

**ESTIMATION OF ECONOMIC IMPACTS OF OPERATION
AND CONSTRUCTION ACTIVITIES OF THE CARSON CITY
AIRPORT ON THE ECONOMY OF CARSON CITY**



**Estimation of Economic Impacts of Operation and Construction Activities of the Carson
City Airport on the Economy of Carson City**

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EXECUTIVE SUMMARY

The University Center for Economic Development in the School of Business at the University of Nevada, Reno completed an analysis of the economic impacts of operation and construction activities of the Carson City Airport (CCA) on the economy of Carson City. Highlights of the study are presented below:

Introduction

- Carson City Airport (CCA) is located three miles northeast of downtown Carson City, 30 miles from downtown Reno, 13 miles from Virginia City, and only 20 minutes from Lake Tahoe. This makes CCA a welcome destination for vacation and business travelers, and ‘just for pleasure’ aviators. Pilots consider CCA to be the most user-friendly airport in Northern Nevada.
- The CCA is currently the 5th overall busiest airport and the 3rd busiest General Aviation (GA) airport in Nevada.
- CCA plays a critical role in the economic vitality of Carson City by creating jobs and income for Carson City residents through normal airport operations, airport related industries, and general aviation opportunities.

- CCA plays a key role for future Carson City economic development efforts. Industries seeking to locate or relocate into an area rate the quality of local airport as an important locational factor.
- CCA significantly impacts the quality of life and community sustainability.

Methodology

- Operation and construction expenditures by CCA, airport tenants, and general aviation visitors and related employees impact the economic activity of through the multiplier effect.
- To derive total CCA output, employment, and labor income impacts, the Minnesota IMPLAN Group, Inc. microcomputer input-output model was employed.

Results

- CCA spent \$724.4 thousand locally on operations. When the expenditures by other businesses because of CCA are included in the analysis, CCA generated a total of \$1.090 million in spending in the Carson City economy.

- CCA employed 2.0 individuals living in Carson City. When the employment created by other businesses because of CCA is included in the analysis, CCA total activities generated and supported a total of 5.1 jobs in the Carson City economy.
- CCA generated \$123.2 thousand in labor income. When the income created by other businesses because of CCA is included in the analysis, the CCA was responsible for \$371.9 thousand in labor income for the Carson City economy.
- There are businesses that are located in Carson City because of the airport and are within the CCA complex. The economic, employment, and labor income impacts of these economic sectors were estimated also.
- CCA related economic sectors spent \$13.863 million locally. When the expenditures by other businesses because of CCA related economic sectors are included in the analysis, CCA related sectors generated a total of \$18.254 million in spending in the Carson City economy.
- CCA related economic sectors employed 80.7 individuals living in Carson City. When the employment created by other businesses because of CCA related economic sectors is included in the analysis, CCA related economic sectors total activities generated and supported a total of 113.4 jobs in the Carson City economy.

- CCA related economic sectors generated \$2.041 million in labor income. When the income created by other businesses because of CCA related economic sectors is included in the analysis, the CCA related economic sectors was responsible for \$3.496 million in labor income for the Carson City economy.
- General aviation visitors to CCA also have tourism impacts on the Carson City economy.
- A study in 2005 obtained personal questionnaires of general aviation visitors and their expenditures in Carson City. A visitor questionnaire was not employed in this study, so the expenditures of the previous study were inflated to 2018 dollars and increased by changes in county tourism activity for impact analysis.
- Direct CCA general aviation tourism expenditures were estimated to be \$11.283 million. From the indirect and induced economic linkages of these direct tourism expenditures, total economic impacts to the Carson City economy from general aviation tourism expenditures was estimated to be \$16.360 million.
- The tourism expenditures by general aviation visitors created 105.7 jobs. Given the economic linkages of the tourism industries in Carson City, total employment impacts in Carson City from these general aviation tourism expenditures is estimated to be 151.1 jobs.

