

E-470 Traffic and Revenue Study



Update Letter
April 2021



**CDM
Smith**



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April 15, 2021

Mr. Jason Myers
Director of Finance
E-470 Public Highway Authority
22470 East 6th Parkway
Aurora, CO 80018

Subject: 2021 Traffic and Toll Revenue “Bring-Down” Letter, E-470 Public Highway Authority

Dear Mr. Myers:

CDM Smith was recently requested by the E-470 Public Highway Authority (Authority) to perform a review of the traffic and toll revenue forecasts contained in our May 2020 Comprehensive Traffic and Revenue Study (referred to as “2020 Study” in this letter) and to update the forecasts contained therein, if necessary. To accomplish this, we reviewed the latest monthly traffic and revenue trend data for each mainline and ramp toll gantry through February 2021 and compared these against the aforementioned 2020 Study forecasts, reviewed the transaction data, comparing actual versus prior estimates of the impact of the novel Coronavirus (COVID-19), toll revenue leakage assumptions, the E-470 improvement project assumptions, the latest Denver Regional Council of Governments (DRCOG) highway improvement program versus what was contained in the 2020 Study, and the latest socioeconomic and demographic forecasts.

Executive Summary

As shown in **Table ES-1**, actual 2020 transactions were 3.1 percent below the 2020 Study forecast. Actual net toll revenues, which include adjustments to account for unbillable and unpaid transactions, were 4.3 percent below the 2020 Study forecast.

Table ES-1
Comparison of Actual and Forecasted 2020 Transactions and Net Toll Revenue

| | Transactions (000s) | Net Toll Revenue (\$000s) ⁽¹⁾ |
|---|------------------------|---|
| 2020 Study Forecast ⁽²⁾ | 59,905 | \$ 162,727 |
| Actual | 58,070 | 155,798 |
| Difference from Forecast | (1,835) | (6,929) |
| Percent Difference | (3.1) | (4.3) |
| ⁽¹⁾ Net Toll Revenue represents toll revenues adjusted for unbillable and unpaid revenues. | | |
| ⁽²⁾ Based on actual data through March 2020. | | |



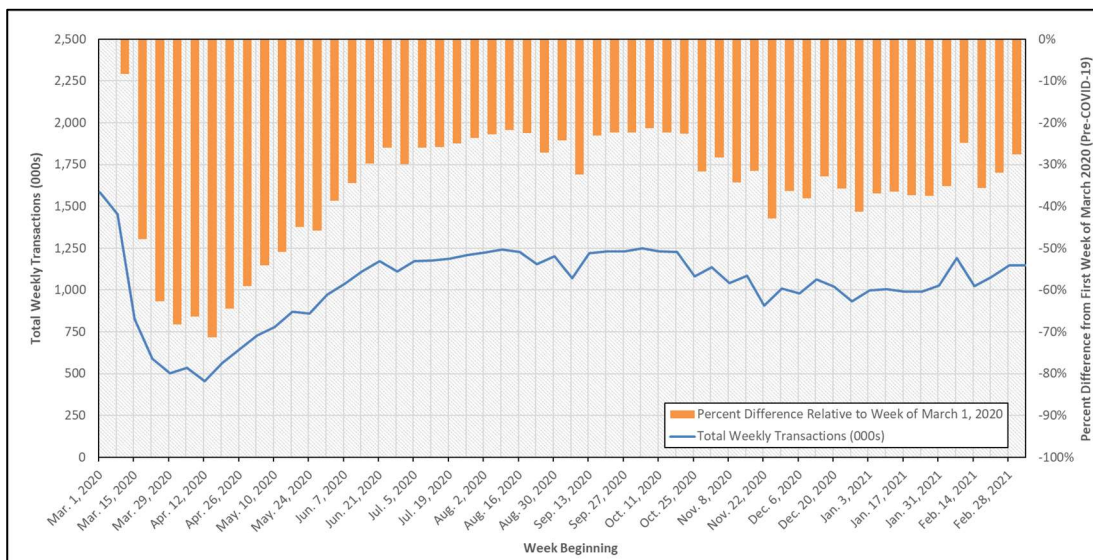
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E-470 produced strong growth in transactions since the end of the Great Recession in 2010, with some years of double-digit growth between 2013 and 2015. More recently, year-over year growth rates in 2018 and 2019 were 5.0 percent and 3.4 percent, respectively, with monthly year-over-year growth rates falling relatively close to the annual average.

In March 2020, traffic impacts related to COVID-19 began as many states and localities began implementing stay-at-home orders, public space closures, social distancing orders and other restrictions in an effort to reduce the spread of the virus based on guidelines from the Center for Disease Control (CDC) and the Federal Government. These restrictions considerably impacted regional traffic patterns. Since more than 20 percent of E-470 traffic originates from or is destined for Denver International Airport (DEN), reductions in air travel and tourism related to the COVID-19 outbreak have impacted E-470 to a greater extent than other facilities in the region. Moreover, since congestion on alternative roadways, such as I-25, I-70 and even local arterials, was significantly reduced E-470 offered lower travel time savings to motorists than it did prior to the COVID-19 outbreak. As a result, E-470 was harder hit than other facilities.

Figure ES-1 illustrates the reduction in total weekly E-470 transactions, as compared with the first week of March prior to the major COVID-19 impacts. There has been some improvement in transactions during February 2021, but it is unclear if this is a trend or only a temporary change. Likely, continued traffic impacts will be related to the length of government stay-at-home orders, public space and school closures, and other travel restrictions. Estimates of the continued traffic impacts related to COVID-19 are discussed later in the letter report.

Figure ES-1
Impacts of COVID-19 on E-470 Weekly Transactions,
Percent Change in Traffic Relative to Volumes During the First Week in March 2020



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In February 2021, EPS completed a high-level review of Denver-area economic conditions since the onset of the COVID-19 pandemic in March 2020 and through the end of 2020. A summary of this review is provided in the EPS 2021 Economic Condition Update Memorandum, which is included in this report as **Appendix A**. The objective of the review was to compare conditions geographically and to compare the emerging patterns against previous economic cycles. This was done because, although there is still uncertainty regarding the success of vaccinations occurring through the U.S. and through 2021, it was believed that past recovery patterns could provide some clarity to questions revolving around how well and/or how quickly the Denver MSA might recover. The analysis suggested that the Denver MSA was impacted to a lesser degree than other metropolitan areas nationwide. In addition, the Denver MSA has recovered more quickly than the national average.

CDM Smith identified four major categories of forecast assumption changes from the most recent transaction and toll revenue forecast, the 2020 Study. These changes, which are discussed in this letter report, include:

- Re-benchmarking E-470 transactions to 2020/2021 Levels based on actual data through February 2021;
- Applying impacts related to changes in interchange and widening improvement assumptions;
- Applying impacts related to changes in assumed construction schedules; and
- Adjusting the assumed impacts of COVID-19.

As part of the current update, a review of the planned highway improvements was conducted by CDM Smith. In general, the results of this review found that the changes to the underlying DRCOG highway improvement assumptions would not present a significant impact to the E-470 System. Additionally, an evaluation of the Authority's proposed capital program was conducted. The major changes involved the advancement of various interchange improvements and planned widenings, as well as the addition of a new interchange at Sable Boulevard. These changes are detailed later in the letter report.

CDM Smith reviewed several sources including the Centers for Disease Control (CDC), Colorado School of Public Health, and the University of Washington Institute for Health Metrics and Evaluation (IHME) projecting the outlook for Covid-19. In addition, CDM Smith performed a review of regional and national toll facility traffic trends for the current study effort. A detailed review of COVID-19 impacts on E-470 transactions was also conducted. Following this review, both short-term and long-term COVID-19 impacts were developed by method of payment, by vehicle class, and by toll location. Additionally, CDM Smith considered the impacts of COVID-19 on trips to and from DEN. These impacts were developed based on actual data through February 2021 for two scenarios: Base Case and Delayed Short-Term Recovery Case. These two scenarios incorporated the most recent recovery timeline assumptions, which were influenced by the availability and administration of COVID-19 vaccinations. Thus, they represent only short-term changes to the prior 2020 Study assumptions.

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Under the Base Case, a 19.6 percent transaction decrease is estimated in 2021, compared to a theoretical forecast without COVID-19. This includes a recovery to a “new normal” by July 2021. A transaction impact of 8.1 percent is then assumed through the remainder of the forecast period. This was done to account for the longer-term effects of the crisis, including potential recessionary impacts through 2021, increases in telecommuting, and reductions in tourism and other recreational trips. The Delayed Short-Term Recovery Case assumes a slower recovery for both airport-related trips (by July 2022) and for other 2-axle vehicles (by December 2021). Thus, a 24.4 percent transaction decrease is estimated in 2021, compared to a theoretical forecast without COVID-19. Neither scenario assumes any impact to 3-or-more-axle vehicles due to the strong performance of commercial vehicles through the pandemic, as noted in this letter report.

We would note there is significant uncertainty to both short-term and long-term travel impacts related to the COVID-19 pandemic. CDM Smith has attempted to use the best available information at the time of developing these forecasts. These assumptions may be subject to change depending on the escalation or recovery from COVID-19, which may materially affect the resulting traffic and revenue estimates.

As noted in this letter report, the underlying normal growth rates, E-470 toll rates, and toll revenue leakage rates were not changed from those included in the prior 2020 Study forecasts. Moreover, no changes were made to the underlying regional ExpressToll market participation rates. However, there are some differences between the 2020 Study and the current study in the share of ExpressToll transactions on E-470 as a result of the differential impacts of COVID-19 by method of payment. Additionally, there are some differences in the forecasted share of ExpressToll E-470 transactions in the long term (beyond 2023) due to the differential impacts of the assumed highway improvement changes by method of payment.

The resulting Base Case annual transactions and net toll revenue forecasts are provided in **Table ES-2**. Annual transactions are expected to increase from 58.1 million in 2020 to 77.0 million by 2021. Following the assumed end of the recovery from the short-term impacts of the COVID-19 pandemic (January 2022) and the realization of a “new normal”, estimated transactions under the Base Case are 89.8 million in 2022. This is just slightly less than actual 2019 transactions under pre-COVID-19 conditions. By 2040, annual transactions are expected to reach 155.2 million, for an average annual growth rate between 2022 and 2040 of 3.1 percent.

Net toll revenues are estimated to increase from \$155.8 million in 2020 to \$205.8 million by 2021. Following the assumed end of the short-term recovery from the COVID-19 pandemic, net toll revenues are estimated to reach \$240.9 million in 2022. Annual net toll revenues are then estimated to grow to \$442.9 million by 2040, aided by assumed toll increases every five years. This represents an average annual increase of 3.4 percent over 2022.

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Table ES-2
Comparison of Current Forecast and 2020 Study Forecast (In Thousands)

| Year | Current Forecast | | Year | 2020 Study Forecast | | Percent Difference | |
|---------------------------|---------------------------|-------------------------------|---------------------------|---------------------------|-------------------------------|---------------------------|-------------------------------|
| | Total Annual Transactions | Total Annual Net Toll Revenue | | Total Annual Transactions | Total Annual Net Toll Revenue | Total Annual Transactions | Total Annual Net Toll Revenue |
| | (000s) | (\$000s) ⁽¹⁾ | | (000s) | (\$000s) ⁽¹⁾ | Transactions | Revenue ⁽¹⁾ |
| 2020 ⁽²⁾⁽⁴⁾⁽⁵⁾ | 58,071 | \$ 155,798 | 2020 ⁽³⁾⁽⁴⁾⁽⁵⁾ | 59,905 | \$ 162,727 | -3.1% | -4.3% |
| 2021 ⁽²⁾⁽⁵⁾⁽⁶⁾ | 77,013 | 205,778 | 2021 ⁽⁵⁾⁽⁶⁾ | 88,003 | 238,354 | -12.5% | -13.7% |
| 2022 ⁽⁵⁾ | 89,753 | 240,929 | 2022 | 89,957 | 243,731 | -0.2% | -1.1% |
| 2023 | 92,328 | 247,728 | 2023 | 92,148 | 249,832 | 0.2% | -0.8% |
| 2024 ⁽⁴⁾ | 96,427 | 259,090 | 2024 ⁽⁴⁾⁽⁶⁾ | 96,055 | 259,987 | 0.4% | -0.3% |
| 2025 ⁽⁶⁾⁽⁷⁾ | 98,969 | 270,225 | 2025 ⁽⁷⁾ | 97,475 | 269,306 | 1.5% | 0.3% |
| 2026 | 101,170 | 275,978 | 2026 | 99,869 | 273,459 | 1.3% | 0.9% |
| 2027 | 103,290 | 281,890 | 2027 ⁽⁶⁾ | 103,629 | 284,107 | -0.3% | -0.8% |
| 2028 ⁽⁴⁾⁽⁶⁾ | 107,473 | 293,799 | 2028 ⁽⁴⁾ | 106,569 | 292,169 | 0.8% | 0.6% |
| 2029 ⁽⁶⁾ | 110,783 | 302,246 | 2029 ⁽⁶⁾ | 109,921 | 301,179 | 0.8% | 0.4% |
| 2030 ⁽⁷⁾ | 113,184 | 313,840 | 2030 ⁽⁷⁾ | 112,133 | 312,543 | 0.9% | 0.4% |
| 2031 ⁽⁶⁾ | 117,894 | 326,890 | 2031 ⁽⁶⁾ | 116,818 | 325,199 | 0.9% | 0.5% |
| 2032 ⁽⁴⁾ | 122,143 | 338,337 | 2032 ⁽⁴⁾ | 121,161 | 336,614 | 0.8% | 0.5% |
| 2033 ⁽⁶⁾ | 127,362 | 352,160 | 2033 ⁽⁶⁾ | 126,488 | 350,791 | 0.7% | 0.4% |
| 2034 | 131,918 | 364,177 | 2034 | 131,189 | 362,925 | 0.6% | 0.3% |
| 2035 ⁽⁶⁾⁽⁷⁾ | 139,328 | 391,760 | 2035 ⁽⁶⁾⁽⁷⁾ | 137,811 | 389,071 | 1.1% | 0.7% |
| 2036 ⁽⁴⁾ | 142,935 | 401,304 | 2036 ⁽⁴⁾ | 143,532 | 401,580 | -0.4% | -0.1% |
| 2037 | 145,930 | 409,469 | 2037 | 146,533 | 409,738 | -0.4% | -0.1% |
| 2038 ⁽⁶⁾ | 150,285 | 421,806 | 2038 ⁽⁶⁾ | 150,840 | 421,768 | -0.4% | 0.0% |
| 2039 | 153,716 | 431,115 | 2039 | 154,442 | 431,637 | -0.5% | -0.1% |
| 2040 ⁽⁴⁾⁽⁶⁾⁽⁷⁾ | 155,201 | 442,917 | 2040 ⁽⁴⁾⁽⁶⁾⁽⁷⁾ | 156,020 | 443,501 | -0.5% | -0.1% |
| 2041 | 158,425 | 451,702 | 2041 | 159,341 | 452,357 | -0.6% | -0.1% |
| 2042 | 162,169 | 461,929 | 2042 | 163,204 | 462,694 | -0.6% | -0.2% |
| 2043 | 166,019 | 472,420 | 2043 | 167,189 | 473,312 | -0.7% | -0.2% |
| 2044 ⁽⁴⁾ | 170,435 | 484,478 | 2044 ⁽⁴⁾ | 171,769 | 485,546 | -0.8% | -0.2% |
| 2045 ⁽⁷⁾ | 172,148 | 496,832 | 2045 ⁽⁷⁾ | 173,461 | 498,222 | -0.8% | -0.3% |
| 2046 | 175,260 | 505,378 | 2046 | 176,696 | 506,904 | -0.8% | -0.3% |
| 2047 | 178,443 | 514,095 | 2047 | 180,012 | 515,768 | -0.9% | -0.3% |
| 2048 ⁽⁴⁾ | 182,180 | 524,383 | 2048 ⁽⁴⁾ | 183,912 | 526,257 | -0.9% | -0.4% |
| 2049 | 185,025 | 532,055 | 2049 | 186,891 | 534,063 | -1.0% | -0.4% |
| 2050 ⁽⁷⁾ | 186,351 | 544,055 | 2050 ⁽⁷⁾ | 188,172 | 546,614 | -1.0% | -0.5% |

(1) Net Revenue includes adjustments for unbillable or uncollectable toll revenue.
(2) Current forecast includes actual data through February 2021.
(3) 2020 Toll Rate Study includes actual data through March 2020.
(4) Leap Year.
(5) COVID-19 traffic impacts.
(6) Assumed widening of various segments of the E-470 mainline.
(7) Assumed 2.0 percent Systemwide Toll Increase.

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Table ES-2 also compares the Base Case transactions and toll revenue estimates from the current effort against those of the 2020 Study. In the short-term, the primary differences are related to the adjustments in assumed COVID-19 impacts. Annual system-wide transactions in 2021 under the current forecast effort are estimated to be 11.0 million, or 12.5 percent less than the 2020 Study forecast, while net toll revenues are estimated to be \$32.6 million less under the current forecast, or 13.7 percent lower than the 2020 Study forecast. Following the recovery from COVID-19 and the achievement of a “new normal”, differences between the current Base Case forecast and the 2020 Study forecast are due to assumed highway improvement and construction schedule changes. By 2040, the estimated differences between the current forecast and the 2020 Study forecast are a 0.8 million decrease in transactions and a \$0.6 million reduction in net toll revenue. These differences represent decreases of 0.5 percent and 0.1 percent in annual toll transactions and net toll revenue, respectively.

Given the uncertainty surrounding the COVID-19 pandemic, CDM Smith also developed a Delayed Short-Term Recovery forecast of transactions and toll revenue for E-470. This scenario assumes a slower recovery for both airport-related trips (by July 2022) and for other 2-axle vehicles (by December 2021). This assumes a slower roll-out of the COVID-19 vaccines and a slightly longer phase-out of current state and local restrictions. It should be noted that the differences between the Base Case and the Delayed Short-Term Recovery forecasts are estimated to occur primarily in 2021, with some minor differences in 2022. By 2023, both the Base Case and Delayed Short-Term Recovery forecasts are assumed to be the same. Traffic and revenue estimates for the Delayed Short-Term Recovery forecast are provided later in this report.

* * *

Prior E-470 Traffic and Toll Revenue Forecasts

Prior to the 2020 Study, the Authority’s last comprehensive traffic and revenue study was prepared in 2018. The 2018 E-470 Traffic and Revenue Forecast Study was requested by the Authority in order to provide forecasts of traffic and revenue incorporating a new toll structure. This new structure included an increase in the surcharge between ExpressToll and LPT transactions and a reduction of tolls at Toll Gantry C. The above-referenced toll structure and the corresponding toll rate assumptions were developed in cooperation with the Authority based, in part, on the results of a toll sensitivity analysis conducted during the study effort. The analysis and the associated forecasts of transactions and revenue also relied upon additional elements from that study, including an independent review of the region’s underlying socioeconomic forecasts by Economic & Planning Systems (EPS), a survey of motorist travel patterns, trip characteristics, and willingness to pay tolls via a Stated Preference survey, a detailed traffic and revenue evaluation, and the collection of significant amounts of traffic and revenue data. Following the completion of the 2018 Study, the Authority implemented the proposed toll rate changes.

In late 2019, the Authority requested CDM Smith to perform an updated comprehensive traffic and revenue study (2020 Study) in support of a bond refinancing effort planned for early 2020. This effort represents the most recent Investment Grade forecasts of traffic and toll revenue for the E-470 System. In addition, the study effort considered various proposed toll rate scenarios and their potential impacts on long term traffic and revenue. This 2020 Study and the associated forecasts of transactions and revenue included the collection of significant amounts of original traffic data and an independent review of the Region's underlying socioeconomic forecasts by EPS. During the course of the study, traffic impacts related to COVID-19 began as many states and localities began implementing stay-at-home orders, public space closures, social distancing orders and other restrictions in an effort to reduce the spread of the virus based on guidelines from the Center for Disease Control (CDC) and the Federal Government. As such, the 2020 Study estimated the impacts of COVID-19 under two scenarios: a "Base Case Forecast", assuming a stabilization of COVID-19 impacts by early 2021, and a "Second Wave Forecast", assuming additional COVID-19 impacts during the first half of 2021.

Actual versus Forecasted Monthly Transactions and Net Toll Revenue (2020-2021)

Table 1 provides a comparison of the forecasted and actual transactions and gross toll revenue for 2020, completed in May 2020. Included in the table are the Base Case Forecasts from the 2020 Study, which include actual data through March 2020. As shown in the table, actual 2020 transactions were 3.1 percent below forecast. Actual net toll revenues, which includes adjustments to account for unbillable and unpaid transactions, were 4.3 percent below the May 2020 forecast.

Table 1
Comparison of Actual and Forecasted 2020 Transactions and Net Toll Revenue

| | Transactions (000s) | Net Toll Revenue (\$000s) ⁽¹⁾ |
|---|------------------------|---|
| 2020 Study Forecast ⁽²⁾ | 59,905 | \$ 162,727 |
| Actual | 58,070 | 155,798 |
| Difference from Forecast | (1,835) | (6,929) |
| Percent Difference | (3.1) | (4.3) |

(1) Net Toll Revenue represents toll revenues adjusted for unbillable and unpaid revenues.
(2) Based on actual data through March 2020.

