from the Esri ArcGIS GeoEnrichment Service and the U.S. Census Bureau's 2014-2018 Five-Year American Community Survey (ACS) data (via the

DRCOG Vulnerable Populations dataset). Percentages of each vulnerable population group per TAZ were then applied to Small-Area Forecast data to estimate the number of households within each population group per TAZ for 2020 and 2050. (A disadvantage of using current percentages in combination with forecast data is that TAZs growing from zero households in 2020 to a significant number of households in 2050 were omitted from the analysis.)

Next, for each destination type (hospitals, grocery stores, colleges or the Central Business District) DRCOG staff created a list of TAZs that included a destination point. For each of the four travel time skims, DRCOG staff selected all records with a destination TAZ matching any TAZ tagged in each destination list. From those skims, all records with travel times below the designated time thresholds considered to be close were then selected.

These skims were then dissolved based on the origin TAZs to get a list of unique TAZs within the "close" time constraints. Finally, DRCOG staff summarized the total regional percentage of households within the TAZs, along with the households estimated as composed of low-income individuals, households of minority people, the estimated households with people over the age of 65, the estimated households with people between the age of 5 and 17, the estimated households without a vehicle, the estimated households with English language-challenged individuals, the estimated households with no English, and the estimated households containing at least one person with a disability.

Percent of households close to hospitals

	Percent within 20 minutes of a hospital (by auto)		Percent within 40 minutes of a hospital (by transit)	
	2020 peak	2050 peak	2020 peak	2050 peak
Entire region	91%	80%	83%	77%
Minority	94%	88%	89%	88%
Low-income	95%	93%	93%	92%
Age 65-plus	90%	82%	82%	77%
Age 5-17	89%	77%	79%	72%
No vehicle	97%	95%	95%	94%
English language-challenged	97%	87%	94%	90%
No English	98%	91%	95%	94%
Disability	91%	83%	84%	79%

Derived using Quarterly Census of Employment and Wages: General Medical and Surgical Hospitals, Psychiatric and Substance Abuse Hospitals, and Specialty Hospitals

Percent of households close to colleges

	Percent within 20 minutes of a college (by auto)		Percent within 40 minutes of a college (by transit)	
	2020 peak	2050 peak	2020 peak	2050 peak
Entire region	94%	87%	83%	77%
Minority	97%	95%	89%	89%
Low-income	98%	96%	93%	92%
Age 65-plus	94%	88%	82%	78%
Age 5-17	93%	86%	79%	73%
No vehicle	99%	97%	95%	94%
English language-challenged	99%	95%	94%	90%
No English	99%	98%	95%	94%
Disability	94%	89%	85%	80%

Derived using DRCOG 2017 Schools inventory dataset

Percent of households close to grocery stores

	Percent within 10 minutes of a grocery store (by auto)		Percent within 20 minutes of a grocery store (by transit)	
	2020 peak	2050 peak	2020 peak	2050 peak
Entire region	91%	83%	82%	77%
Minority	94%	93%	88%	88%
Low-income	96%	95%	93%	92%
Age 65-plus	90%	84%	82%	77%
Age 5-17	89%	81%	78%	72%
No vehicle	97%	96%	95%	94%
English language-challenged	97%	91%	93%	90%
No English	98%	94%	95%	94%
Disability	92%	86%	84%	79%

Derived using Quarterly Census of Employment and Wages: Super Markets and Other Grocery Stores

Percent of households close to Central Business District

	Percent within 20 minutes of Central Business District (by auto)		Percent within 40 minutes of Central Business District (by transit)	
	2020 peak	2050 peak	2020 peak	2050 peak
Entire region	17%	15%	66%	64%
Minority	19%	16%	75%	78%
Low-income	30%	23%	83%	83%
Age 65-plus	16%	12%	66%	65%
Age 5-17	11%	9%	59%	58%
No vehicle	36%	34%	86%	87%
English language-challenged	21%	19%	83%	83%
No English	24%	23%	88%	89%
Disability	17%	14%	69%	68%

Derived using the DRCOG Small-Area Forecast and the DRCOG 2019 Urban Centers Dataset

Percent of population close to jobs

Just like in the previous measures, to determine the percent of each vulnerable population close to jobs, first the TAZ data was combined with demographic information from the Esri ArcGIS GeoEnrichment Service and the 2014-2018 Five-Year American Community Survey data (via the DRCOG Vulnerable Populations dataset). Percentages of each vulnerable population group per TAZ were then applied to Small-Area Forecast data to estimate the number of households within each population group per TAZ for 2020 and 2050. (A disadvantage of using current percentages in combination with forecast data is that TAZs growing from zero households in 2020 to significant numbers of households in 2050 were omitted from this analysis.)

Next, DRCOG staff used the small-area forecast again to find the number of forecast jobs per TAZ for 2020 and 2050. For each of the four travel time skims, all records were selected with a destination TAZ within the designated "close" time thresholds of 20 minutes for auto and 40 minutes for transit.

From those skims DRCOG staff dissolved the data based on the origin TAZs and summarized the number of jobs within the "close" thresholds. Origin TAZs with over 100,000 jobs "close" were then selected. Finally, DRCOG staff summarized the total regional percentage of households within these TAZs, along with the low-income estimated households, and the minority estimated households, the estimated households with people over the age of 65, the estimated households with people between the age of 5 and 17, the estimated households without a vehicle, the estimated households with English language-challenged individuals, the estimated households with no English, and the estimated households containing at least one person with a disability.

Percent of households close to jobs

	Percent within 20 minutes of 100,000 jobs (by auto)		Percent within 40 minutes of 100,000 jobs (by transit)	
	2020 peak	2050 peak	2020 peak	2050 peak
Entire region	78%	70%	81%	76%
Minority	83%	82%	87%	88%
Low-income	89%	87%	91%	92%
Age 65-plus	77%	71%	80%	77%
Age 5-17	72%	63%	77%	71%
No vehicle	91%	91%	94%	95%
English language-challenged	89%	84%	92%	90%
No English	90%	88%	93%	93%
Disability	78%	72%	82%	79%

Derived using the DRCOG Small-Area Forecast and the Quarterly Census of Employment and Wages

Conclusion

The data suggests that all vulnerable populations may have similar shifts in travel time between 2020 and 2050. This also suggests that the fiscally constrained network of projects included in the 2050 RTP will not disproportionally affect any of the vulnerable populations included in this analysis.

It is valuable to consider how travel times and expected growth will affect current areas of concentrated vulnerable populations. Areas of concentrated vulnerable populations will change and move throughout the region as it grows in the future. However, this analysis provided a theoretical glimpse into how our planned transportation system may affect vulnerable populations. While any transportation project can have both negative effects and benefits — regardless of travel mode or project location — it is important that these outcomes are not spatially concentrated within the region. The future transportation system envisioned by the 2050 RTP is intended to benefit the entire region.