- Additionally, tourism expenditures by general aviation tourist created \$4.130 million in labor income in the Carson City economy. When the income created by other businesses because of general aviation tourism expenditures is included in the analysis, the CCA general aviation visitors were responsible for \$5.907 million in labor income for the Carson City economy.
- CCA also impacts the Carson City economy through its construction activities. It was estimated that the cumulative one-time direct economic, employment, and household income impacts from 2003 to 2018 were \$22.217 million, 156.1 jobs, and \$9.772 million, respectively. Cumulative total economic, employment, and household income impacts of CCA construction activities on the Carson City economy were estimated to be \$31.458 million, 221.9 jobs, and \$12.581 million, respectively.
- A summation of tenants and visitor direct output, employment, and labor income impacts were estimated to be \$25.870 million, 188.4 employees, and \$6.204 million, respectively. Total output, employment, and labor income impacts for tenants and visitors is estimated to be \$35.704 million, 269.6 jobs, and \$9.775 million, respectively. Results of this study compare favorably to a previous study completed in 2005 (Marx and Harris, 2005).
- A summation of operation and construction direct output, employment, and labor income impacts were estimated to be \$48.087 million, 344.5 employees, and \$16.066 million, respectively. Total output, employment, and labor income impacts for operation and

construction activities is estimated to be \$67.162 million, 491.5 jobs, and \$22.356 million, respectively.

- In addition to its quantitative impacts on the Carson City economy, the presence of an airport improves the region's attractiveness. Businesses consider airport proximity in their location decision.
- These impacts demonstrate that CCA is a critical player for current and future economic development in the Carson City economy.
- Economic development agencies, business groups, and local leaders should be aware of the importance of CCA as a key partner and primary sector for current and future economic development opportunities in Carson City.

SECTION 1: INTRODUCTION

The primary purpose of this report is to document the contributions of the Carson City Airport (CCA) to the economy of Carson City. The CCA is currently the 5th overall busiest airport and the 3rd busiest General Aviation (GA) airport in Nevada (U.S. Department of Transportation, 2016). Data presented in this report reveal that CCA operations and construction activities have an impact on local economic activity, employment, and labor income (employee compensation and proprietor income) in Carson City - a contribution often overlooked in public policy discussions. CCA operations and construction play an important role in local economic development by creating jobs and income for residents through the normal airport operations, airport related industries, and general aviation activities. The economic linkages of CCA operations and construction activities are also responsible for generating employment and income in other economic sectors in the Carson City economy.

Utilizing data provided by CCA and other sources, the analysis presented in this report indicates that CCA operations, CCA construction, CCA related economic sectors and general aviation visitors spent \$48.087 million locally. When the expenditures by other businesses because of CCA are included in the analysis, CCA generated a total \$67.162 million in spending in the Carson City economy. Additionally, CCA operations, CCA construction, CCA related economic sectors and CCA general aviation tourist are responsible for employment of 344.5 individuals living in Carson City. When the employment created by other businesses because of CCA is included in the analysis, CCA generated and supported a total of 491.5 jobs in the Carson City economy. Similarly, CCA operations, CCA construction, CCA related economic sectors, and CCA general aviation tourists generated \$16.067 million in labor income (employee compensation and proprietor income). When the income created by other businesses because of all CCA activities

is included in the analysis, CCA, CCA related economic sectors, and expenditures by CCA general aviation visitors was responsible for \$22.356 million in labor income in the Carson City economy.

As local and state policymakers consider economic development opportunities for their areas, they should bear in mind the importance of airports to local and regional economies. As this report demonstrates, CCA provides much more than necessary transportation. The jobs, income, and economic benefits created in other businesses, as well as sales tax revenue generate by all sectors represent additional contributions to economic well-being in the Carson City economy.