Trends in Monthly Toll Transactions

Transaction growth on E-470 over the past 10-year period from 2011 to 2020 is presented by mainline toll gantry in **Figure 1**. These trends are depicted on an average daily basis, which accounts for leap days. Total monthly transaction trends are presented graphically in **Figure 2** for the same time period, including data for January and February 2021. The 54.0 million transactions

Figure 1
Historical Annual Average Daily Traffic by Mainline Toll Location

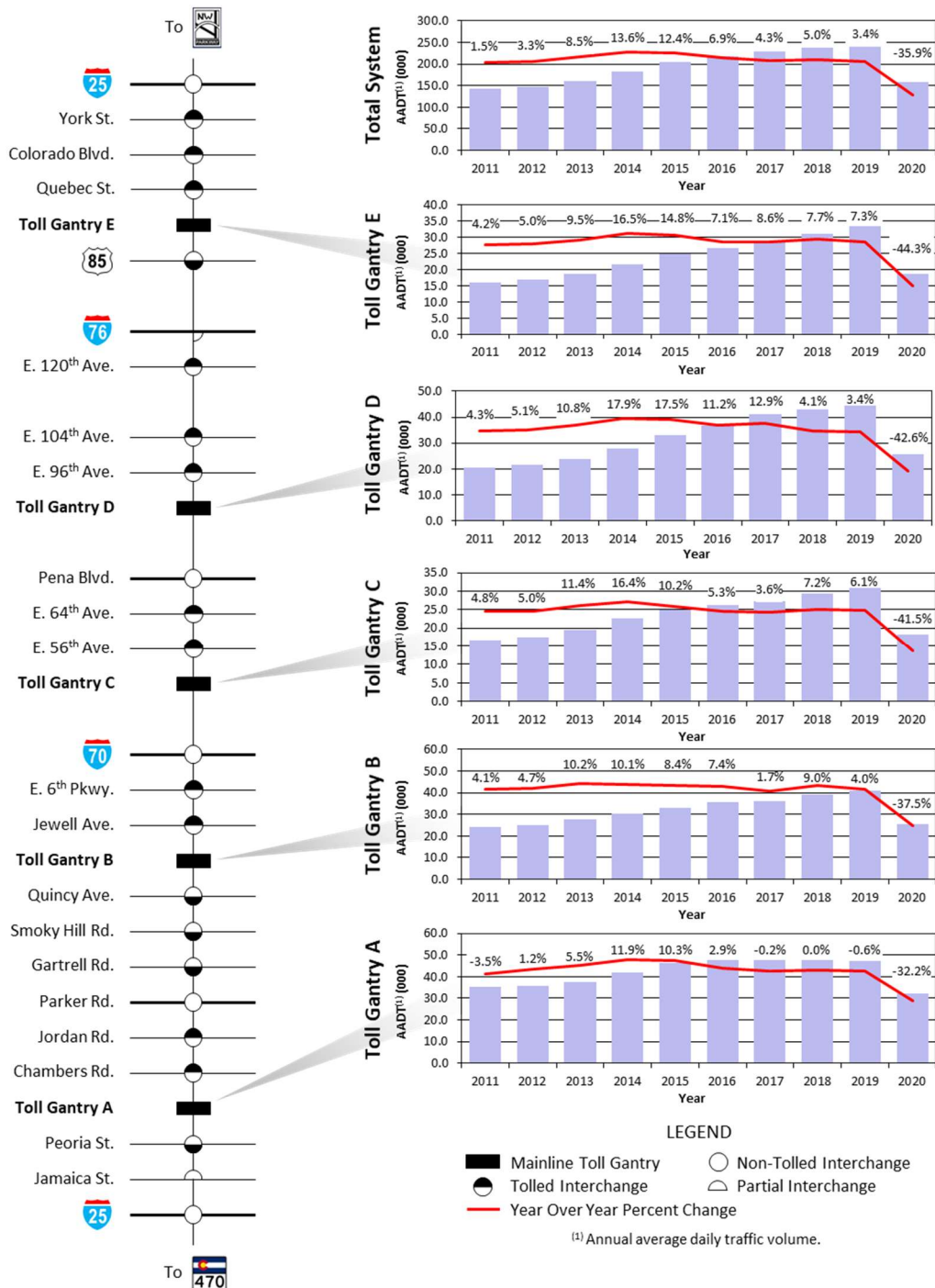
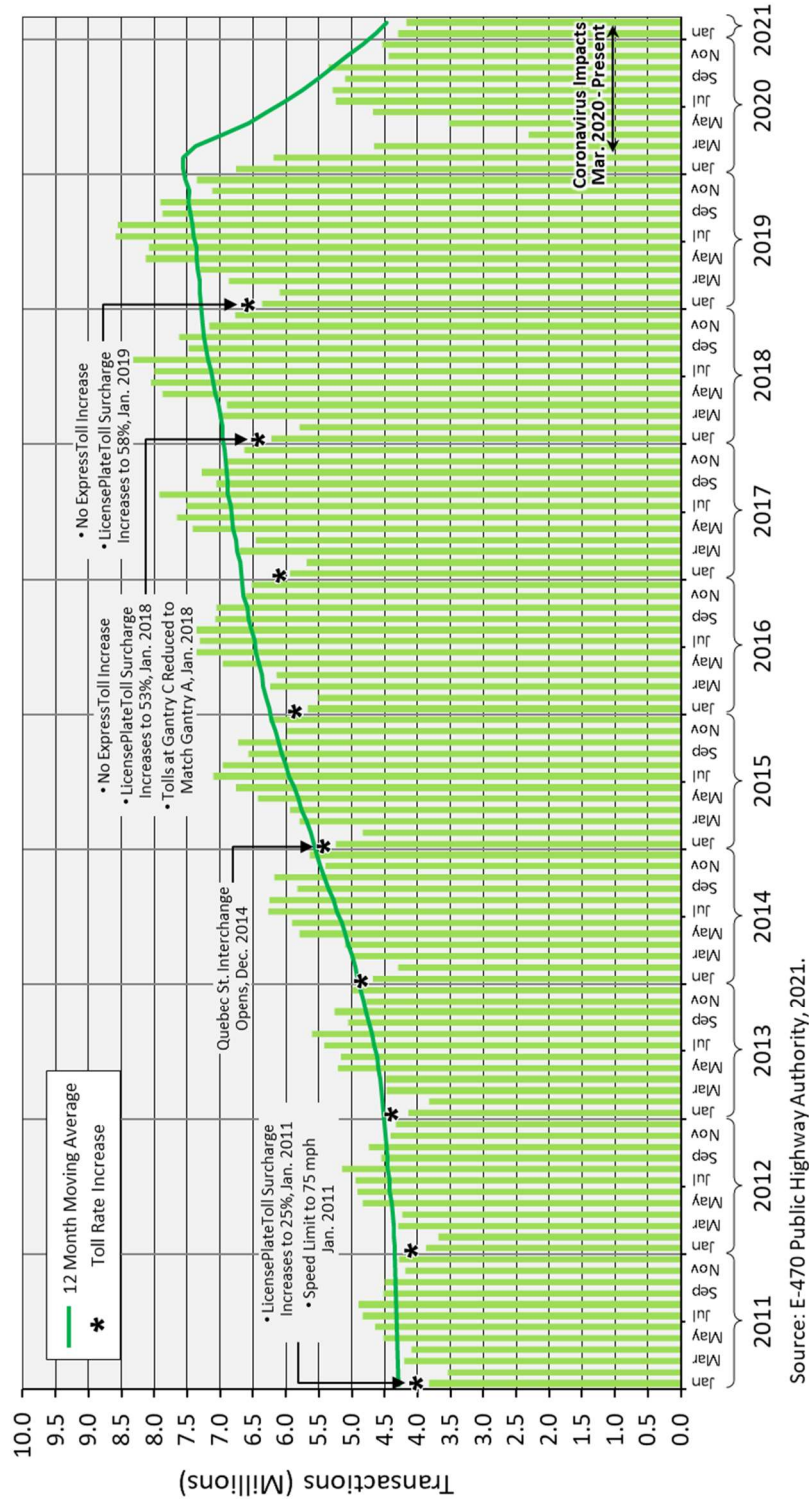


Figure 2
Historical Monthly Transaction Trends, 2011 - 2021



Source: E-470 Public Highway Authority, 2021.

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in 2012 fell only 176,000 transactions short of the 2007 pre-recession high of 54.1 million. Transactions in 2013 grew by 8.5 percent. This acceleration in growth compared to the 3.3 percent growth a year prior, actually began in July 2013. From July through December 2013, growth accelerated, averaging 10.6 percent. This double-digit, year-over-year transaction growth continued through 2015, likely due to continued economic recovery from the Great Recession and significant reductions in gasoline prices. Average daily transactions increased at a lower, but still robust 6.9 percent in 2016, reaching over 218,500 per day. Since 2015, annual transaction growth has remained robust, although generally at slightly lower, single-digit rates. Continued strong growth in transactions occurred despite the impacts of gas price shocks resulting from the impacts of Hurricanes Harvey and Irma in September 2017 (representing the first year-over-year decrease in transactions in almost seven years on E-470 for a single month). As gas prices stabilized and employment levels grew between 2017 and 2019, strong transaction growth continued on E-470. Year-over-year growth rates in 2018 and 2019 were 5.0 percent and 3.4 percent, respectively, with year-over-year growth rates by month falling relatively close to the annual average. Beginning March 2020, transactions decreased significantly due to the public space closures, event cancellations, stay-at-home orders, and reduced economic activity resulting from the COVID-19 outbreak. The effects of COVID-19 and these government stay-at-home orders and other travel restrictions to E-470 traffic and their potential impacts on future traffic and revenue are discussed in greater detail later in this letter report.

Table 2 provides the actual total monthly transactions for the E-470 System through February 2021. The average year-over-year decrease in E-470 traffic volumes as a result of the COVID-19 pandemic was 35.7 percent, with the peak reduction of 70.8 percent occurring in April 2020. Transactions during the most recent month of data, February 2021, indicated a decline of 32.6 percent compared to the prior year (pre-COVID-19).

Recent Trends Related to COVID-19

In March 2020, traffic impacts related to COVID-19 began as many states and localities began implementing stay-at-home orders, public space closures, social distancing orders and other restrictions in an effort to reduce the spread of the virus based on guidelines from the Center for Disease Control (CDC) and the Federal Government. **Figure 3** presents a timeline of major 2020 events for Colorado and the Denver Metro Area related to the COVID-19, as well as the confirmed COVID-19 cases, hospitalizations, and related deaths. These are compared against a 7-day running average of actual E-470 daily transactions. As of March 30, 2021, there have been almost 459,400 confirmed cases of COVID-19 in Colorado since the beginning of the pandemic, with almost 6,100 deaths. Within the 7-County Denver Metro area, there have been over 255,000 confirmed cases and almost 3,600 deaths, or roughly 56 percent of the total statewide impact.

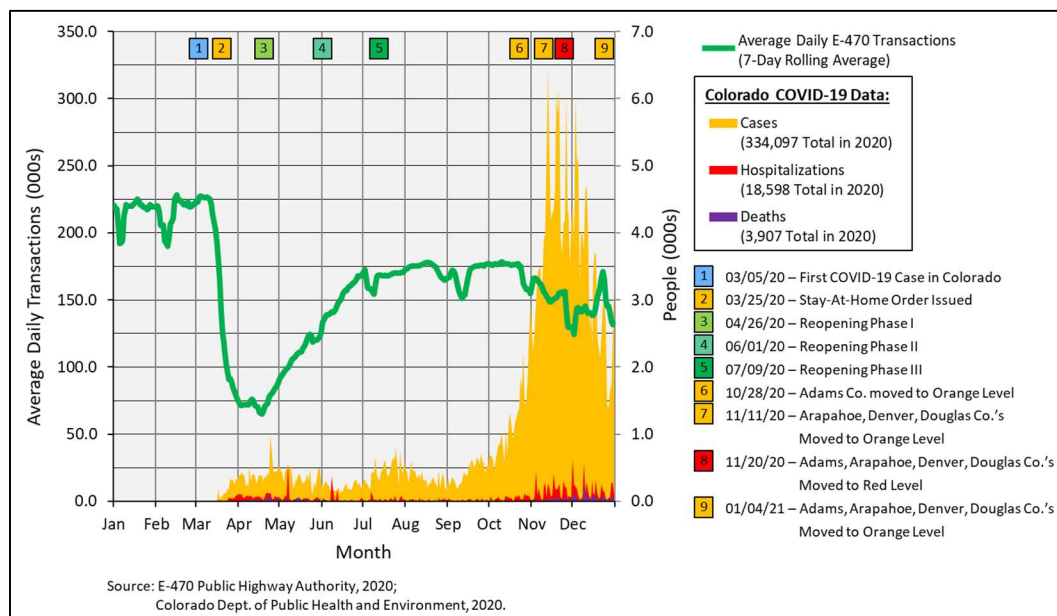
The first COVID-19 case was recorded on March 5, 2020. On March 11, 2020, Colorado Governor Polis issued an emergency declaration due to COVID-19. This was followed by an order on March 18, 2020 to suspend in-person instruction at Colorado schools and a March 25, 2020 stay-at-home

Table 2
Actual Monthly Transactions in Thousands, 2019 - 2021

| Month | 2019 | Percent Change | 2020 | Percent Change | 2021 |
|-----------------------------|---------------|----------------|---------------|----------------|--------------|
| January | 6,370 | 6.0% | 6,754 | -36.4% | 4,293 |
| February | 6,104 | 1.4% | 6,191 | -32.6% | 4,172 |
| March | 6,868 | -32.1% | 4,666 | | |
| April | 7,317 | -68.5% | 2,304 | | |
| May | 8,137 | -56.7% | 3,521 | | |
| June | 8,084 | -42.2% | 4,674 | | |
| July | 8,581 | -38.9% | 5,243 | | |
| August | 8,549 | -38.1% | 5,293 | | |
| September | 7,885 | -35.3% | 5,098 | | |
| October | 7,910 | -32.3% | 5,351 | | |
| November | 7,115 | -37.6% | 4,438 | | |
| December | 7,360 | -38.3% | 4,538 | | |
| Total ⁽¹⁾ | 90,280 | -35.7% | 58,070 | -34.6% | 8,466 |

(1) 2021 over 2020 comparison based on year-to-date transactions.

Figure 3
Major COVID-19 Events and Comparison to Average Daily E-470 Transactions, 2020



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order. Denver Mayor Hancock issued a similar stay-at-home order on March 25, 2020. Phased reopening began on April 26, 2020 and continued through September 2020. In response to a surge in COVID-19 cases in October 2020, many Denver Metro Area counties were moved to Orange Level Status, which is a color on the dial created by the Colorado Health Department to indicate how each county in Colorado was tracking and what level of restrictions are in place based on the statistics and trends. The colors range from the lowest end of restrictions of green, to blue, yellow, orange, red and purple, where purple has the most restrictions in place. Orange level in October 2020 included a recommendation for higher-risk populations to stay and work from home, limited to the sizes of public gatherings, some remote public education, restricted restaurant capacity and bar closures, and other restrictions for retail and recreational facilities. As the COVID-19 surge intensified in November 2020, additional restrictions were added as Adams, Arapahoe, Denver, and Douglas Counties were moved to Red Level Status. Since the availability of a COVID-19 vaccine and the reduction of local cases, Adams, Broomfield, Boulder, Denver, and Douglas Counties have been moved to Yellow Level Status, which includes some increased capacity for restaurants, retail and recreational facilities. Arapahoe and Jefferson Counties are currently on Blue Level Status, which allows additional capacity for restaurants and retail facilities, permits bars to reopen with capacity restrictions, and removes restrictions from outdoor recreational facilities. Variances from these restrictions have been permitted for some facilities, such as the Denver Zoo, Park Meadows Mall, Flatiron Crossing Mall, and selected Denver museums.

These restrictions considerably impacted regional traffic patterns. Since more than 20 percent of E-470 traffic originates from or is destined for Denver International Airport (DEN), reductions in air travel and tourism related to the COVID-19 outbreak have impacted E-470 to a greater extent than other facilities in the region. Moreover, since congestion on alternative roadways, such as I-25, I-70 and even local arterials, was significantly reduced E-470 offered lower travel time savings to motorists than it did prior to the COVID-19 outbreak. As a result, E-470 was harder hit than other facilities. This is illustrated in **Figure 4**, which presents the year-over-year difference in average daily traffic volumes by month for E-470, Northwest Parkway and other Denver area roadways.

As shown in **Figure 4**, the average year-over-year decrease in E-470 traffic volumes as a result of the COVID-19 pandemic was 35.7 percent, with the peak reduction of 70.8 percent occurring in April 2020. This was similar to the impact to the other tolled highway in the Denver region, Northwest Parkway, which experienced an average year-over-year decrease of 39.5 percent in 2020. By comparison, other Denver Metro Area roadways averaged a decrease of 14.8 percent during 2020, with a peak year-over-year reduction of 44.8 percent in April 2020. This is roughly half the impact experienced by E-470 due to COVID-19.

Figure 5 illustrates the reduction in total weekly E-470 transactions, as compared with the first week of March prior to the major COVID-19 impacts. As previously indicated, some impacts were observed during the second week of March, with transactions falling roughly 10 percent week-

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Figure 4
Comparison of Year-over-Year Changes in Volumes on E-470
and Other Denver Metro Area Roadways, 2019 to 2020

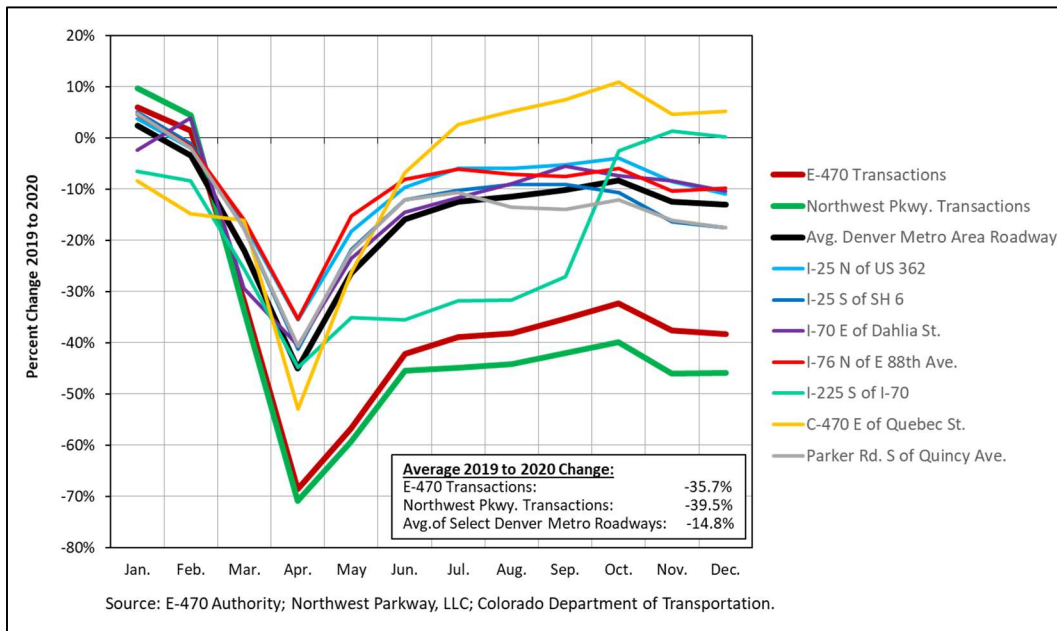
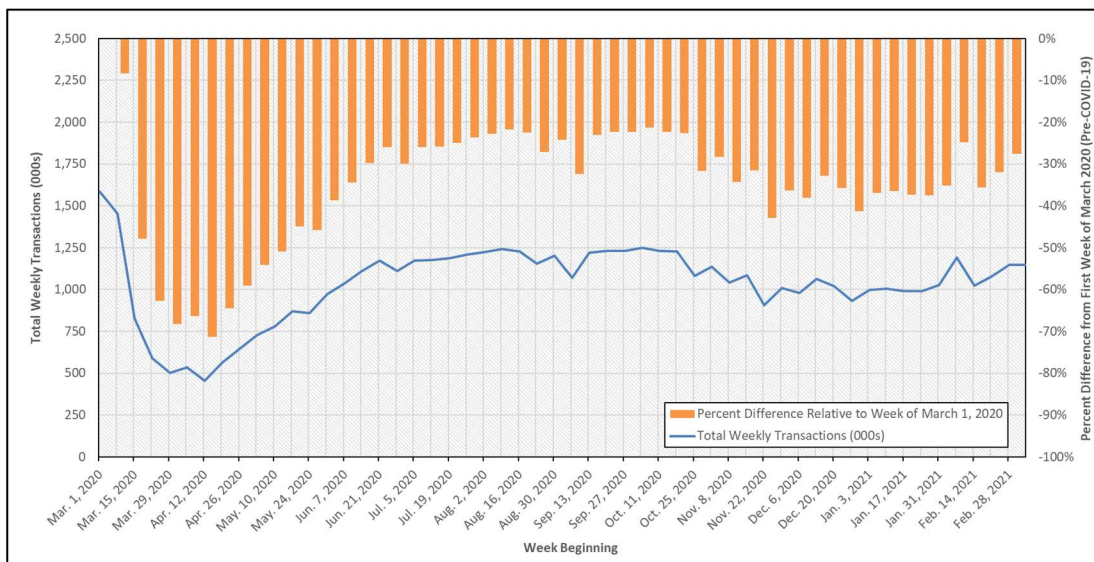


Figure 5
Impacts of COVID-19 on E-470 Weekly Transactions,
Percent Change in Traffic Relative to Volumes During the First Week in March 2020



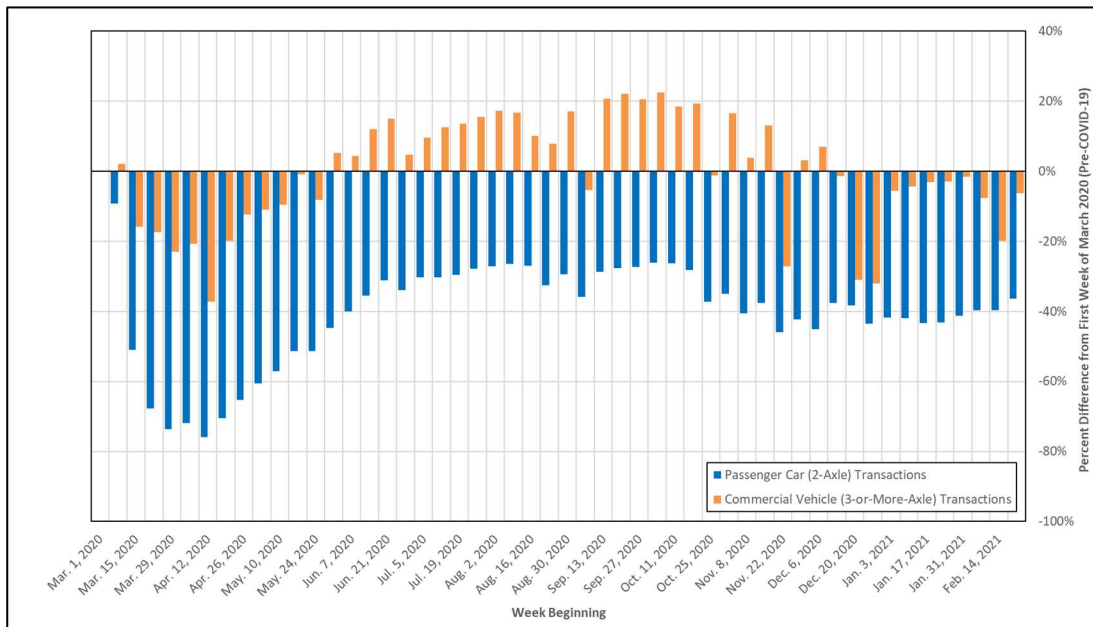
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over-week. However, the major impacts began during the third week and deepened to a reduction of more than 65 percent during the last week of March. Transactions began to recover in late April, coinciding with the implementation of Reopening Phase I. Transactions continued to recover through mid-June, when they plateaued at roughly 20 to 25 percent below the level they had reached the first week of March prior to the major COVID-19 impacts. During this period, impacts during holiday weeks, such as Independence Day and Labor Day, were greater due to the restrictions imposed on travel and recreational facilities. The impacts of COVID-19 began to increase in October and November as government restrictions increased in response to the additional COVID-19 cases reported at that time. There has been some improvement in transactions during February 2021, but it is unclear if this is a trend or only a temporary change. Likely, continued traffic impacts will be related to the length of government stay-at-home orders, public space and school closures, and other travel restrictions. Estimates of the continued traffic impacts related to COVID-19 are discussed later in the letter report.

One significant factor of the recent COVID-19 related traffic trends is the disparate impacts to E-470 transactions by vehicle class. Given the nature of the stay-at-home orders, daily home-based work trips were significantly impacted. In contrast, food and goods deliveries increased. As a result, passenger car traffic has been affected much more than commercial vehicle traffic to date. **Figure 6** compares E-470 transactions week-over-week by vehicle class based on the number of axles. During the peak of the COVID-19 impacts in April 2020, while E-470 passenger car transactions were down by over 75 percent compared to the first week of March, commercial vehicle transactions were down by just over 35 percent. This matches trends observed nationally on other toll facilities. As passenger car transactions began to recover in late April, commercial vehicle transactions also recovered leading to actual growth compared to pre-COVID-19 conditions by May 2020. Commercial vehicles continued to maintain a roughly 12 percent increase in transactions through November 2020, compared to the first week of March 2020. This recovery was led primarily by strong performance in 3-or-more-axle ExpressToll vehicles. By contrast, the recovery in passenger cars plateaued during the same period at roughly 30 percent below the level they had reached pre-COVID-19.

The strong performance of commercial vehicles may be the result of additional home delivery and retail supplies as people self-quarantined and worked from home, in compliance with state and local mandates. However, impacts during holiday weeks, such as Independence Day and Labor Day, have had a much greater negative impact on commercial vehicles than they did on passenger cars, as illustrated in **Figure 6**. In recent months, commercial vehicle transactions have dropped, relative to the first week of March 2020. This may be the result of seasonal changes or a response to the intensification of COVID-19 restrictions during the caseload surge of November and December 2020. It's clear that while commercial vehicle transactions, and the resulting toll revenues, continue to show resilience through the continued COVID-19 pandemic, future impacts to commercial vehicle traffic will be contingent upon continued supply chain stability, long-term employment levels and by the ability of consumers to afford food and other basic supplies.

Figure 6
Impacts of COVID-19 on E-470 Weekly Transactions by Vehicle Class,
Percent Change in Traffic Relative to Volumes During the First Week in March 2020



Looking at the impacts of COVID-19 at a gantry-level, traffic on E-470 has been reduced to a greater extent on the northern segments of the facility. The year-over-year decrease in average daily traffic between 2019 and 2020 at Gantries C, D and E ranges from 41.5 percent to 44.3 percent. By contrast, the year-over-year decreases at Gantries A and B were 32.2 percent and 37.5 percent, respectively. This is due to the greater percentage of through traffic at Gantries C, D and E, particularly those destined to Pena Boulevard and DEN. Based on an analysis of trip patterns conducted prior to COVID-19 as part of the 2020 Study, over 50 percent of trips at Gantries D and E are travelling to or from Pena Boulevard or nearby interchanges. At Gantry C, roughly 35 percent of trips are headed to or from Pena Boulevard, while at Gantries A and B the share is only 25 percent and 13 percent, respectively. As a result, the significant impacts to airline travel resulting from COVID-19, which will be reviewed later in this letter, had a greater influence on travel at those segments in the north carrying more DEN-related traffic. Looking at the toll ramps in aggregate, average daily traffic volumes were 23.0 percent less in 2020 than in 2019. These impacts are almost half those at the mainline toll gantries, likely due to the more local nature of the traffic at these locations and relatively lower toll rates at ramps compared to mainline toll gantries. The local traffic movements at the toll ramps would also likely be supported by the increase in home delivery and other stay-at-home support services utilized by those self-quarantining and working from home. These differentials in COVID-19 impacts by toll gantry were critical components under the current effort that were used to develop estimates of future COVID-19 impacts.

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In addition to the differences in impact by location, CDM Smith reviewed the impacts of COVID-19 to the distribution of hourly traffic at the mainline toll gantries. A comparison of the average weekday hourly traffic distribution for 2019 and 2020 is presented in **Figure 7**. As shown, there is a decrease in the percentage of traffic during the peak periods and an increase in the percentage of traffic during the midday period at all mainline toll gantries. This is due to the increase in telecommuting in response to the COVID-19 pandemic and the impacts to overall regional employment. The time-of-day discount for 3-or-more axle vehicles, implemented in January 2020 and referenced later in this report, may have also contributed to the reduction in the share of peak period traffic. In total, average weekday peak period (6:00 – 9:00 AM and 3:00 – 7:00 PM) traffic decreased from 56.0 percent of the total day in 2019 to 52.5 percent in 2020, while midday (9:00 AM - 3:00 PM) traffic increased from 28.9 percent in 2019 to 33.8 percent in 2020.

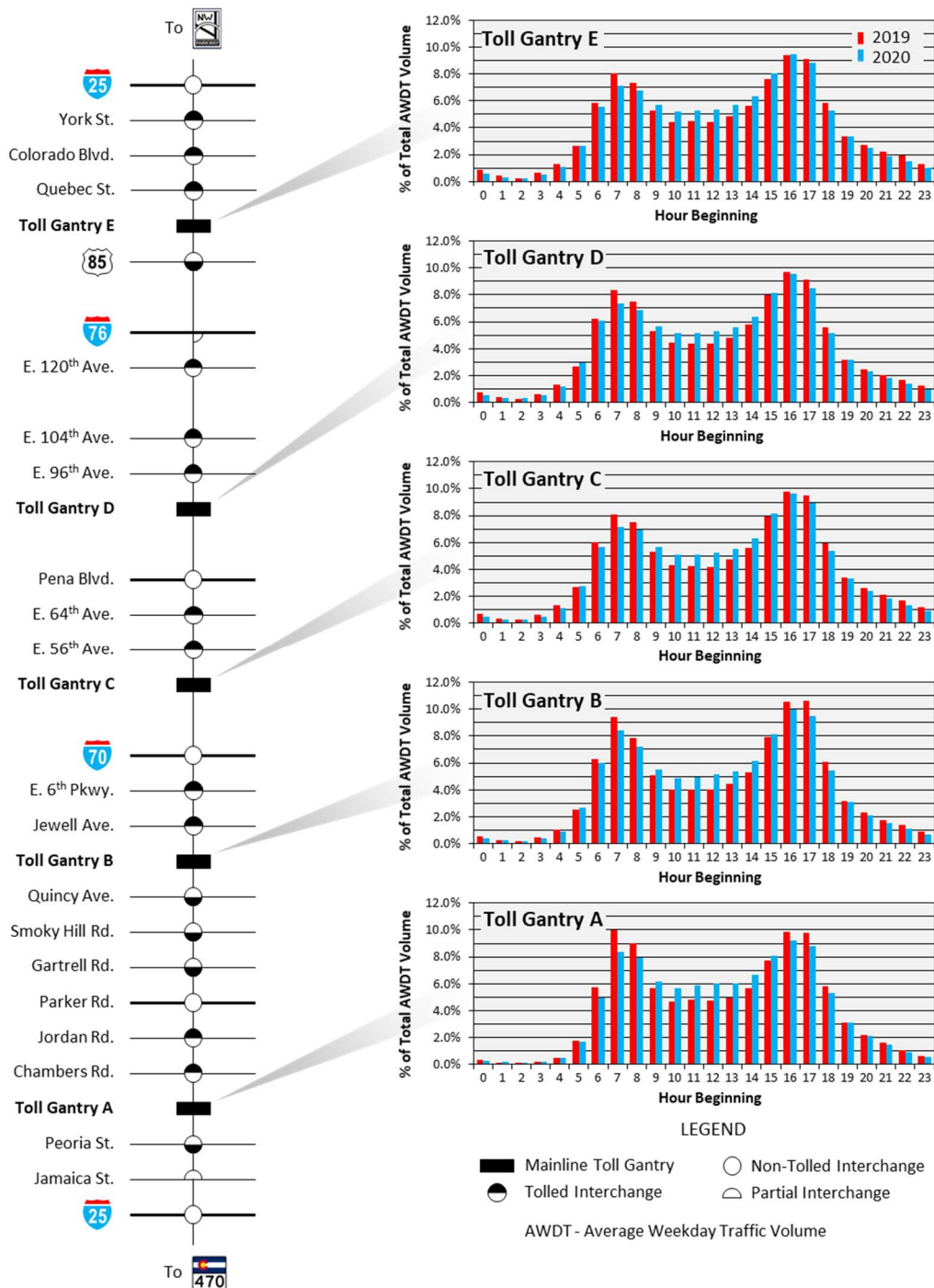
Review of Economic Conditions

Under the 2020 Study, Economic & Planning Systems (EPS) reviewed the 2015 to 2040 employment, population, and household projections of the Denver Regional Council of Governments (DRCOG). Motivation for this independent review was to account for economic and demographic conditions in a dynamic regional market that continues to change and expand. EPS ultimately recommended minor changes to these growth forecasts, both at aggregate level and for specific traffic analysis zones (TAZ), which serve as an input to the regional travel demand model. The goal of the recommended adjustment was to include the latest economic conditions and major development plans, which could influence traffic demand on E-470. The findings from this work were used as a basic input to the travel demand model which, in turn, aided in the forecasting of the traffic and revenue potential for E-470 for the 2020 Study. It should be noted that the underlying employment, population, and household projections developed by EPS for the 2020 Study did not include the impacts of COVID-19. Instead, CDM Smith incorporated the impacts as a post-processing adjustment to the output of the regional travel demand model.

For the current study effort, it was assumed that the long term employment, population, and household projections provided by EPS for the 2020 Study still reflected underlying regional conditions without the impact of COVID-19. Thus, it was important that a review of the socio-economic impacts of COVID-19 was performed. This assessment would be used to adjust the ongoing impacts of COVID-19 and assumed length of recovery to a “new normal” following the pandemic.

In February 2021, EPS completed a high-level review of Denver-area economic conditions since the onset of the COVID-19 pandemic in March 2020 and through the end of the year. A summary of this review is provided in the EPS 2021 Economic Condition Update Memorandum, which is included in this report as **Appendix A**. This effort included:

Figure 7
Distribution of Average Weekday Hourly Traffic by Mainline Gantry, 2019 and 2020



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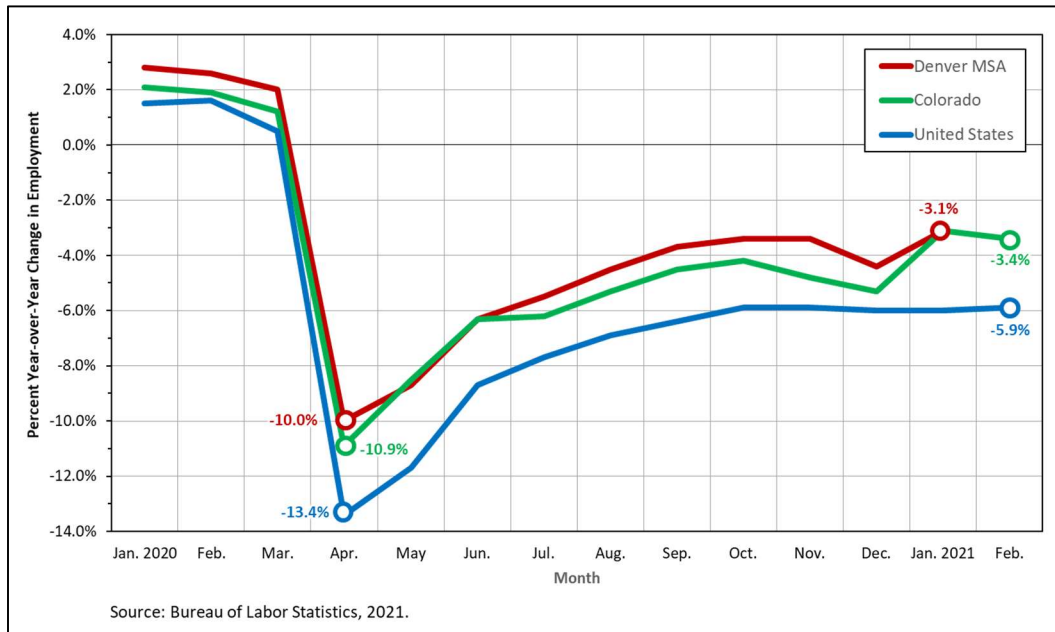
- A review of monthly data for employment, enplanements at Denver International Airport (DEN), residential construction activity, and nationwide consumer confidence;
- A geographic analysis of data for the Denver Metropolitan Statistical Area (MSA) as defined by the U.S. Census and Bureau of Labor Statistics (i.e., the Denver-Aurora-Lakewood MSA), the State of Colorado, and the U.S.;
- A historical analysis from 2000, capturing the recessions of 2001 and the Great Recession (2007-2009); and
- Analyses indexed to 2000 for comparability of geographic scales and comparability of historical recovery patterns.

The objective of the review was to compare conditions geographically and to compare the emerging patterns against previous economic cycles. This was done because, although there is still uncertainty regarding the success of vaccinations occurring through the U.S. and through 2021, it was believed that past recovery patterns could provide some clarity to questions revolving around how well and/or how quickly the Denver MSA might recover. The analysis suggested the following findings:

- Consumer confidence appears to have been shaken more so at the onset of this pandemic than following either 9/11 or the Great Recession;
- Enplanements at DEN have recovered a greater degree of the pre-COVID peak than the overall U.S.;
- Employment in Denver has recovered a greater degree of its pre-COVID peak than the State of Colorado or U.S.; and
- Residential construction activity in Denver appears to be relatively unaffected, given the “critical business” designation and exemption from any shut-down orders.

As noted, the EPS assessment reviewed the impacts of COVID-19 to overall employment within the region. The year-over-year percent changes in employment for the Denver MSA, Colorado and the U.S. overall are presented in **Figure 8**. In April 2020, at the height of the COVID-19 pandemic, employment within the Denver MSA was 10.0 percent below that of the prior year. This was comparable to the year-over-year differences for the State of Colorado and significantly less than the average nationwide impact. All three geographies have exhibited a similar recovery curve through January 2021, the most recent month for which employment data are available for the Denver MSA. Employment within the Denver MSA has recovered to within 3.1 percent of its 2019 levels, as compared to employment within Colorado and U.S., which have recovered to within 3.4 percent and 5.9 percent of their 2019 levels, respectively. The smaller impact to and stronger recovery in regional employment exhibited by the Denver MSA may be the result of prior growth trends and differences in the specific COVID-19 restrictions enacted within the Denver MSA.

Figure 8
Year-over-Year Changes in Employment for Denver, Colorado and the U.S.



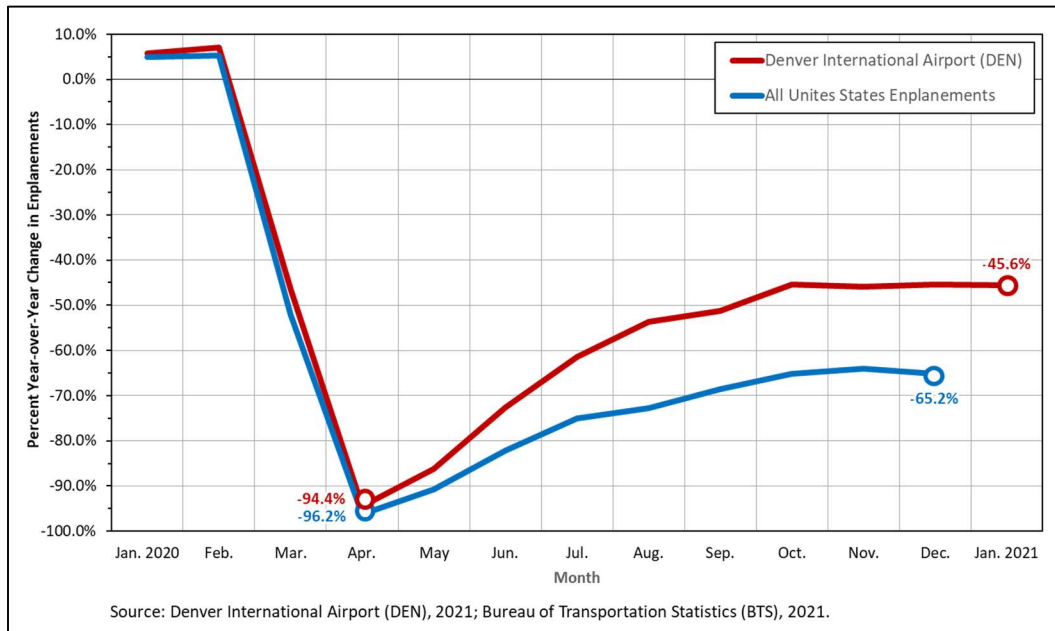
Given the importance of DEN to regional travel patterns, EPS also reviewed local and national enplanement trends. **Figure 9** provides a comparison between the year-over-year percent changes in enplanements for DEN and total U.S. enplanements. Following the advent of the COVID-19 pandemic, air travel was reduced by roughly 95 percent, both at DEN and nationally. Since April 2020, the recovery of air travel at DEN has significantly outpaced the national average. January 2021 enplanements at DEN were 45.6 percent less than those in January 2020, prior to the COVID-19 pandemic. By comparison, national enplanements are still 65.2 percent below pre-COVID-19 levels. Given the significance of DEN to E-470 transactions and toll revenue, as previously noted, the differential between DEN and all U.S. enplanements was important when considering national forecasts in the recovery of air travel within the traffic and revenue forecast.

Like many metropolitan areas, Denver has been impacted by COVID-19. However, the data indicate that the Denver MSA was impacted to a lesser degree than other areas nationwide. In addition, the Denver MSA has recovered more quickly than the national average.

Review of the Highway Improvement Program

As part of the traffic and toll revenue study performed in support of the 2020 Study, a detailed review was conducted of the proposed highway improvements for the immediate E-470 corridor and along principal competing and complementary freeways. As part of the current update, a

Figure 9
Year-over-Year Changes in Enplanements for Denver International Airport and the U.S.



review of the planned highway improvements was conducted by CDM Smith. **Table 3** presents the changes between the prior 2020 Study highway improvement assumptions and those of the current study effort. In general, the results of this review found that the changes to the underlying DRCOG highway improvement assumptions would not present a significant impact to the E-470 System.

Additionally, an evaluation of the Authority's proposed capital program was conducted. **Table 4** presents a summary of the changes in highway improvement assumptions between the current study and the 2020 Study. These changes were based on information provided by E-470 Staff. The most significant changes are:

- The advancement of the E 38th Avenue full-diamond interchange from 2025 to 2023, including the relocation of Mainline Gantry C to the South, and the assumption that an additional permanent interchange will be constructed at E 48th Avenue in 2030;
- The advancement of the mainline widening between Pena Boulevard and E 104th Avenue from 2027 to 2025;
- The addition of a new interchange at Sable Boulevard in 2025 and the removal of the proposed Potomac Street interchange from the capital program; and
- The advancement of the proposed E 112th Avenue interchange from 2035 to 2031.

Table 3
Programmed Regional Highway Improvements
Assumed in the 2020 Study and the Current Study

| Network Year of Improvement | | Facility Name | From | To | Improvement | Length | Counties |
|-----------------------------|---------------|--------------------------|-----------------------------|--------------------------|------------------------------|--------|-------------------|
| Prior 2020 Study | Current Study | | | | | | |
| 2021 | 2020/2021 | C-470 | Colorado Blvd. | Wadsworth Blvd. | WB: Add 1 Toll/Managed Lane | 8.2 | Douglas/Jefferson |
| 2021 | 2020/2021 | C-470 | I-25 | Colorado Blvd. | WB: Add 2 Toll/Managed Lanes | 4.1 | Douglas |
| 2021 | 2020/2021 | C-470 | Wadsworth Blvd. | I-25 | EB: Add 1 Toll/Managed Lane | 10.8 | Douglas/Jefferson |
| 2025 | 2020 | 104th Ave. | US-85 | SH-2 | Widen from 2 to 4 Lanes | 1.8 | Adams |
| 2025 | 2020/Complete | 144th Ave. | US-287 | Zuni St. | Widen from 2 to 4 Lanes | 3.5 | Broomfield |
| 2025 | 2030 | 160th Ave. | Lowell Blvd. | Sheridan Pkwy. | New 2 Lanes | 1.0 | Broomfield |
| 2025 | 2020/Complete | 6th Ave./6th Pkwy. | 6th Pkwy. | Harvest Rd. | Widen from 2 to 6 Lanes | 0.4 | Arapahoe |
| 2025 | 2020 | 6th Pkwy | SH-30 | E-470 | New 2 Lane Road | 1.3 | Arapahoe |
| 2025 | 2030 | 96th St. | 96th St. at Northwest Pkwy. | SH-128 | Add Toll Lanes | 2.3 | Broomfield |
| 2025 | 2030 | Green Valley Ranch Blvd. | Chambers Rd. | Telluride St. | Widen from 4 to 6 Lanes | 1.5 | Denver |
| 2025 | N/A | Harvest Rd. | Mississippi Ave. | Alameda Ave. | New 6 Lanes | 1.0 | Arapahoe |
| 2025 | 2030 | Jefferson Pkwy. | Candelas Pkwy. | | New Partial Interchange | | Jefferson |
| 2025 | 2030 | Jefferson Pkwy. | Indiana St./o SH-128 | | New Partial Interchange | | Jefferson |
| 2025 | 2030 | Jefferson Pkwy. | SH-72 | | New Partial Interchange | | Jefferson |
| 2025 | 2030 | Jefferson Pkwy. | SH-93 | | New 4 Lane Toll Road | | Jefferson |
| 2025 | 2020/Complete | Pena Blvd. | Tower Rd. | SH-128 | Add on-ramp to WB Pena | 10.2 | Jefferson |
| 2025 | N/A | Picadilly Rd. | Jewell Ave. | | New 4 Lanes | 2.7 | Denver |
| 2025 | 2020 | SH-2 | 72nd Ave. | 6th Pkwy. | Widen from 2 to 4 Lanes | 7.5 | Arapahoe |
| 2025 | 2030 | SH-7 | Boulder County Line | I-76 | Widen from 2 to 4 Lanes | 2.5 | Adams |
| 2025 | 2030 | Sheridan Pkwy. | NW Pkwy. | Sheridan Pkwy. | Widen from 2 to 4 Lanes | 1.3 | Broomfield |
| 2025 | 2030 | Sheridan Blvd. | Lowell Blvd. | SH-7 | Widen from 2 to 4 Lanes | 1.1 | Broomfield |
| 2025 | 2020 | Tower Rd. | 38th/40th Ave. | NW Pkwy. | Widen from 2 to 4 Lanes | 1.0 | Denver |
| 2025 | 2020 | Tower Rd. | Pena Blvd. | Green Valley Ranch Blvd. | Widen from 2 1/4 to 6 Lanes | 3.8 | Adams |
| 2025 | 2020 | Washington St. | 144th Ave. | 104th Ave. | Widen from 2 to 4 Lanes | 0.7 | Adams |
| 2030 | 2030 | 104th Ave. | Colorado Blvd. | McKay Rd. | Widen from 2 to 4 Lanes | 0.7 | Adams |
| 2030 | 2030 | 104th Ave. | Marion St. | Colorado Blvd. | Widen from 4 to 6 Lanes | 1.6 | Adams |
| 2030 | 2030 | 104th Ave. | McKay Road | US-85 | Widen from 2 to 4 Lanes | 1.9 | Adams |
| 2030 | 2030 | 144th Ave. | Washington St. | York St. | Widen from 2 to 4 Lanes | 1.0 | Adams |
| 2030 | 2030 | 144th Ave. | York St. | Colorado Blvd. | Widen from 2 to 4 Lanes | 1.0 | Adams |
| 2030 | 2030 | 48th Ave. | Picadilly Rd. | Powhaton Rd. | New 6 Lanes | 3.0 | Adams |
| 2030 | 2030 | 48th Ave. | Powhaton Rd. | Monaghan Rd. | New 2 Lanes | 1.0 | Adams |
| 2030 | 2030 | 56th Ave. | Dunkirk St. | Himalaya St. | Widen from 4 to 6 Lanes | 0.5 | Denver |
| 2030 | 2030 | 56th Ave. | E-470 | Powhaton Rd. | Widen from 2 to 6 Lanes | 2.0 | Adams |
| 2030 | 2030 | 56th Ave. | Havana St. | Pena Blvd. | Widen from 2 to 6 Lanes | 4.3 | Denver |
| 2030 | 2030 | 56th Ave. | Himalaya St. | Picadilly Rd. | Widen from 2 to 6 Lanes | 1.0 | Denver |
| 2030 | 2030 | 56th Ave. | Pena Blvd. | Tower Rd. | Widen from 4 to 6 Lanes | 0.7 | Denver |
| 2030 | 2030 | 56th Ave. | Picadilly Rd. | E-470 | Widen from 2 to 6 Lanes | 1.0 | Adams |
| 2030 | 2030 | 64th Ave. | Denver/Aurora City Limit | Himalaya St. | Widen from 2 to 6 Lanes | 0.5 | Adams |
| 2030 | 2030 | 64th Ave. | Harvest Rd. | Powhaton Rd. | New 2 Lanes | 1.0 | Adams |
| 2030 | 2030 | 64th Ave. | Himalaya Rd. | Harvest Rd. | Widen from 2 to 4 Lanes | 3.0 | Adams |

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Table 3 (Continued)
Programmed Regional Highway Improvements
Assumed in the 2020 Study and the Current Study

| Network Year of Improvement | | Facility Name | From | To | Improvement | Length | Counties |
|-----------------------------|---------------|-----------------------------|----------------------------|---------------------------|-----------------------------------|--------|------------------|
| Prior 2020 Study | Current Study | | | | | | |
| 2030 | 2030 | 64th Ave. | Powhatan Rd. | Monaghan Rd. | New 4 Lanes | 1.0 | Adams |
| 2030 | 2030 | 64th Ave. | Tower Rd. | Denver/Aurora City Limits | Widen from 2 to 4 Lanes | 0.5 | Denver |
| 2030 | 2030 | 6th Ave. | Airport Blvd. | Tower Rd. | Widen from 2 to 6 Lanes | 1.0 | Arapahoe |
| 2030 | 2030 | 6th Ave./SH 30 | Tower Rd. | 6th Pkwy. | Widen from 2 to 6 Lanes | 1.6 | Arapahoe |
| 2030 | 2030 | 6th Pkwy./Steve D. Hogan | E-470 | Gun Club Rd. | Widen from 2 to 6 Lanes | 0.3 | Arapahoe |
| 2030 | 2030 | Arapahoe Rd. | Waco St. | Himalaya St. | Widen from 4 to 6 Lanes | 1.3 | Arapahoe |
| 2030 | 2030 | Broncos Pkwy. | Jordan Rd. | Liverpool St. | Widen from 4 to 6 Lanes | 0.5 | Arapahoe |
| 2030 | 2030 | Broncos Pkwy. (Easter Ave.) | Havana St. | Parker Rd. | Widen from 4 to 6 Lanes | 0.8 | Arapahoe |
| 2030 | 2030 | Buckley Rd. | 118th Ave. | Peoria St. | Widen from 4 to 6 Lanes | 1.0 | Arapahoe |
| 2030 | 2030 | Buckley Rd. | 136th Ave. | Cameron Dr. | Widen from 2 to 6 Lanes | 1.3 | Adams |
| 2030 | 2030 | C-470 | Broadway | Bromley Ln. | Widen from 2 to 4 Lanes | 2.0 | Adams |
| 2030 | 2030 | C-470 | Colorado Blvd. | I-25 | WB: Add 1 Toll/Managed Lane | 6.6 | Douglas |
| 2030 | 2030 | C-470 | S. Kipling Pkwy. | Lucent Blvd. | EB: Add 1 Toll/Managed Lane | 3.7 | Douglas |
| 2030 | 2030 | C-470 | Wadsworth Blvd. | Wadsworth Blvd. | EB: Add 1 Toll/Managed Lane | 3.0 | Jefferson |
| 2030 | 2030 | Chambers Rd. | Main Street | S. Kipling Pkwy. | WB: Add 1 Toll/Managed Lane | 1.4 | Jefferson |
| 2030 | 2030 | E. Bromley Ln. | Tower Rd. | Lincoln Ave. | Widen from 2 to 4 Lanes | 1.4 | Douglas |
| 2030 | 2030 | Green Valley Ranch Blvd. | Hwy 85 | I-76 | Widen from 4 to 6 Lanes | 1.1 | Adams |
| 2030 | 2030 | Green Valley Ranch Blvd. | Chambers Rd. | Sable Blvd. | Widen from 4 to 6 Lanes | 0.5 | Adams |
| 2030 | 2030 | Green Valley Ranch Blvd. | Telluride St. | Pena Blvd. | Widen from 2 to 4 Lanes | 1.0 | Denver |
| 2030 | 2030 | Gun Club Rd. | 1.5 Miles s/of Quincy Ave. | Tower Rd. | Widen from 4 to 6 Lanes | 0.5 | Denver |
| 2030 | 2030 | Hampden Ave. | Picadilly Rd. | Quincy Ave. | Widen from 2 to 6 Lanes | 1.6 | Arapahoe |
| 2030 | 2030 | Harvest Mile Rd. | I-70 | Gun Club Rd. | Widen from 2 to 4 Lanes | 1.1 | Arapahoe |
| 2030 | 2030 | Harvest Mile Rd. | 48th Ave. | 64th Ave. | New 3 Lanes | 1.0 | Adams |
| 2030 | 2030 | Harvest Mile Rd. | 6th Ave. | 26th Ave. | New 2/4 Lanes | 1.5 | Adams |
| 2030 | 2030 | Harvest Mile Rd. | Alameda Ave. | 56th Ave. | New 6 Lanes | 1.2 | Adams |
| 2030 | 2030 | Huron St. | 150th Ave. | I-70 | New 6 Lanes | 1.1 | Adams |
| 2030 | 2030 | Huron St. | 160th Ave. | 6th Ave. | Widen from 3 to 6 Lanes | 1.0 | Arapahoe |
| 2030 | 2030 | I-25 | 120th Ave. | SH-7 | Widen from 2 to 4 lanes | 1.3 | Broomfield |
| 2030 | 2030 | I-25 | 84th Ave. | SH-7 | Add 1 Managed Lane Each Direction | 1.2 | Broomfield |
| 2030 | 2030 | I-70 | Harvest Rd. | Thornton Pkwy. | Add 1 New Lane Each Direction | 6.0 | Adams/Broomfield |
| 2030 | 2030 | I-70 | I-25 | Chambers Rd. | Add New Interchange | 2.8 | Adams |
| 2030 | 2030 | I-70 | Picadilly Rd. | | Add 2 New Managed Lanes | 3.8 | Adams/Arapahoe |
| 2030 | 2030 | I-76 | Bridge St | | Add New Interchange | | Denver/Adams |
| 2030 | 2030 | Jewell Ave. | E-470 | Gun Club Rd. | New Interchange | | Adams |
| 2030 | 2030 | Jewell Ave. | Gun Club Rd. | Harvest Rd. | Widen from 2 to 6 Lanes | 0.5 | Arapahoe |
| 2030 | 2030 | Lincoln Ave. | Himalaya Rd. | E-470 | Widen from 2 to 6 Lanes | 1.0 | Arapahoe |
| 2030 | 2030 | Lincoln Ave. | Keystone Blvd. | Parker Rd. | Widen from 3 to 6 Lanes | 1.4 | Arapahoe |
| 2030 | 2030 | Lincoln Ave. | Peoria St. | 1st Ave. | Widen from 4 to 6 Lanes | 1.6 | Douglas |
| 2030 | 2030 | | | | Widen from 4 to 6 Lanes | 0.7 | Douglas |

Table 3 (Continued)
Programmed Regional Highway Improvements
Assumed in the 2020 Study and the Current Study

| Network Year of Improvement | | Facility Name | From | To | Improvement | Length | Counties |
|-----------------------------|---------------|------------------------------|-------------------------------|------------------------------|-------------------------|--------|----------------|
| Prior 2020 Study | Current Study | | | | | | |
| 2030 | 2030 | Lincoln Ave. | 1st St. | Keystone Blvd. | Widen from 4 to 6 Lanes | 1.8 | Douglas |
| 2030 | 2030 | Pena Blvd. | Jackson Gap St. | DIA Terminal | Widen from 6 to 8 Lanes | 1.7 | Denver |
| 2030 | 2030 | Pena Blvd. | I-70 | E-470 | Widen from 4 to 8 Lanes | 6.4 | Denver |
| 2030 | 2030 | Pena Blvd. | E-470 | Jackson Gap St. | Widen from 6 to 8 Lanes | 2.9 | Denver |
| N/A | 2030 | Pena Blvd. | Gun Club Rd. | | Interchange Capacity | 0.0 | Denver |
| 2030 | 2030 | Peoria St. | E-470 | .75 miles s/o Lincoln Ave. | Widen from 2 to 4 Lanes | 1.9 | Douglas |
| 2030 | 2030 | Picadilly Rd. | 48th Ave. | 56th Ave. | Widen from 2 to 6 lanes | 1.2 | Adams |
| 2030 | 2030 | Picadilly Rd. | 56th Ave. | 70th Ave./Aurora City Limits | New 6 Lanes | 1.7 | Adams |
| 2030 | 2030 | Picadilly Rd. | 6th Ave. | Colfax Ave. | Widen from 2 to 6 Lanes | 1.6 | Arapahoe |
| 2030 | 2030 | Picadilly Rd. | 70th Ave. | 82nd Ave. | New 6 Lanes | 1.5 | Denver |
| 2030 | 2030 | Picadilly Rd. | Colfax Ave. | I-70 | New 6 Lanes | 0.3 | Adams |
| 2030 | 2030 | Picadilly Rd. | I-70 | Smith Rd. | Widen from 2 to 6 Lanes | 0.5 | Adams |
| 2030 | 2030 | Picadilly Rd. | Smith Rd. | 48th Ave. | Widen from 2 to 6 Lanes | 2.2 | Adams |
| 2030 | 2030 | Powhatan Rd. | 26th Ave. | 48th Ave. | New 6 Lanes | 2.0 | Adams |
| 2030 | 2030 | Quebec St. | 120th Ave. | 128th Ave. | Widen from 2 to 4 Lanes | 1.0 | Adams |
| 2030 | 2030 | Quebec St. | 132nd Ave. | 160th Ave. | Widen from 2 to 4 Lanes | 3.5 | Adams |
| 2030 | 2030 | Quincy Ave. | Plains Pkwy./Copperleaf Blvd. | Gun Club Rd. | Widen from 2 to 6 Lanes | 0.6 | Arapahoe |
| 2030 | 2030 | Ridgeway Pkwy. (Mainstreet) | Havana St. | Lone Tree E. City Limit | Widen from 2 to 4 Lanes | 1.8 | Douglas |
| 2030 | 2030 | SH-30 | Steve D. Hogan Pkwy | Mississippi Ave. | Widen from 2 to 4 Lanes | 2.2 | Arapahoe |
| 2030 | 2030 | SH-7 | Sheridan Pkwy. | I-25 | Widen from 2 to 6 Lanes | 1.5 | Broomfield |
| 2030 | 2030 | SH-7 | 164th Ave. | Dahlia St. | Widen from 2 to 4 Lanes | 2.2 | Adams |
| 2030 | 2030 | Tower Rd. | York St. | Big Dry Creek | Widen from 2 to 4 Lanes | 0.7 | Adams |
| 2030 | 2030 | Tower Rd. | 48th Ave. | 56th Ave. | Widen from 4 to 6 Lanes | 1.0 | Denver |
| 2030 | 2030 | Tower Rd. | 56th Ave. | Pena Blvd. | Widen from 2 to 4 Lanes | 2.4 | Denver |
| 2030 | 2030 | Tower Rd. | 6th Ave. | Colfax Ave. | New 2 Lanes | 1.0 | Arapahoe |
| 2030 | 2030 | Tower Rd. | Colfax Ave. | Smith Rd. | Widen from 2 to 6 Lanes | 1.0 | Adams |
| 2030 | 2030 | Tower Rd. | Pena Blvd. | 104th Ave. | Widen from 4 to 6 Lanes | 3.8 | Adams |
| 2030 | 2030 | Tower/Buckley Rd. | 105th Ave. | 118th Ave. | New 4 Lanes | 2.0 | Adams |
| 2030 | 2030 | US-85 | 104th Ave | | New interchange | | Adams |
| 2030 | 2030 | US-85 | 120th Ave | | New interchange | | Adams |
| 2030 | 2030 | Washington St. | 152nd Ave. | 160 Ave. | Widen from 2 to 4 Lanes | 1.4 | Adams |
| 2030 | 2030 | York St. | 160th Ave. (SH-7) | 168th Ave. | Widen from 2 to 4 Lanes | 1.0 | Adams |
| 2030 | 2030 | York St. | E-470 | SH-7 | Widen from 2 to 4 Lanes | 0.7 | Adams |
| N/A | 2035 | 48th Ave. | Imboden Rd. | Quail Run Rd. | Widen from 2 to 6 Lanes | 1.0 | Adams |
| 2035 | 2040 | 6th Pkwy. | SH-30 | E-470 | Widen from 2 to 6 Lanes | 1.3 | Arapahoe |
| 2035 | 2040 | Hampden Ave./Havana St. (SH- | Florence St. | s/o Yale Ave. | Widen from 5 to 6 Lanes | 1.4 | Denver |
| 2035 | 2040 | I-70 | E-470 | | Interchange Capacity | | Adams/Arapahoe |
| 2035 | 2020 | Main Street | Lone Tree E. City Limit | Chambers Rd. | Widen from 2 to 4 Lanes | 0.9 | Douglas |
| 2040 | 2040 | 120th Ave. | E-470 | Picadilly Rd. | Widen from 2 to 6 Lanes | 2.6 | Adams |
| 2040 | 2040 | 120th Ave. | Sable Blvd. | E-470 | Widen from 2 to 6 Lanes | 2.0 | Adams |

Table 3 (Continued)
Programmed Regional Highway Improvements
Assumed in the 2020 Study and the Current Study

| Network Year of Improvement | | Facility Name | From | To | Improvement | Length | Counties |
|-----------------------------|---------------|------------------------------|-------------------------------|------------------------------|-------------------------|--------|----------------|
| Prior 2020 Study | Current Study | | | | | | |
| 2030 | 2030 | Lincoln Ave. | 1st St. | Keystone Blvd. | Widen from 4 to 6 Lanes | 1.8 | Douglas |
| 2030 | 2030 | Pena Blvd. | Jackson Gap St. | DIA Terminal | Widen from 6 to 8 Lanes | 1.7 | Denver |
| 2030 | 2030 | Pena Blvd. | I-70 | E-470 | Widen from 4 to 8 Lanes | 6.4 | Denver |
| 2030 | 2030 | Pena Blvd. | E-470 | Jackson Gap St. | Widen from 6 to 8 Lanes | 2.9 | Denver |
| N/A | 2030 | Pena Blvd. | Gun Club Rd. | | Interchange Capacity | 0.0 | Denver |
| 2030 | 2030 | Peoria St. | E-470 | .75 miles s/o Lincoln Ave. | Widen from 2 to 4 Lanes | 1.9 | Douglas |
| 2030 | 2030 | Picadilly Rd. | 48th Ave. | 56th Ave. | Widen from 2 to 6 lanes | 1.2 | Adams |
| 2030 | 2030 | Picadilly Rd. | 56th Ave. | 70th Ave./Aurora City Limits | New 6 Lanes | 1.7 | Adams |
| 2030 | 2030 | Picadilly Rd. | 6th Ave. | Colfax Ave. | Widen from 2 to 6 Lanes | 1.6 | Arapahoe |
| 2030 | 2030 | Picadilly Rd. | 70th Ave. | 82nd Ave. | New 6 Lanes | 1.5 | Denver |
| 2030 | 2030 | Picadilly Rd. | Colfax Ave. | I-70 | New 6 Lanes | 0.3 | Adams |
| 2030 | 2030 | Picadilly Rd. | I-70 | Smith Rd. | Widen from 2 to 6 Lanes | 0.5 | Adams |
| 2030 | 2030 | Picadilly Rd. | Smith Rd. | 48th Ave. | Widen from 2 to 6 Lanes | 2.2 | Adams |
| 2030 | 2030 | Powhatan Rd. | 26th Ave. | 48th Ave. | New 6 Lanes | 2.0 | Adams |
| 2030 | 2030 | Quebec St. | 120th Ave. | 128th Ave. | Widen from 2 to 4 Lanes | 1.0 | Adams |
| 2030 | 2030 | Quebec St. | 132nd Ave. | 160th Ave. | Widen from 2 to 4 Lanes | 3.5 | Adams |
| 2030 | 2030 | Quincy Ave. | Plains Pkwy./Copperleaf Blvd. | Gun Club Rd. | Widen from 2 to 6 Lanes | 0.6 | Arapahoe |
| 2030 | 2030 | Ridgeway Pkwy. (Mainstreet) | Havana St. | Lone Tree E. City Limit | Widen from 2 to 4 Lanes | 1.8 | Douglas |
| 2030 | 2030 | SH-30 | Steve D. Hogan Pkwy | Mississippi Ave. | Widen from 2 to 4 Lanes | 2.2 | Arapahoe |
| 2030 | 2030 | SH-7 | Sheridan Pkwy. | I-25 | Widen from 2 to 6 Lanes | 1.5 | Broomfield |
| 2030 | 2030 | SH-7 | 164th Ave. | Dahlia St. | Widen from 2 to 4 Lanes | 2.2 | Adams |
| 2030 | 2030 | Tower Rd. | York St. | Big Dry Creek | Widen from 2 to 4 Lanes | 0.7 | Adams |
| 2030 | 2030 | Tower Rd. | 48th Ave. | 56th Ave. | Widen from 4 to 6 Lanes | 1.0 | Denver |
| 2030 | 2030 | Tower Rd. | 56th Ave. | Pena Blvd. | Widen from 2 to 4 Lanes | 2.4 | Denver |
| 2030 | 2030 | Tower Rd. | 6th Ave. | Colfax Ave. | New 2 Lanes | 1.0 | Arapahoe |
| 2030 | 2030 | Tower Rd. | Colfax Ave. | Smith Rd. | Widen from 2 to 6 Lanes | 1.0 | Adams |
| 2030 | 2030 | Tower Rd. | Pena Blvd. | 104th Ave. | Widen from 4 to 6 Lanes | 3.8 | Adams |
| 2030 | 2030 | Tower/Buckley Rd. | 105th Ave. | 118th Ave. | New 4 Lanes | 2.0 | Adams |
| 2030 | 2030 | US-85 | 104th Ave | | New interchange | | Adams |
| 2030 | 2030 | US-85 | 120th Ave | | New interchange | | Adams |
| 2030 | 2030 | Washington St. | 152nd Ave. | 160 Ave. | Widen from 2 to 4 Lanes | 1.4 | Adams |
| 2030 | 2030 | York St. | 160th Ave. (SH-7) | 168th Ave. | Widen from 2 to 4 Lanes | 1.0 | Adams |
| 2030 | 2030 | York St. | E-470 | SH-7 | Widen from 2 to 4 Lanes | 0.7 | Adams |
| N/A | 2035 | 48th Ave. | Imboden Rd. | Quail Run Rd. | Widen from 2 to 6 Lanes | 1.0 | Adams |
| 2035 | 2040 | 6th Pkwy. | SH-30 | E-470 | Widen from 2 to 6 Lanes | 1.3 | Arapahoe |
| 2035 | 2040 | Hampden Ave./Havana St. (SH- | Florence St. | s/o Yale Ave. | Widen from 5 to 6 Lanes | 1.4 | Denver |
| 2035 | 2040 | I-70 | E-470 | | Interchange Capacity | | Adams/Arapahoe |
| 2035 | 2020 | Main Street | Lone Tree E. City Limit | Chambers Rd. | Widen from 2 to 4 Lanes | 0.9 | Douglas |
| 2040 | 2040 | 120th Ave. | E-470 | Picadilly Rd. | Widen from 2 to 6 Lanes | 2.6 | Adams |
| 2040 | 2040 | 120th Ave. | Sable Blvd. | E-470 | Widen from 2 to 6 Lanes | 2.0 | Adams |

Table 3 (Continued)
Programmed Regional Highway Improvements
Assumed in the 2020 Study and the Current Study

| Network Year of Improvement | | Facility Name | From | To | Improvement | Length | Counties |
|-----------------------------|---------------|--------------------|----------------------------|------------------|---------------------------|--------|----------|
| Prior 2020 Study | Current Study | | | | | | |
| 2040 | 2040 | 152nd Ave. | Washington St. | York St. | Widen from 2 to 4 Lanes | 1.2 | Adams |
| 2040 | 2040 | 48th Ave. | Powhatan Rd. | Monaghan Rd. | Widen from 2 to 4 Lanes | 1.0 | Adams |
| 2040 | 2040 | 56th Ave. | Powhatan Rd. | Imboden Rd. | Widen from 2 to 4 Lanes | 5.0 | Adams |
| 2040 | 2040 | 64th Ave. | Harvest Rd. | Powhatan Rd. | Widen from 2 to 4 Lanes | 1.0 | Adams |
| 2040 | 2040 | 64th Ave. | Himalaya Rd. | Harvest Rd. | Widen from 4 to 6 lanes | 3.0 | Adams |
| 2040 | 2040 | 96th Ave. | SH-2 | Tower Road | Widen from 2 to 4 Lanes | 5.0 | Adams |
| 2040 | 2040 | 96th Ave. | Tower Rd. | Picadilly Rd. | Widen from 2 to 6 Lanes | 2.0 | Adams |
| N/A | 2040 | Arapahoe Rd. | Havana St. / Jordan Rd. | | Grade Separation | 1.4 | Arapahoe |
| 2040 | 2040 | Colorado Blvd. | 144th Ave. | 168th Ave. | Widen from 0/2 to 4 Lanes | 3.7 | Adams |
| 2040 | 2040 | Gun Club Rd. | Yale Ave. | Mississippi Ave. | Widen from 2/4 to 6 Lanes | 2.1 | Arapahoe |
| 2040 | 2040 | Harvest Mile Rd. | 56th Ave. | 64th Ave. | Widen from 3 to 6 Lanes | 1.0 | Adams |
| 2040 | 2040 | Harvest Mile Rd. | I-70 | 26th Ave. | Widen from 4 to 6 lanes | 1.5 | Adams |
| 2040 | 2040 | Harvest Mile Rd. | 56th Ave. | 64th Ave. | Widen from 3 to 6 lanes | 1.0 | Adams |
| 2040 | 2040 | Harvest Rd. | Jewell Ave. | Mississippi Ave. | Widen from 2 to 6 lanes | 1.0 | Arapahoe |
| 2040 | 2040 | I-225 | I-25 | Yosemite St. | Interchange Capacity | | Denver |
| 2040 | 2040 | I-270 | I-25 | I-70 | Widen from 4 to 6 lanes | | Adams |
| 2040 | 2040 | Imboden Rd. | 48th Ave. | 56th Ave. | Widen from 2 to 4 Lanes | 1.0 | Adams |
| 2040 | 2040 | Monaghan Rd. | Quincy Ave. | Yale Ave. | New 6 Lanes | 2.0 | Arapahoe |
| 2040 | 2040 | Monaghan Rd. | 26th Ave. | 56th Ave. | Widen from 2 to 4 Lanes | 5.0 | Arapahoe |
| 2040 | 2040 | Monaghan Rd. | 56th Ave. | 64th Ave. | New 4 Lanes | 5.0 | Arapahoe |
| 2040 | 2040 | Parker Rd. (SH-83) | Quincy Ave. | Hampden Ave. | Widen from 6 to 8 Lanes | 1.0 | Arapahoe |
| 2040 | 2040 | Peoria St. | .75 miles s/o Lincoln Ave. | Main Street | Widen from 2 to 4 Lanes | 0.5 | Douglas |
| 2040 | 2040 | Picadilly Rd. | 82nd Ave. | 96th Ave. | New 6 Lanes | 1.8 | Adams |
| 2040 | 2040 | Picadilly Rd. | 96th Ave. | 120th Ave. | New 6 Lanes | 3.0 | Adams |
| 2040 | 2040 | Powhatan Rd. | Smoky Hill Rd. | County Line Rd. | Widen from 2 to 6 Lanes | 1.0 | Arapahoe |
| 2040 | 2040 | Quail Run Rd. | I-70 | 48th Ave. | New 4 Lanes | 3.0 | Adams |
| 2040 | 2040 | Quincy Ave. | Hayesmount Rd. | Watkins Rd. | Widen from 2 to 6 Lanes | 2.0 | Arapahoe |
| 2040 | 2040 | Quincy Ave. | Monaghan Rd. | Hayesmount Rd. | Widen from 2 to 6 Lanes | 1.1 | Arapahoe |
| 2040 | 2040 | SH-7 | Riverdale Rd. | US-85 | Widen from 2 to 4 Lanes | 1.1 | Adams |
| 2040 | 2040 | Smoky Hill Rd. | Pheasant Run Pkwy. | Versailles Pkwy. | Widen from 4 to 6 Lanes | 4.4 | Arapahoe |
| 2040 | 2040 | Tower Rd. | 6th Ave. | Colfax Ave. | Widen from 2 to 6 Lanes | 1.0 | Arapahoe |
| 2040 | 2040 | Watkins Rd. | Quincy Ave. | I-70 | Widen from 2 to 6 Lanes | 7.1 | Arapahoe |
| 2040 | 2040 | Yale Ave. | Monaghan Rd. | Hayesmount Rd. | Widen from 2 to 6 Lanes | 1.1 | Arapahoe |
| 2040 | 2040 | York St. | 152nd Ave. | E-470 | Widen from 2 to 4 Lanes | 0.2 | Adams |

Table 4
Assumed E-470 Highway Improvements
Under the 2020 Study and the Current Study

| 2020 Study | | Current Study | | From | To | Improvement | Length | Counties |
|-----------------------|--------------------|-----------------------|--------------------|----------------|----------------|---|--------|------------------|
| Years of Construction | Year of Completion | Years of Construction | Year of Completion | | | | | |
| 2019-2020 | 2021 | 2019-2020 | 2021 | Quincy Ave. | I-70 | Widen from 4 to 6 Lanes | 7.0 | Arapahoe |
| 2019-2020 | 2021 | 2020 | 2021 | 38th Ave. | | New Interchange (Partial) - In/Out Movement | | Adams |
| 2023-2024 | 2025 | 2022 | 2023 | Gantry C | | Relocate Gantry C to the South | | Adams |
| 2023-2024 | 2025 | 2022 | 2023 | 38th Ave. | | New Interchange (Full) | | Adams |
| 2021-2022 | 2023 | 2022 | 2023 | I-70 | | Ramp C - EB I-70 to SB E-470 | | Adams |
| 2022-2023 | 2024 | 2022-2024 | 2025 | I-70 | Pena Blvd. | Widen from 4 to 6 Lanes | 7.4 | Adams/Denver |
| 2025-2026 | 2027 | 2022-2024 | 2025 | Pena Blvd. | E 104th Ave. | Widen from 4 to 6 lanes | 7.6 | Adams/Denver |
| 2024-2025 | 2026 | 2023-2024 | 2025 | 88th Ave. | | Add New Interchange | | Adams |
| N/A | N/A | 2023-2024 | 2025 | Sable Blvd. | | Add New Interchange | | Adams |
| 2025-2026 | 2027 | 2026-2027 | 2028 | E 104th Ave. | I-76 | Widen from 4 to 6 lanes | 7.6 | Adams/Denver |
| 2027-2028 | 2029 | 2027-2028 | 2029 | I-25 South | Parker Rd. | Widen from 6 to 8 Lanes | 5.5 | Arapahoe |
| 2028-2029 | 2030 | 2025-2029 | 2030 | I-70 | | Interchange Rebuild Completion / Capacity | | Adams |
| 2019-2020 | 2021 | 2030 | 2031 | 48th Ave. | | Add New Interchange | | Adams |
| 2029-2030 | 2031 | 2029-2030 | 2031 | Parker Rd. | Smoky Hill Rd. | Widen from 6 to 8 lanes | 5.4 | Arapahoe/Douglas |
| 2031-2032 | 2033 | 2031-2032 | 2033 | Smoky Hill Rd. | I-70 | Widen from 6 to 8 lanes | 9.7 | Arapahoe |
| 2033-2034 | 2035 | 2030 | 2031 | 112th Ave. | | Add New Interchange | | Adams |
| 2033-2034 | 2035 | 2033-2034 | 2035 | I-76 | | Ramp - NB E-470 to WB I-76 | | Adams |
| 2033-2034 | 2035 | 2033-2034 | 2035 | I-76 | US 85 | Widen from 4 to 6 lanes | 2.8 | Adams |
| 2034-2035 | 2036 | N/A | N/A | Potomac St. | | Add New Interchange | | Adams |
| 2036-2037 | 2038 | 2036-2037 | 2038 | US 85 | I-25 N | Widen from 4 to 6 lanes | 8.2 | Adams |
| 2038-2039 | 2040 | 2035-2039 | 2040 | I-76 | | Ramp - WB I-76 to NB E-470 | | Adams |
| 2038-2039 | 2040 | 2038-2039 | 2040 | Pena Blvd. | I-76 | Widen from 6 to 8 Lanes | 7.6 | Adams/Denver |

The impact of these updates to the Authority's proposed capital program, and the resulting changes to the assumed construction dates of these projects, have been incorporated into the updated traffic and revenue forecasts. For projects previously included in the 2020 Study, the estimated impacts of each project were advanced or delayed as appropriate based on the new assumptions. For the projects or roadways configurations not previously included in the 2020 Study, such as the interchanges at E 48th Avenue and Sable Boulevard, traffic assignments with and without the project were run using the regional travel demand model developed under the 2020 Study. The modeled volumes produced by the two assignments were then compared, and the differences were used to estimate the impacts of the new projects under the current study effort. The impacts of the highway improvement changes, as well as the changes in assumed construction time prior to the opening dates, were applied as adjustments to the traffic and revenue forecasts.

For example, the proposed Sable Boulevard interchange was estimated to generate 3,600 transactions per average weekday at the new toll ramps in 2025 (excluding the impacts of COVID-19). Accounting for the estimated shifts from the adjacent US 85 and E 120th Avenue interchanges, the net impact to the E-470 System of the proposed Sable Boulevard interchange was estimated to be an additional 2,800 vehicles per average weekday. On an annual basis, including the impacts of COVID-19, this represents over 0.8 million additional transactions systemwide in 2025, with 1.1 million new transactions generated by the toll ramps at the proposed Sable Boulevard interchange.

Transaction and Toll Revenue Forecast Assumptions

Since July 4, 2009, E-470 has employed an entirely cashless toll collection system, providing two methods of toll payment: ExpressToll, and License Plate Toll (LPT). Although COVID-19 has impacted motorists differently based on their method of payment, it is unclear whether these impacts represent structural changes to the underlying ExpressToll market participation rates. As a result, CDM Smith addressed the changes in the share of ExpressToll transactions, as compared to the 2020 Study, by applying estimated COVID-19 impacts by method of payment. Thus, while no specific changes to the underlying ExpressToll and LPT share were made, the distribution of transactions by method of payment were adjusted based on the difference in respective impacts to ExpressToll and LPT.

Table 5 provides the underlying ExpressToll market participation rates assumed in the prior and current study efforts, as well as the forecasted distributions. The method of payment distributions shown in the table are consistent with the prior 2020 Study assumptions, which were based on historic trends and anticipated future increases in ExpressToll participation. The differences in the forecasted share of ExpressToll E-470 transactions shown in **Table 5** are primarily due to the impacts of COVID-19 by method of payment in the short term (through 2022) and due to impacts of the assumed highway improvement changes in the long term.

Table 5
Assumed ExpressToll Market Participation Rates
and Forecasted Method of Payment Distributions

| Year | ExpressToll Market Share | | |
|------|---|-------------------------------------|---------------|
| | Percent of Total Regional Trips ⁽¹⁾ | Percent of Total E-470 Transactions | |
| | | 2020 Study | Current Study |
| 2021 | 73.4 | 74.3 | 72.8 |
| 2025 | 74.3 | 74.7 | 74.8 |
| 2030 | 74.3 | 74.7 | 74.6 |
| 2035 | 74.5 | 74.8 | 74.9 |
| 2040 | 74.7 | 75.1 | 74.9 |

(1) Represents model inputs assumed under both the 2020 Study and Current Study.

E-470 currently has 22 toll locations; five mainline toll gantries and 17 toll gantries strategically located at E-470 ramps/interchanges. The current toll rate at the mainline toll locations, in both 2020 and 2021, is \$2.70 at Toll Gantries A and C, and \$2.95 at Toll Gantries B, D, and E for ExpressToll passenger cars, representing a cost of \$0.30 per mile for a 47-mile full-length trip on E-470. Toll rates for LPT passenger car customers are \$4.30 at Toll Gantries A and C, and \$4.65 at Toll Gantries B, D, and E, meaning that ExpressToll customers are provided a roughly 37 percent discount over LPT toll rates. Commercial vehicles are charged by the axle based on a modified “N-1” system. Beyond 2-axes, the third axle is charged 90 percent of the 2-axle vehicle toll and each additional axle is charged 95 percent of the 2-axle vehicle toll. Additionally, as part of a two-year pilot program, a 20 percent discount is also provided to 3-or-more axle ExpressToll vehicles between 9:00 AM and 12:00 PM. For forecasting purposes, the average toll rate for commercial vehicles was used based on the average number of axles observed at mainline toll locations and the impact of the time-of-day discount. At ramp toll locations, the current toll rate in 2020 and 2021 is \$1.25 for ExpressToll and \$2.05 for LPT customers. Passenger cars and commercial vehicles pay the same toll rate at all the ramp toll locations.

Based on discussions with E-470 Staff, CDM Smith utilized the same toll rate assumptions as those used for the Base Case forecast in the 2020 Study under the current study effort. These toll rates, which are presented in **Table 6** were developed in cooperation with E-470 Staff and assumed a 2 percent increase every five years. Additionally, current toll rate differentials between ExpressToll and LPT and between passenger cars and commercial vehicles were assumed to be maintained through the forecast period. The toll rate at the mainline toll locations under these assumptions will be \$2.90 at Toll Gantries A and C, and \$3.15 at Toll Gantries B, D, and E by 2040 for ExpressToll

Table 6
Passenger Car Toll Rate Assumptions

| Year | Method of Payment | Toll Location | | | | | |
|---------------------|-------------------|---------------|----------|----------|----------|----------|------------|
| | | Gantry A | Gantry B | Gantry C | Gantry D | Gantry E | Toll Ramps |
| 2020 ⁽¹⁾ | ExpressToll | \$ 2.70 | \$ 2.95 | \$ 2.70 | \$ 2.95 | \$ 2.95 | \$ 1.25 |
| | LicensePlateToll | \$ 4.30 | \$ 4.65 | \$ 4.30 | \$ 4.65 | \$ 4.65 | \$ 2.05 |
| 2021 | ExpressToll | \$ 2.70 | \$ 2.95 | \$ 2.70 | \$ 2.95 | \$ 2.95 | \$ 1.25 |
| | LicensePlateToll | \$ 4.30 | \$ 4.65 | \$ 4.30 | \$ 4.65 | \$ 4.65 | \$ 2.05 |
| 2025 ⁽²⁾ | ExpressToll | \$ 2.75 | \$ 3.00 | \$ 2.75 | \$ 3.00 | \$ 3.00 | \$ 1.30 |
| | LicensePlateToll | \$ 4.40 | \$ 4.80 | \$ 4.40 | \$ 4.80 | \$ 4.80 | \$ 2.05 |
| 2030 ⁽²⁾ | ExpressToll | \$ 2.80 | \$ 3.05 | \$ 2.80 | \$ 3.05 | \$ 3.05 | \$ 1.35 |
| | LicensePlateToll | \$ 4.45 | \$ 4.85 | \$ 4.45 | \$ 4.85 | \$ 4.85 | \$ 2.15 |
| 2035 ⁽²⁾ | ExpressToll | \$ 2.85 | \$ 3.10 | \$ 2.85 | \$ 3.10 | \$ 3.10 | \$ 1.40 |
| | LicensePlateToll | \$ 4.55 | \$ 4.95 | \$ 4.55 | \$ 4.95 | \$ 4.95 | \$ 2.25 |
| 2040 ⁽²⁾ | ExpressToll | \$ 2.90 | \$ 3.15 | \$ 2.90 | \$ 3.15 | \$ 3.15 | \$ 1.45 |
| | LicensePlateToll | \$ 4.60 | \$ 5.00 | \$ 4.60 | \$ 5.00 | \$ 5.00 | \$ 2.30 |

⁽¹⁾ Toll rates effective January 1, 2020.

⁽²⁾ Toll rate adjustments based on a 2 percent increase and assumed to be effective on January 1.

passenger cars. These 2040 toll rates represent a cost of \$0.32 per mile for a 47-mile full-length trip on E-470. Toll rates in 2040 for LPT passenger car customers based on these assumptions will be \$4.60 at Toll Gantries A and C, and \$5.00 at Toll Gantries B, D, and E. At ramp toll locations, the toll rate in 2040 will be \$1.45 for ExpressToll and \$2.30 for LPT customers based on these toll rate assumptions. It was also assumed that passenger cars and commercial vehicles will continue to pay the same toll rate at the ramp toll locations through the forecast period. However, it should be noted that E-470 Staff has indicated the current policy approved by the Authority's board of directors goes through the end of 2021, and 2022 toll rates and beyond will be under consideration.

Lastly, CDM Smith reviewed current rates of toll revenue leakage for the E-470 System. Although COVID-19 has created some differences in toll collection rates, it is unclear whether these impacts represent underlying structural changes or simply short-term impacts. Following discussions with E-470 Staff, it was decided that no changes would be made to the assumed rates of toll revenue leakage. Thus, the forecasts were adjusted to reflect actual revenues through January 2021. Beyond January 2021, the same rates of toll revenue leakage as those assumed in the 2020 Study were employed for the current study effort. The assumed toll revenue leakage rates are summarized in **Table 7**.

Table 7
Assumed Toll Revenue Leakage Rates

| Year | Leakage as a Percent of Total Revenue by Method of Payment | | | Total Leakage |
|---------------------|--|--------------------|---------------------|---------------|
| | Unbillable LicensePlate | Unpaid ExpressToll | Unpaid LicensePlate | |
| 2020 ⁽¹⁾ | 25.4 | 0.3 | 23.3 | 15.9 |
| 2021 ⁽¹⁾ | 21.7 | 0.6 | 22.8 | 15.3 |
| 2025 | 14.8 | 1.4 | 25.2 | 14.0 |
| 2030 | 14.0 | 1.4 | 25.2 | 13.8 |
| 2035 | 14.0 | 1.4 | 25.2 | 13.7 |
| 2040 and Beyond | 14.0 | 1.4 | 25.2 | 13.6 |

(1) Based on actual revenue data through January 2021.

Transaction Impacts Related to COVID-19

Under the 2020 Study, a 36.1 percent reduction in 2020 transactions was assumed, based on forecasts from the financial community at the time of the COVID-19 crisis duration. Varied impacts were assumed for passenger cars and commercial vehicles, based on actual observations through mid-April 2020. A slow recovery was assumed in 2020, with the impact of COVID-19 reducing to 10 percent for passenger cars and 20 percent for commercial vehicles by January 2021. Additional impacts were assumed through 2021 with passenger car traffic reaching a “new normal” by April 2021 of 8.1 percent below a theoretical forecast without COVID-19. The impacts to commercial vehicles were assumed to continue through 2021, gradually lessening to 5 percent by December 2021. An annual transaction reduction of 8.1 percent was then applied from 2022 through the remainder of the forecast period, as compared to the forecast without COVID-19 impacts. This was done to account for the longer-term effects of the crisis, including potential recessionary impacts through 2020, increases in telecommuting, and reductions in tourism and other recreational trips.

For the current study effort, CDM Smith performed a review of regional and national toll facility traffic trends in light of the COVID-19 pandemic, as well as a review of forecasts and estimates available from rating agencies and other financial institutions. Additionally, CDM Smith reviewed the impacts of the COVID-19 pandemic on E-470 transactions, as previously noted in this report. Following this review, both short-term and long-term COVID-19 impacts were developed by method of payment, by vehicle class, and by toll location. Additionally, CDM Smith considered the impacts of COVID-19 on trips to and from DEN. These impacts, which are summarized in **Table 8**, were developed based on actual data through February 2021 for two scenarios: Base Case and Delayed Short-Term Recovery Case. These two scenarios incorporated the most recent recovery timeline assumptions, which were influenced by the availability and administration of COVID-19 vaccinations. Thus, they represent only short-term changes to the prior 2020 Study assumptions, which are also shown in the table.

Table 8
Summary of Assumed COVID-19 Impacts to E-470 Systemwide Transactions (Short-Term)
Estimated Impacts Over Non-COVID-19 Conditions

| Month / Year | Total Base Case Impact | | | Total Delayed Short-Term Recovery Case Impact | | |
|------------------------|------------------------|---------------|---------------|---|---------------|---------------|
| | ExpressToll | LPT | Total | ExpressToll | LPT | Total |
| 2020 Study | | | | | | |
| Total 2021 | (8.1) | (8.1) | (8.1) | | | |
| 2022 and Beyond | (8.2) | (7.8) | (8.1) | | | |
| Current Study | | | | | | |
| March 2021 | (38.0) | (30.4) | (36.1) | (38.0) | (30.4) | (36.1) |
| April 2021 | (28.0) | (23.7) | (27.0) | (34.2) | (28.1) | (32.7) |
| May 2021 | (22.3) | (20.0) | (21.7) | (31.1) | (26.3) | (29.9) |
| June 2021 | (18.5) | (17.5) | (18.2) | (28.3) | (24.6) | (27.3) |
| July 2021 | (13.1) | (12.8) | (13.0) | (23.0) | (20.1) | (22.2) |
| August 2021 | (13.0) | (12.8) | (13.0) | (20.9) | (18.7) | (20.3) |
| September 2021 | (13.0) | (12.7) | (12.9) | (19.1) | (17.4) | (18.7) |
| October 2021 | (10.1) | (9.7) | (10.0) | (14.8) | (13.4) | (14.5) |
| November 2021 | (10.1) | (9.7) | (10.0) | (13.5) | (12.5) | (13.3) |
| December 2021 | (10.1) | (9.7) | (10.0) | (12.4) | (11.7) | (12.2) |
| Total 2021 | (21.2) | (14.7) | (19.6) | (26.4) | (18.7) | (24.4) |
| 2022 | (8.2) | (7.8) | (8.1) | (8.4) | (8.0) | (8.3) |
| 2023 and Beyond | (8.2) | (7.8) | (8.1) | (8.2) | (7.8) | (8.1) |

Under the Base Case, a 19.6 percent transaction decrease is estimated in 2021, compared to a theoretical forecast without COVID-19. This includes a recovery to a “new normal” by July 2021. A transaction impact of 8.1 percent is then assumed through the remainder of the forecast period. This was done to account for the longer-term effects of the crisis, including potential recessionary impacts through 2020, increases in telecommuting, and reductions in tourism and other recreational trips. The Delayed Short-Term Recovery Case assumes a slower recovery for both airport-related trips (by July 2022) and for other 2-axle vehicles (by December 2021). Thus, a 24.4 percent transaction decrease is estimated in 2021, compared to a theoretical forecast without COVID-19. Neither scenario assumes any impact to 3-or-more-axle vehicles due to the strong performance of commercial vehicles through the pandemic, as previously noted in this letter report.

Transaction and Toll Revenue Forecast Development

CDM Smith identified 4 major categories of forecast assumption changes from the most recent transaction and toll revenue forecast, the 2020 Study. These changes, which have been discussed in this letter report, include:

- Re-benchmarking E-470 transactions to 2020/2021 Levels based on actual data through February 2021;
- Applying impacts related to changes in interchange and widening improvement assumptions;

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- Applying impacts related to changes in assumed construction schedules; and
- Adjusting the assumed impacts of COVID-19.

As previously noted in this letter report, the underlying normal growth rates, E-470 toll rates, and toll revenue leakage rates were not changed from those included in the prior 2020 Study forecasts. Moreover, no changes were made to the underlying regional ExpressToll market participation rates. However, as previously noted in **Table 5**, there are some differences between the 2020 Study and the current study in the share of ExpressToll transactions on E-470 as a result of the differential impacts of COVID-19 by method of payment. Additionally, there are some differences in the forecasted share of ExpressToll E-470 transactions in the long term (beyond 2023) due to the differential impacts of the assumed highway improvement changes by method of payment.

The estimated impacts for each of the 4 categories of forecast assumption changes were applied to the Base Case forecasts developed under the 2020 Study. This was done by method of payment and by toll location. In this way, the resulting transactions and toll revenue forecasts incorporate the prior 2020 Study assumptions, except as modified to reflect the updated assumptions noted in this report.

The estimated transaction and revenue forecasts presented in the remainder of this report therefore recognize not only the forecast assumptions previously detailed herein, but also the short- and long-term estimated impacts of COVID-19 crisis. We would note there is significant uncertainty to both short-term and long-term travel impacts related to the COVID-19 pandemic. CDM Smith has attempted to use the best available information at the time of developing these forecasts. These assumptions may be subject to change depending on the escalation or recovery from COVID-19, which may materially affect the resulting traffic and revenue estimates.

Basic Study Assumptions

Traffic and toll revenue estimates for E-470 are predicated upon the following assumptions, which are considered reasonable for purposes of the forecasts:

1. The toll collection concept and toll schedules as shown in this report will be adopted. Both ExpressToll and LPT will be employed.
2. The percentage of ExpressToll and LPT customers will be assumed as detailed.
3. Improvements to the present highway and local road system in the travel corridor will be limited to those described in this report. No other competing facilities, or capacity expansions, will occur in the forecast period.
4. Underlying regional and corridor growth, excluding the impacts of COVID-19, will be generally as forecast by DRCOG as reviewed and refined by Economic & Planning Systems under the 2020 Study.

5. No major recession or significant economic restructuring will occur which would substantially reduce traffic in the region, other than the potential economic impacts described in this report related to the COVID-19 outbreak.
6. Over the long-term, motor fuel will remain in adequate supply, and future increases in fuel price will not significantly exceed the overall rate of inflation.
7. Inflation will average 2.0 percent per year through 2040.
8. Revenue leakage due to unreadable plates or uncollectable ExpressToll or LPT transactions or any transactions that cannot be processed and payment collected will occur. Leakage estimates have been estimated by CDM Smith in this analysis using actual historical data provided by the Authority.
9. The E-470 toll road will be well-maintained and effectively signed.
10. No natural disasters will occur that could significantly alter travel patterns through the area.
11. No local, regional, or national emergency will arise that would abnormally restrict the use of motor vehicles, other than those described in this report related to the COVID-19 outbreak.

Any significant departure from these basic assumptions could materially affect estimated traffic and toll revenue for the E-470.

Base Case Transaction and Toll Revenue Estimates

The resulting Base Case annual transactions are provided by method of payment in **Table 9**, along with total gross and net toll revenue estimates. These estimates reflect the re-benchmarking of transactions to 2020 levels, the revised highway improvement assumptions, and changes to the estimated impacts of COVID-19. Annual transactions are expected to increase from 58.1 million in 2020 to 77.0 million by 2021. Following the assumed end of the recovery from the short-term impacts of the COVID-19 pandemic (January 2022) and the realization of a “new normal”, estimated transactions under the Base Case are 89.8 million in 2022. This is just slightly less than actual 2019 transactions under pre-COVID-19 conditions. By 2040, annual transactions are expected to reach 155.2 million, for an average 18-year annual growth rate between 2022 and 2040 of 3.1 percent. Beyond 2040, transaction growth is estimated to moderate based on longer-term trends previously forecasted under the 2020 Study, growing by an average of 1.8 percent to 186.4 million in 2050.

Annual toll revenue estimates are also provided in **Table 9**. Gross toll revenues, excluding revenue adjustments to account for non-revenue vehicles, unbillable LPT images and unpaid ExpressToll and LPT transactions, were calculated by multiplying the estimated transactions by the nominal toll

Table 9
Estimated Annual Base Case Transactions and Toll Revenue (In Thousands)

| Year | Total Annual Transactions (000s) | | | Total Annual Toll Revenue (\$000s) | | |
|---------------------------|----------------------------------|--------|---------|------------------------------------|---|--------------------|
| | ExpressToll | LPT | Total | Gross ⁽¹⁾ | Uncollectible and Unpaid ⁽²⁾ | Net ⁽³⁾ |
| 2020 ⁽⁴⁾⁽⁵⁾⁽⁶⁾ | 42,811 | 15,260 | 58,071 | \$ 185,277 | \$ (29,479) | \$ 155,798 |
| 2021 ⁽⁴⁾⁽⁶⁾⁽⁷⁾ | 56,043 | 20,970 | 77,013 | 243,058 | (37,280) | 205,778 |
| 2022 ⁽⁶⁾ | 66,660 | 23,093 | 89,753 | 281,470 | (40,541) | 240,929 |
| 2023 | 68,689 | 23,639 | 92,328 | 288,904 | (41,176) | 247,728 |
| 2024 ⁽⁵⁾ | 71,766 | 24,661 | 96,427 | 301,802 | (42,712) | 259,090 |
| 2025 ⁽⁷⁾⁽⁸⁾ | 74,014 | 24,955 | 98,969 | 314,158 | (43,933) | 270,225 |
| 2026 | 75,594 | 25,576 | 101,170 | 320,822 | (44,844) | 275,978 |
| 2027 | 77,104 | 26,186 | 103,290 | 327,564 | (45,674) | 281,890 |
| 2028 ⁽⁵⁾⁽⁷⁾ | 80,035 | 27,438 | 107,473 | 341,469 | (47,670) | 293,799 |
| 2029 ⁽⁷⁾ | 82,495 | 28,288 | 110,783 | 351,153 | (48,907) | 302,246 |
| 2030 ⁽⁸⁾ | 84,417 | 28,767 | 113,184 | 363,952 | (50,112) | 313,840 |
| 2031 ⁽⁷⁾ | 88,120 | 29,774 | 117,894 | 378,904 | (52,014) | 326,890 |
| 2032 ⁽⁵⁾ | 91,273 | 30,870 | 122,143 | 392,202 | (53,865) | 338,337 |
| 2033 ⁽⁷⁾ | 95,196 | 32,166 | 127,362 | 408,182 | (56,022) | 352,160 |
| 2034 | 98,605 | 33,313 | 131,918 | 422,105 | (57,928) | 364,177 |
| 2035 ⁽⁷⁾⁽⁸⁾ | 104,333 | 34,995 | 139,328 | 453,833 | (62,073) | 391,760 |
| 2036 ⁽⁵⁾ | 107,017 | 35,918 | 142,935 | 464,915 | (63,611) | 401,304 |
| 2037 | 109,212 | 36,718 | 145,930 | 474,423 | (64,954) | 409,469 |
| 2038 ⁽⁷⁾ | 112,433 | 37,852 | 150,285 | 488,751 | (66,945) | 421,806 |
| 2039 | 114,952 | 38,764 | 153,716 | 499,585 | (68,470) | 431,115 |
| 2040 ⁽⁵⁾⁽⁷⁾⁽⁸⁾ | 116,210 | 38,991 | 155,201 | 512,664 | (69,747) | 442,917 |
| 2041 | 118,603 | 39,822 | 158,425 | 522,851 | (71,149) | 451,702 |
| 2042 | 121,384 | 40,785 | 162,169 | 534,706 | (72,777) | 461,929 |
| 2043 | 124,244 | 41,775 | 166,019 | 546,868 | (74,448) | 472,420 |
| 2044 ⁽⁵⁾ | 127,527 | 42,908 | 170,435 | 560,844 | (76,366) | 484,478 |
| 2045 ⁽⁸⁾ | 129,151 | 42,997 | 172,148 | 574,161 | (77,329) | 496,832 |
| 2046 | 131,469 | 43,791 | 175,260 | 584,051 | (78,673) | 505,378 |
| 2047 | 133,840 | 44,603 | 178,443 | 594,137 | (80,042) | 514,095 |
| 2048 ⁽⁵⁾ | 136,626 | 45,554 | 182,180 | 606,040 | (81,657) | 524,383 |
| 2049 | 138,744 | 46,281 | 185,025 | 614,919 | (82,864) | 532,055 |
| 2050 ⁽⁸⁾ | 140,112 | 46,239 | 186,351 | 627,727 | (83,672) | 544,055 |

(1) Gross Revenue does not include adjustments for unbillable or uncollectable toll revenue.
(2) Uncollectible toll revenue represents non-revenue vehicles, bad or duplicate license plate images, or any other transactions for which revenue cannot be collected.
(3) Net Revenue includes adjustments for unbillable or uncollectable toll revenue.
(4) Includes actual data through February 2021.
(5) Leap Year.
(6) COVID-19 traffic impacts have been included in 2020 due to stay-at-home orders, public space closures and other travel restrictions. Some recovery is assumed through 2022, though longer-term traffic impacts of 8.1 percent have been included through the remainder of the forecast period.
(7) Assumed widening of various segments of the E-470 mainline.
(8) Assumed 2.0 percent Systemwide Toll Increase.

rates. Gross toll revenues are estimated to increase from \$185.3 million in 2020 to \$243.1 million by 2021, and to \$281.5 million in 2022. Assuming toll increases of 2.0 percent every five years beginning in 2025, annual gross toll revenues are estimated to reach \$512.7 million by 2040. This represents an average annual increase of 3.4 percent over 2022. This rate of growth is projected to moderate through 2050, with gross toll revenues reaching an estimated \$627.7 million in that year.

Adjustments for uncollectible and unpaid revenue were developed in cooperation with E-470 Staff, as previously discussed, in order to estimate net toll revenues, which include revenue adjustments to account for non-revenue vehicles, unbillable LPT images and unpaid ExpressToll and LPT transactions. Based on these assumed rates of leakage, net toll revenues are estimated to increase from \$155.8 million in 2020 to \$205.8 million by 2021. Following the assumed end of the short-term recovery from the COVID-19 pandemic (January 2022), net toll revenues are estimated to reach \$240.9 million in 2022. Annual net toll revenues are then estimated to grow to \$442.9 million by 2040, aided by assumed toll increases every five years. This represents an average annual increase of 3.4 percent over 2022. Net toll revenues are then estimated to be \$544.1 million by 2050.

Table 10 compares the Base Case transactions and toll revenue estimates from the current effort against those of the 2020 Study. In the short-term, the primary differences are related to the adjustments in assumed COVID-19 impacts. Annual system-wide transactions in 2021 under the current forecast effort are estimated to be 11.0 million, or 12.5 percent less than the 2020 Study forecast, while net toll revenues are estimated to be \$32.6 million less under the current forecast, or 13.7 percent lower than the 2020 Study forecast. Following the recovery from COVID-19 and the achievement of a “new normal”, differences between the current Base Case forecast and the 2020 Study forecast are due to assumed highway improvement and construction schedule changes. By 2040, the estimated differences between the current forecast and the 2020 Study forecast are a 0.8 million decrease in transactions and a \$0.6 million reduction in net toll revenue. These differences represent decreases of 0.5 percent and 0.1 percent in annual toll transactions and net toll revenue, respectively.

Delayed Short-Term Recovery Transaction and Toll Revenue Estimates

Given the uncertainty surrounding the COVID-19 pandemic, CDM Smith also developed a Delayed Short-Term Recovery forecast of transactions and toll revenue for E-470. This scenario assumes a slower recovery for both airport-related trips (by July 2022) and for other 2-axle vehicles (by December 2021), as previously noted in **Table 8**. This assumes a slower roll-out of the COVID-19 vaccine and a slightly longer phase-out of current state and local restrictions. It should be noted that the differences between the Base Case and the Delayed Short-Term Recovery forecasts are estimated to occur primarily in 2021, with some minor differences in 2022. This is illustrated graphically for 2021 in **Figure 10**, which also provides actual data through 2019 for historical context. By 2023, both the Base Case and Delayed Short-Term Recovery forecasts are assumed to be the same.

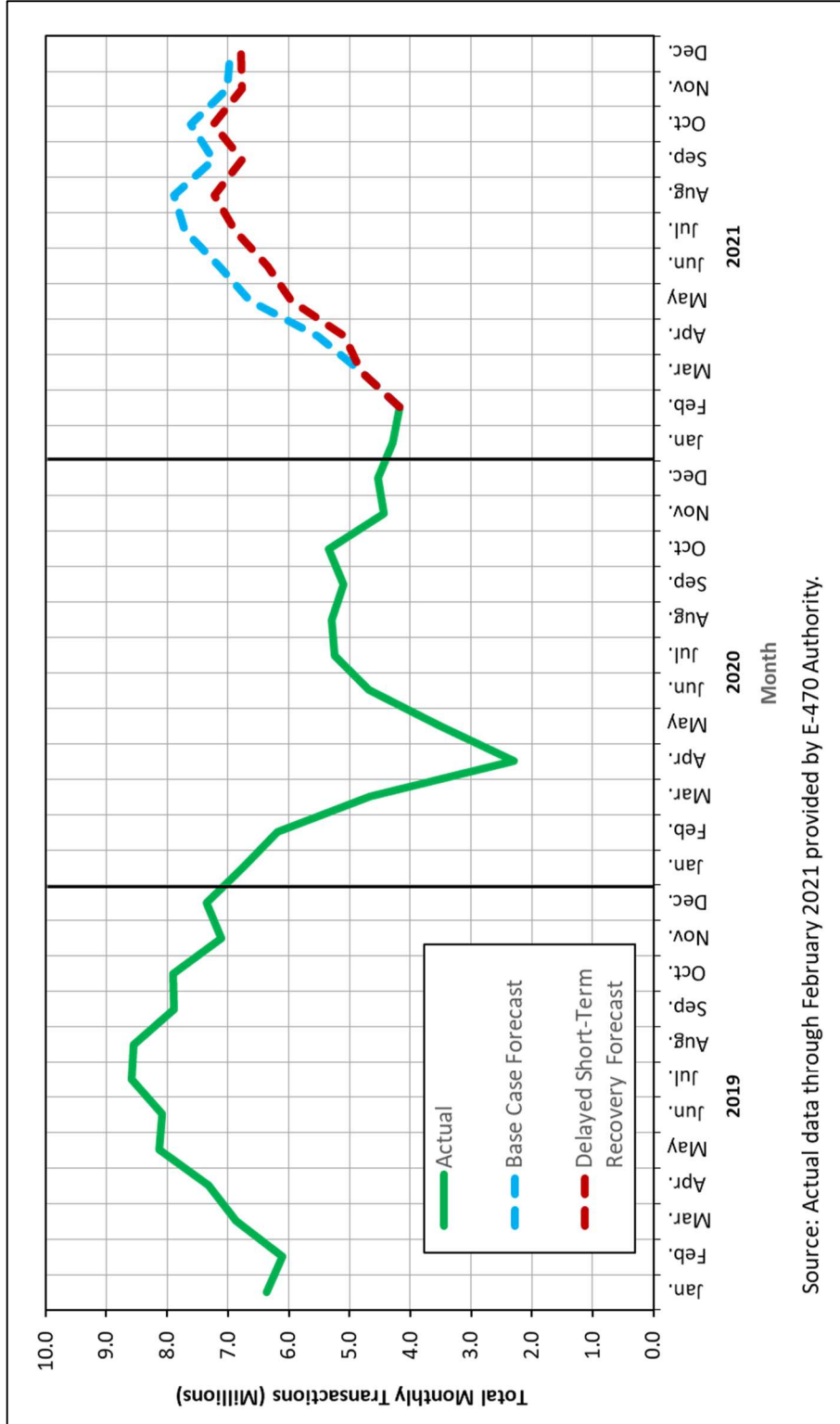
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Table 10
Comparison of 2020 Study Forecast and Current Forecast (In Thousands)

| Year | Current Forecast | | Year | 2020 Study Forecast | | Percent Difference | |
|---------------------------|-------------------------------------|--|---------------------------|-------------------------------------|--|---------------------------|--|
| | Total Annual Transactions (000s) | Total Annual Net Toll Revenue (\$000s) ⁽¹⁾ | | Total Annual Transactions (000s) | Total Annual Net Toll Revenue (\$000s) ⁽¹⁾ | Total Annual Transactions | Total Annual Net Toll Revenue ⁽¹⁾ |
| 2020 ⁽²⁾⁽⁴⁾⁽⁵⁾ | 58,071 | \$ 155,798 | 2020 ⁽³⁾⁽⁴⁾⁽⁵⁾ | 59,905 | \$ 162,727 | -3.1% | -4.3% |
| 2021 ⁽²⁾⁽⁵⁾⁽⁶⁾ | 77,013 | 205,778 | 2021 ⁽⁵⁾⁽⁶⁾ | 88,003 | 238,354 | -12.5% | -13.7% |
| 2022 ⁽⁵⁾ | 89,753 | 240,929 | 2022 | 89,957 | 243,731 | -0.2% | -1.1% |
| 2023 | 92,328 | 247,728 | 2023 | 92,148 | 249,832 | 0.2% | -0.8% |
| 2024 ⁽⁴⁾ | 96,427 | 259,090 | 2024 ⁽⁴⁾⁽⁶⁾ | 96,055 | 259,987 | 0.4% | -0.3% |
| 2025 ⁽⁶⁾⁽⁷⁾ | 98,969 | 270,225 | 2025 ⁽⁷⁾ | 97,475 | 269,306 | 1.5% | 0.3% |
| 2026 | 101,170 | 275,978 | 2026 | 99,869 | 273,459 | 1.3% | 0.9% |
| 2027 | 103,290 | 281,890 | 2027 ⁽⁶⁾ | 103,629 | 284,107 | -0.3% | -0.8% |
| 2028 ⁽⁴⁾⁽⁶⁾ | 107,473 | 293,799 | 2028 ⁽⁴⁾ | 106,569 | 292,169 | 0.8% | 0.6% |
| 2029 ⁽⁶⁾ | 110,783 | 302,246 | 2029 ⁽⁶⁾ | 109,921 | 301,179 | 0.8% | 0.4% |
| 2030 ⁽⁷⁾ | 113,184 | 313,840 | 2030 ⁽⁷⁾ | 112,133 | 312,543 | 0.9% | 0.4% |
| 2031 ⁽⁶⁾ | 117,894 | 326,890 | 2031 ⁽⁶⁾ | 116,818 | 325,199 | 0.9% | 0.5% |
| 2032 ⁽⁴⁾ | 122,143 | 338,337 | 2032 ⁽⁴⁾ | 121,161 | 336,614 | 0.8% | 0.5% |
| 2033 ⁽⁶⁾ | 127,362 | 352,160 | 2033 ⁽⁶⁾ | 126,488 | 350,791 | 0.7% | 0.4% |
| 2034 | 131,918 | 364,177 | 2034 | 131,189 | 362,925 | 0.6% | 0.3% |
| 2035 ⁽⁶⁾⁽⁷⁾ | 139,328 | 391,760 | 2035 ⁽⁶⁾⁽⁷⁾ | 137,811 | 389,071 | 1.1% | 0.7% |
| 2036 ⁽⁴⁾ | 142,935 | 401,304 | 2036 ⁽⁴⁾ | 143,532 | 401,580 | -0.4% | -0.1% |
| 2037 | 145,930 | 409,469 | 2037 | 146,533 | 409,738 | -0.4% | -0.1% |
| 2038 ⁽⁶⁾ | 150,285 | 421,806 | 2038 ⁽⁶⁾ | 150,840 | 421,768 | -0.4% | 0.0% |
| 2039 | 153,716 | 431,115 | 2039 | 154,442 | 431,637 | -0.5% | -0.1% |
| 2040 ⁽⁴⁾⁽⁶⁾⁽⁷⁾ | 155,201 | 442,917 | 2040 ⁽⁴⁾⁽⁶⁾⁽⁷⁾ | 156,020 | 443,501 | -0.5% | -0.1% |
| 2041 | 158,425 | 451,702 | 2041 | 159,341 | 452,357 | -0.6% | -0.1% |
| 2042 | 162,169 | 461,929 | 2042 | 163,204 | 462,694 | -0.6% | -0.2% |
| 2043 | 166,019 | 472,420 | 2043 | 167,189 | 473,312 | -0.7% | -0.2% |
| 2044 ⁽⁴⁾ | 170,435 | 484,478 | 2044 ⁽⁴⁾ | 171,769 | 485,546 | -0.8% | -0.2% |
| 2045 ⁽⁷⁾ | 172,148 | 496,832 | 2045 ⁽⁷⁾ | 173,461 | 498,222 | -0.8% | -0.3% |
| 2046 | 175,260 | 505,378 | 2046 | 176,696 | 506,904 | -0.8% | -0.3% |
| 2047 | 178,443 | 514,095 | 2047 | 180,012 | 515,768 | -0.9% | -0.3% |
| 2048 ⁽⁴⁾ | 182,180 | 524,383 | 2048 ⁽⁴⁾ | 183,912 | 526,257 | -0.9% | -0.4% |
| 2049 | 185,025 | 532,055 | 2049 | 186,891 | 534,063 | -1.0% | -0.4% |
| 2050 ⁽⁷⁾ | 186,351 | 544,055 | 2050 ⁽⁷⁾ | 188,172 | 546,614 | -1.0% | -0.5% |

(1) Net Revenue includes adjustments for unbillable or uncollectable toll revenue.
(2) Current forecast includes actual data through February 2021.
(3) 2020 Toll Rate Study includes actual data through March 2020.
(4) Leap Year.
(5) COVID-19 traffic impacts.
(6) Assumed widening of various segments of the E-470 mainline.
(7) Assumed 2.0 percent Systemwide Toll Increase.

Figure 10
Comparison of Estimated Annual Transactions
Under the Base Case and Delayed Short-Term Recovery Scenarios



Source: Actual data through February 2021 provided by E-470 Authority.

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Annual transaction and toll revenue estimates under the Delayed Short-Term Recovery scenario are provided in **Table 11**, including a comparison against the Base Case. Annual system-wide transactions in 2021 under the Delayed Short-Term Recovery forecast effort are estimated to be 72.3 million. This represents a difference of 4.7 million, or 6.1 percent, compared to the Base Case. Net toll revenues are estimated to be \$194.0 million under the Delayed Short-Term Recovery Case, or \$11.8 million less than under the Base Case. This is a difference of 5.7 percent. In 2022, the Delayed Short-Term Recovery forecast assumes a longer recovery for airport-related trips than the Base Case. As a result, there is a 0.2 percent difference between the two scenarios in 2022 in terms of the estimated transactions and net toll revenues. By 2023, 92.3 million in systemwide transactions and \$247.7 million in net toll revenues are estimated for both the Base Case and Delayed Short-Term Recovery forecasts following the assumed end of the recovery from the impacts of the COVID-19 pandemic and the realization of a “new normal”.

Table 11
Comparison of Estimated Annual Transactions and Toll Revenue (In Thousands)
Under the Base Case and Delayed Short-Term Recovery Scenarios

| Year | Total Annual Transactions (000s) | | | Total Annual Toll Revenue (\$000s) | | |
|---|----------------------------------|--------|----------------|------------------------------------|---|--------------------|
| | ExpressToll | LPT | Total | Gross ⁽¹⁾ | Uncollectible and Unpaid ⁽²⁾ | Net ⁽³⁾ |
| Base Case Forecast | | | | | | |
| 2021 ⁽⁴⁾⁽⁶⁾⁽⁷⁾ | 56,043 | 20,970 | 77,013 | \$ 243,058 | \$ (37,280) | \$ 205,778 |
| 2022 ⁽⁶⁾ | 66,660 | 23,093 | 89,753 | 281,470 | (40,541) | 240,929 |
| 2023 | 68,689 | 23,639 | 92,328 | 288,904 | (41,176) | 247,728 |
| Delayed Short-Term Recovery Forecast | | | | | | |
| 2021 ⁽⁴⁾⁽⁶⁾⁽⁷⁾ | 52,347 | 19,989 | 72,336 | 228,783 | (34,828) | 193,955 |
| 2022 ⁽⁶⁾ | 66,511 | 23,042 | 89,553 | 280,777 | (40,442) | 240,335 |
| 2023 | 68,689 | 23,639 | 92,328 | 288,904 | (41,176) | 247,728 |
| Difference | | | | | | |
| 2021 | (3,696) | (981) | (4,677) | (14,275) | 2,452 | (11,823) |
| 2022 | (149) | (51) | (200) | (693) | 99 | (594) |
| 2023 | - | - | - | - | - | - |
| Percent Difference | | | | | | |
| 2021 | (6.6) | (4.7) | (6.1) | (5.9) | (6.6) | (5.7) |
| 2022 | (0.2) | (0.2) | (0.2) | (0.2) | (0.2) | (0.2) |
| 2023 | - | - | - | - | - | - |

(1) Gross Revenue does not include adjustments for unbillable or uncollectable toll revenue.
(2) Uncollectible toll revenue represents non-revenue vehicles, bad or duplicable license plate images, or any other transactions for which revenue cannot be collected.
(3) Net Revenue includes adjustments for unbillable or uncollectable toll revenue.
(4) Includes actual data through February 2021.
(5) Leap Year.
(6) COVID-19 traffic impacts have been included in 2020 due to stay-at-home orders, public space closures and other travel restrictions. Some recovery is assumed through 2022, though longer-term traffic impacts of 8.1 percent have been included through the remainder of the forecast period.



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CDM Smith appreciates the important nature of this assignment and the opportunity to work with the Authority. As always, please do not hesitate to contact us with any comments and/or questions.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Kamran Khan', written over a horizontal line.

Kamran Khan
Senior Vice President
CDM Smith Inc.



Mr. Jason Myers

April 15, 2021

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Disclaimer

CDM Smith used currently-accepted professional practices and procedures in the development of these traffic and revenue estimates. However, as with any forecast, differences between forecasted and actual results may occur, as caused by events and circumstances beyond the control of the forecasters. In formulating the estimates, CDM Smith reasonably relied upon the accuracy and completeness of information provided (both written and oral) by the E-470 Public Highway Authority. CDM Smith also relied upon the reasonable assurances of other independent parties and is not aware of any material facts that would make such information misleading.

CDM Smith made qualitative judgments related to several key variables in the development and analysis of the traffic and revenue estimates that must be considered; therefore, selecting portions of any individual result without consideration of the intent of the whole may create a misleading or incomplete view of the results and the underlying methodologies used to obtain the results. CDM Smith gives no opinion as to the value or merit of partial information extracted from this report.

All estimates and projections reported herein are based on CDM Smith's experience and judgment and on a review of information obtained from multiple agencies, including the E-470 Public Highway Authority. These estimates and projections may not be indicative of actual or future values and are therefore subject to substantial uncertainty. Certain variables such as future developments, economic cycles, global pandemics and impacts related to advances in automotive technology etc. cannot be predicted with certainty and may affect the estimates or projections expressed in this report, such that CDM Smith does not specifically guarantee or warrant any estimate or projection contained within this report.

While CDM Smith believes that the projections and other forward-looking statements contained within the report are based on reasonable assumptions as of the date of the report, such forward-looking statements involve risks and uncertainties that may cause actual results to differ materially from the results predicted. Therefore, following the date of this report, CDM Smith will take no responsibility or assume any obligation to advise of changes that may affect its assumptions contained within the report, as they pertain to socioeconomic and demographic forecasts, proposed residential or commercial land use development projects and/or potential improvements to the regional transportation network.

CDM Smith is not, and has not been, a municipal advisor as defined in Federal law (the Dodd Frank Bill) to the E-470 Public Highway Authority and does not owe a fiduciary duty pursuant to Section 15B of the Exchange Act to the E-470 Public Highway Authority with respect to the information and material contained in this report. CDM Smith is not recommending and has not recommended any action to the E-470 Public Highway Authority. The E-470 Public Highway Authority should discuss the information and material contained in this report with any and all internal and external advisors that it deems appropriate before acting on this information.

Appendix A
Economic Conditions Update
Economic & Planning Systems

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MEMORANDUM

To: CDM Smith and E-470 Public Highway Authority
From: Economic & Planning Systems
Subject: Economic Conditions Update
Date: February 18, 2021

The memorandum provides a glimpse of economic conditions since the onset of the COVID-19 pandemic in March 2020 and through the end of the year. It includes:

- Monthly data for employment, enplanements at Denver International Airport (DEN), residential construction activity, and nationwide consumer confidence.
- Geographic analysis of data for the Denver Metropolitan Statistical Area (MSA) as defined by the U.S. Census and Bureau of Labor Statistics (i.e., the Denver-Aurora-Lakewood MSA), the State of Colorado, and the U.S.
- Historical analysis from 2000, capturing the recessions of 2001 and the Great Recession (2007-2009).
- Analyses indexed to 2000 for comparability of geographic scales and comparability of historical recovery patterns.

The objective is to: a) compare conditions geographically and b) compare the emerging patterns against previous economic cycles. Although there is still uncertainty regarding the success of vaccinations occurring through the U.S. and through 2021, past recovery patterns (once unknowns and subsequent volatility of public health concerns have been minimized) provide some clarity to questions revolving around how well the Denver MSA might recover. The analysis suggests the following findings:

- Consumer confidence appears to have been shaken more so at the onset of this pandemic than following either 9/11 or the Great Recession.
- Enplanements at DEN have recovered a greater degree of the pre-COVID peak than the U.S.
- Employment in Denver has recovered a greater degree of its pre-COVID peak than the State of Colorado or U.S.
- Residential construction activity in Denver appears to be relatively unaffected, given the “critical business” designation and exemption from any shut-down orders.

The Economics of Land Use



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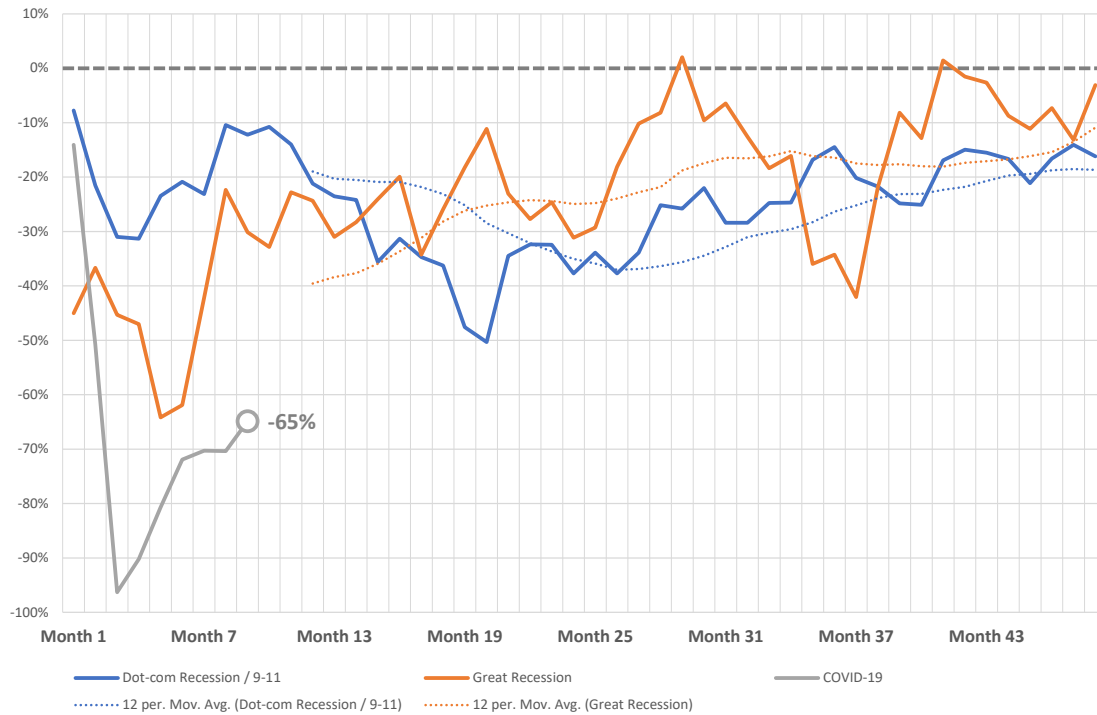
Consumer Confidence

Data on the Consumer Confidence Index (CCI), a metric widely adopted as a proxy for consumer spending, were collected from The Conference Board.

Trends

In fact, the CCI reached its highest point during the last 20 years in January 2000. In the 12 months preceding the COVID-19 pandemic, the CCI had reached its highest levels since 2000, averaging approximately 130. Since March 2020, it has fluctuated up and down, averaging approximately 95, which is 65 percent below the pre-COVID peak.

- **Following 9/11**, the CCI dropped approximately 45 percent off its January 2000 peak. It climbed another 37 percent over the subsequent couple of years before the Great Recession but did not recover a pre-9/11 peak.
- **Following the Great Recession**, the CCI declined (not immediately) 60 percent to a low of 43 and took 117 months to recover its pre-Great Recession peak (in May 2018).



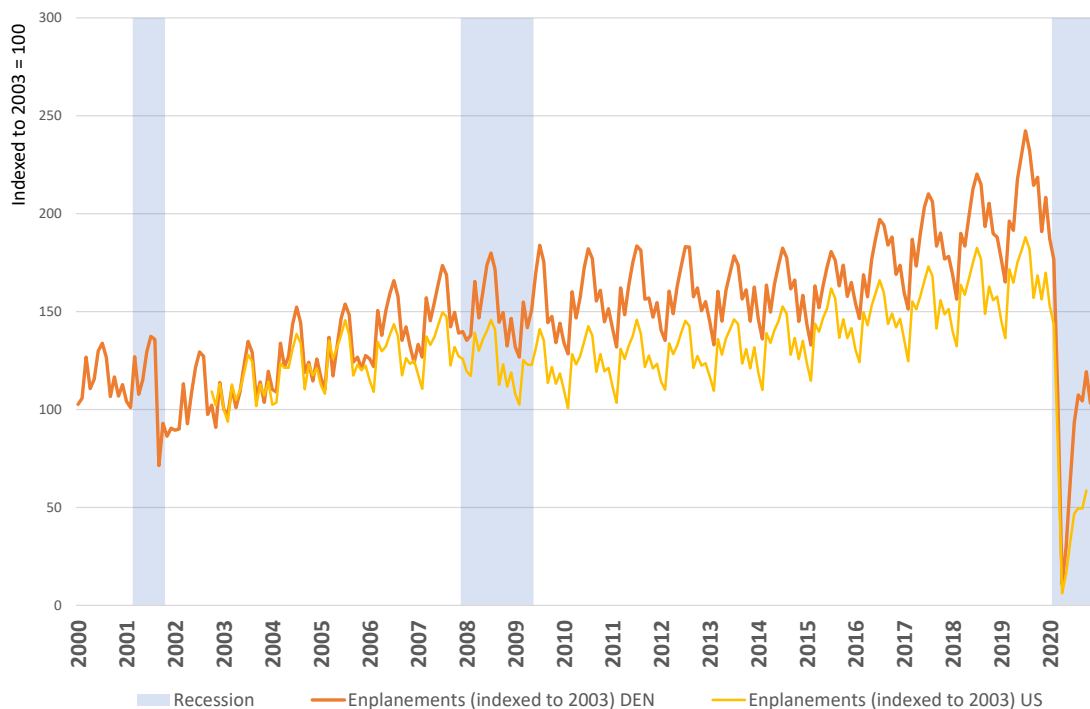
Enplanements

Data were collected from Denver International Airport (abbreviated as the airport code DEN) and the Bureau of Transportation Statistics (BTS).

Trends

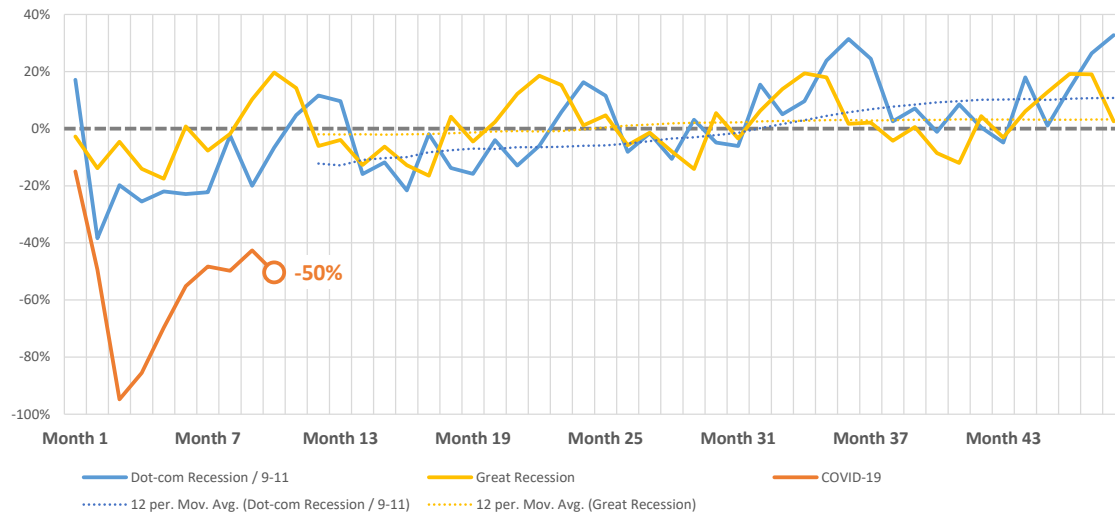
In April 2020, passenger traffic at DEN declined 95 percent from the 12-month average preceding the beginning of the pandemic. By November 2020, traffic at DEN had recovered to 50 percent below that peak. This compares against nationwide travel, which also declined 95 percent from the preceding 12-month average but has recovered only to 65 percent below pre-COVID levels.

- **Following 9/11**, enplanements at DEN dropped (not immediately) to 15 percent below the preceding 12-month average activity. Data were unavailable from BTS to identify a drop in enplanements nationally.
- **Following the Great Recession**, enplanements at DEN dropped (not immediately) to 4 percent below preceding 12-month average levels, while U.S. enplanements dropped 10 percent below previous levels.



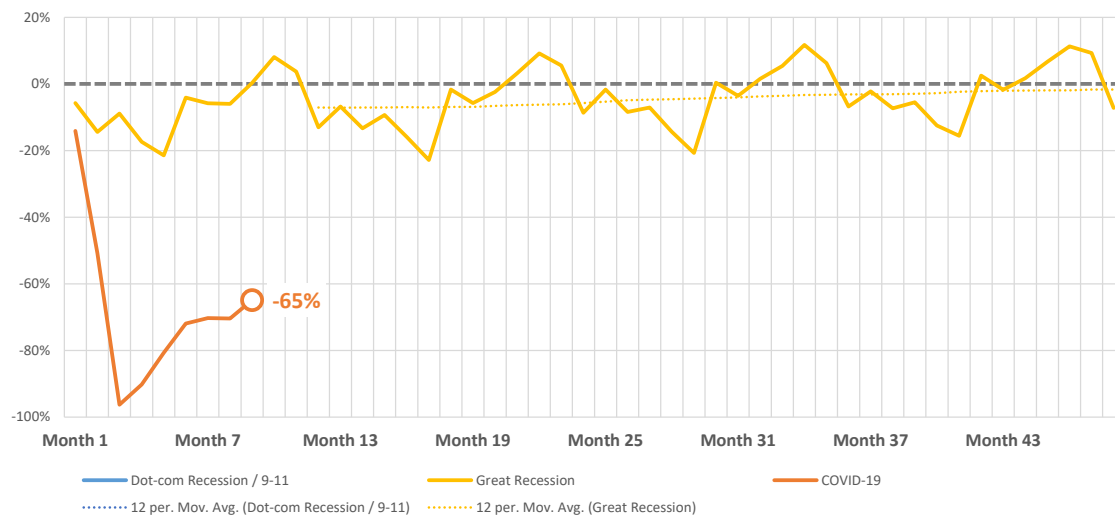
DEN Recovery Patterns

Enplanements are currently 50 percent below the 12-month average prior to March 2020. Enplanements at DEN recovered the prior peak in 31 months following the Great Recession, and after 45 months following 9/11. Dotted lines in the graph shown for illustrative purposes and do not represent exact points at which indexed activity recovers levels of activity above 0 percent.



U.S. Recovery Patterns

Nationwide enplanements are currently 65 percent below the 12-month average prior to March 2020. Enplanements nationwide recovered the prior peak in 71 months following the Great Recession. Data were unavailable from BTS to evaluate trends before 2003, i.e., 9/11.



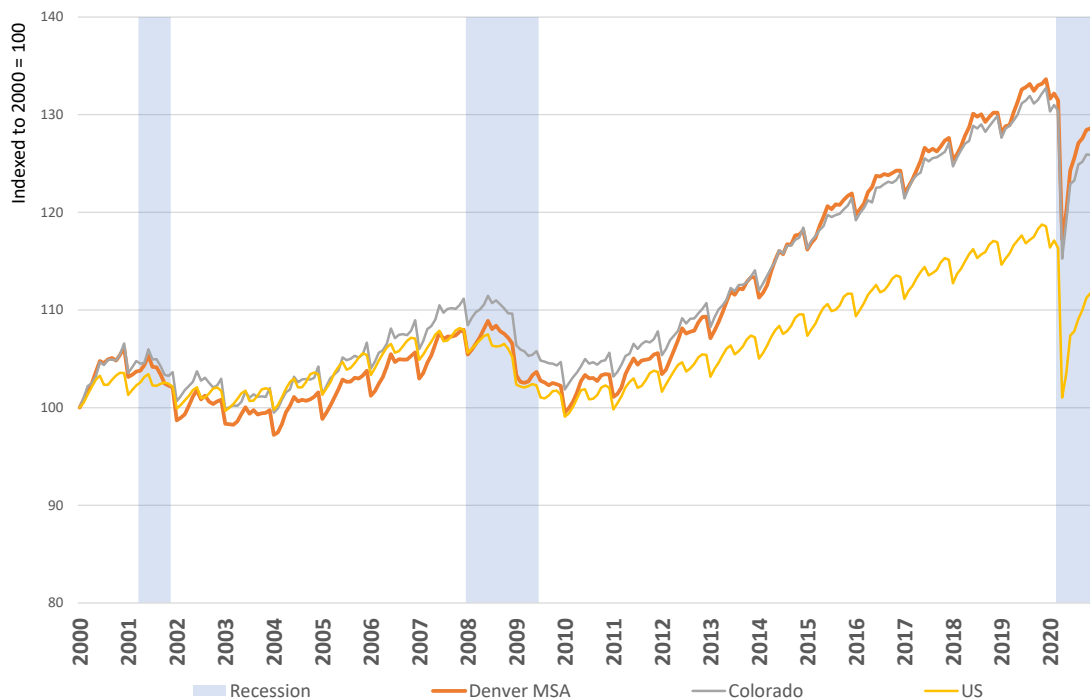
Employment

Monthly employment data were collected from the Bureau of Labor Statistics and indexed to 2000 (at 100) for direct comparison purposes.

Trends

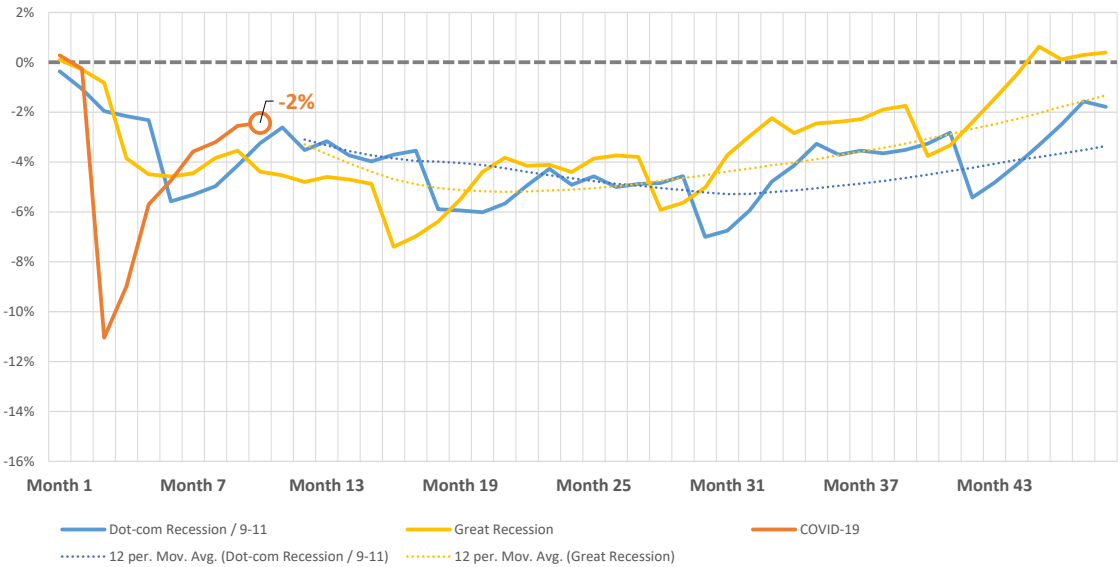
By November 2020, the MSA had recovered back employment levels from 2018, the State of Colorado had recovered average employment levels from 2017, and the U.S. had recovered back to 2016 levels.

- **Following 9/11**, the MSA declined to 8 percent below previous peak levels, the State of Colorado declined 7 percent and U.S. more modestly declined 4 percent.
- **Following the Great Recession**, the MSA declined 9 percent from its prior peak, the State of Colorado declined 9 percent, and the U.S. declined 8 percent.



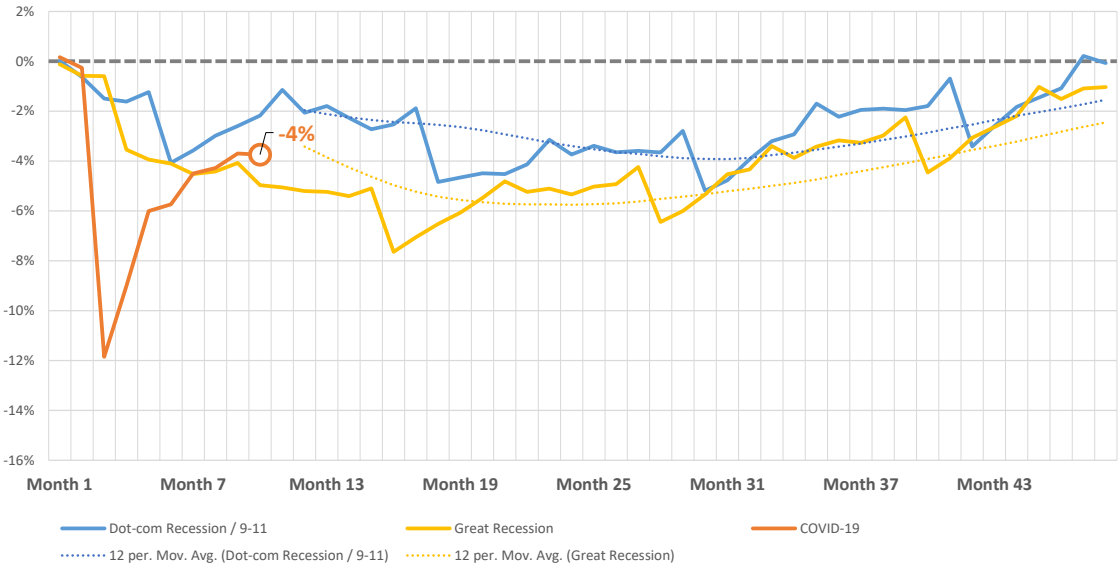
MSA Recovery Patterns

Employment levels in the MSA have currently recovered to 2 percent below their prior 12-month average peak. It took the MSA just 33 months to recover its 2008 peak after the Great Recession, but 76 months to recover its 2000 peak after 9/11. Dotted lines in the graph shown for illustrative purposes and do not represent exact points at which indexed activity recovers levels of activity above 0 percent.



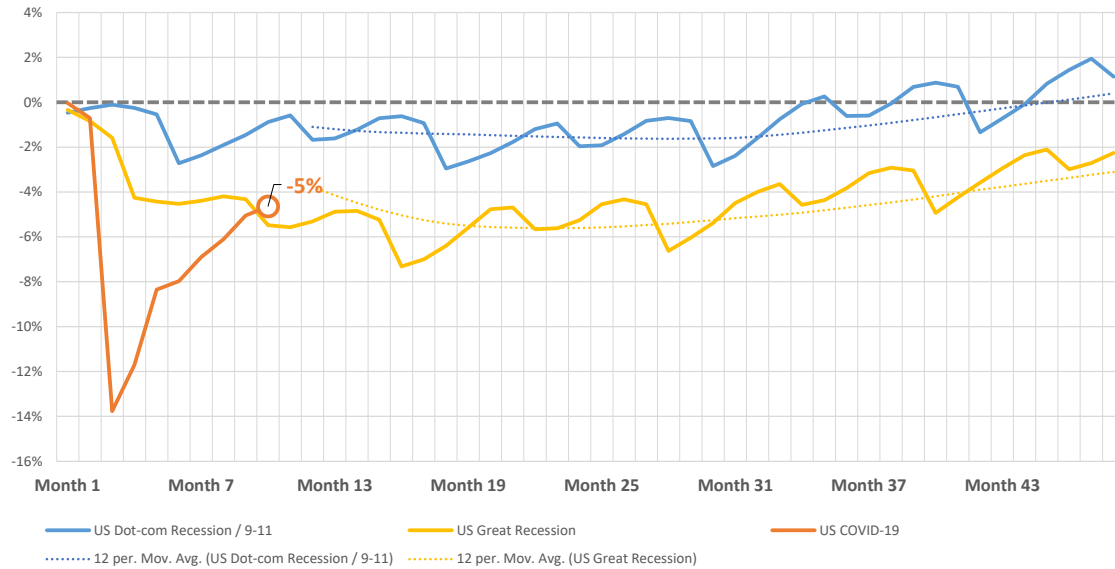
Colorado Recovery Patterns

Employment levels in the State have currently recovered to 4 percent below their prior 12-month average peak. It took the State of Colorado 40 months to recover its 2008 peak after the Great Recession, and 66 months to recover its 2000 peak after 9/11.



U.S. Recovery Patterns

Employment levels in the U.S. have currently recovered to 5 percent below their prior 12-month average peak. It took the nation 75 months to recover from the Great Recession, and 46 months following 9/11.



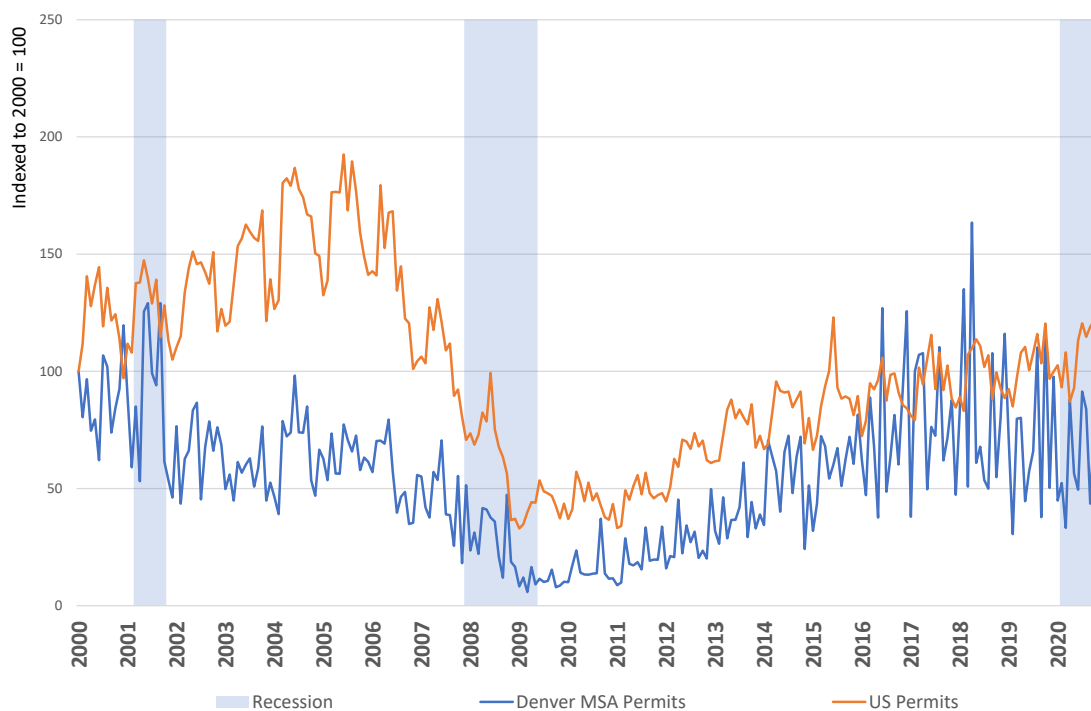
Residential Construction

Residential construction data, representing units built, were collected from the Denver Metro Homebuilders Association and the U.S. Census, and indexed to 2000 (at 100) for direct comparison purposes.

Trends

Owing partly to the “critical business” designation and stay-at-home exemption the residential construction industry received from the State of Colorado, construction activity has not been affected to the same degree as broader economic activity during the COVID-19 recession.¹ Patterns in the previous economic cycle are, however, clearer:

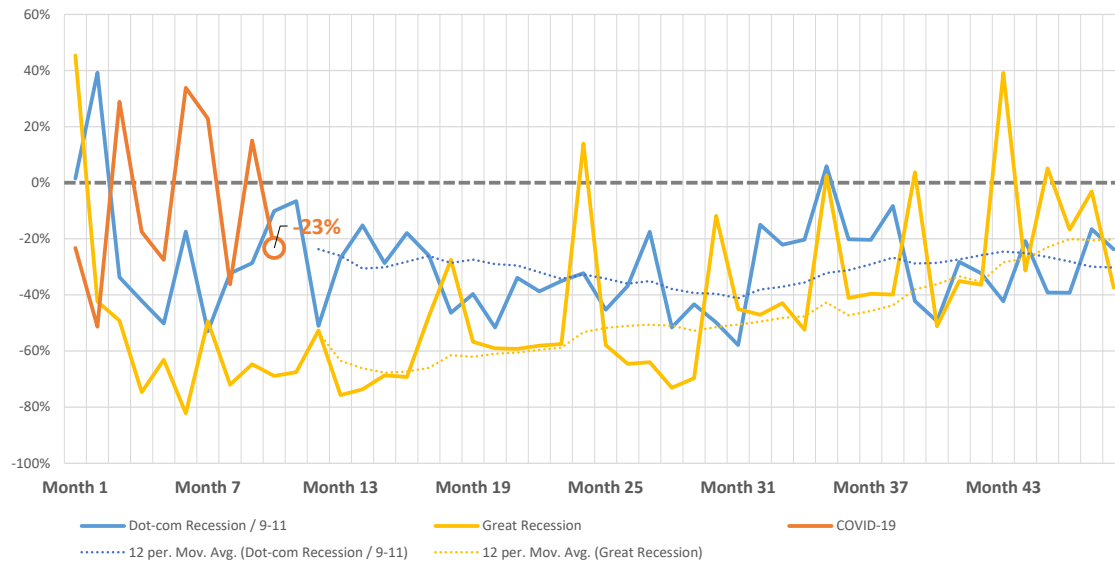
- ***In the MSA***, residential construction plateaued following 9/11 at approximately 60 percent of its activity levels in 2000 and through much of 2007. Following the onset of the housing crisis and Great Recession, activity fell for the following two years to approximately 10 percent of the MSA’s average activity in 2000. Since then, activity has recovered and been fluctuating between 50 and 100 percent of 2000 levels.
- ***At the national level***, residential construction patterns show a more apparent seasonality and predictability with regards to national trends, rising toward the onset of the Great Recession, plummeting afterward, and only slowly recovering over the subsequent decade.



¹ <https://covid19.colorado.gov/public-health-executive-orders>

Denver MSA Recovery Patterns

As noted, construction (currently fluctuating above and below average activity) has not been as affected in the MSA as it has been during previous cycles. Following 9/11, activity dropped to approximately 60 percent of activity, but did not recover in the lead-up to the Great Recession. Following the Great Recession, it was not until 2018 that activity returned to 2000 levels.



U.S. Recovery Patterns

Following 9/11, residential construction did not drop but steadily climbed toward the beginning of the Great Recession. Since the 2008, construction activity still has not returned to levels from the year 2000.