Estimation of Economic Impacts of Carson City Airport on the Economy of Carson City is divided into five sections. The first section is an introduction into the study. The second section briefly discusses the role of the airport sector in economic development, highlighting the financial and non-financial linkages between the airport sector and the rest of the local economy. The third section provides an overview of the demographic and economic trends in Carson City. The fourth section discusses the Carson City Airport (CCA) within the Carson City economy and measures the economic impacts of CCA has on the local economy. The fourth section, also, demonstrates the direct, indirect, and induced economic impact of CCA operations and construction on the economy, jobs and labor income in the Carson City economy. Utilizing an economic impact model, this report provides estimates of the direct economic contribution of airport operation and construction activity, as well as the indirect and induced or secondary income and employment impacts in other businesses resulting from airport operation and construction activity. The jobs and income generated in other business are estimated with employment and income multipliers derived for the Carson City economy. Additionally, the report compares results of a Carson City Airport impact study completed by Marx and Harris (2005). The report also contains an appendix that summarizes the model and data used to estimate employment and income multipliers.

SECTION 2: LOCAL AIRPORTS AND LOCAL ECONOMIC DEVELOPMENT

Over the past couple of decades, the airport sector has become an important engine of economic growth in Carson City and other areas of Nevada. Economic activities of the airport include local airport operations, supporting airport industries, activities of general aviation visitors, and airport construction. The premise of this report is that communities and community leaders need to improve their understanding of the importance of the airport sector to the local economy, including the amount of jobs and income it provides, directly and indirectly, and its role in generating additional employment and labor income to the residents in the Carson City economy. The nexus between airport services and rural development is typically overlooked. An airport can attract and maintain business and job growth for the Carson City economy.

Local Business and Job Growth

The dynamic infrastructure provided by civil aviation not only supports businesses in their ability to innovate, create new jobs and explore economic opportunities, civil aviation also provides us with vital connectivity to family, friends, and new frontiers (U.S. Department of Transportation, 2015). For the state of Washington (Bucher Willis and Ratliff Corporation, 2001), the entire aviation system is important to the state and its local economies for several reasons. One, the network of airports extends commerce and economic development opportunity throughout the state. Two, while some individual airport impacts are relatively small on a statewide basis, they are nonetheless meaningful to their communities at the local level. Lastly, airports make important economic contributions to the local economy besides impacts associated with value of output, employment, or labor income. The mere existence of an airport derives benefits to the local populace in knowing the community has access to aviation services.

SECTION 3: DEMOGRAPHIC AND ECONOMIC CONTEXT OF CARSON CITY

Former professor Gary Smith of Washington State University notes in the Pacific Northwest Regional Economic Analysis Project (PNREAP) website (Smith, 2010):

“Attracting and retaining people to live, work, raise a family, and retire underlies the economic growth of any region. Population growth is both a cause and a consequence of economic growth. Patterns of population growth and change reflect differences among regions to attract and retain people both as producers and consumers in their economy.”

Population

With this basic understanding, data and graphs from PNREAP’s website will be examined to further clarify the economic status of Carson City.

- Carson City is located in northeastern Nevada. The county is bordered by Washoe County to the north, Storey and Lyon counties in the east, Douglas County in the south and Placer County, California in the west. Carson City is the state capitol for the state of Nevada.
- According to the U.S. Department of Commerce, the population for Carson City decreased from 55,025 in 2010 to 54,742 in 2016. During this timeframe the population rank in the state for Carson City remained as the third highest in the state (Table 1).
- Also, of interest is the growth of Nevada’s metropolitan counties (Clark, Carson City, Storey and Washoe Counties), which grew from 2,434,382 in 2010 to 2,668,073 in 2016. The nonmetropolitan counties of Nevada have also realized a population increase from 268,902 in 2010 to 271,985 in 2016. However, even with the rural Nevada population

increase, the proportionate metropolitan share of Nevada’s total population increased from 90.05 percent in 2010 to 90.75 percent in 2016.

Table 1. County Population, Rank of Population, State of Nevada, 2010 to 2016.

COUNTY	2010		2016	
	Population	Rank	Population	Rank
Clark, NV	1,953,216	1	2,155,664	1
Washoe, NV	422,146	2	453,616	2
Carson City (Independent City), NV	55,025	3	54,742	3
Lyon, NV	52,070	4	53,179	4
Elko, NV	49,074	5	52,168	5
Douglas, NV	47,026	6	48,020	6
Nye, NV	43,858	7	43,423	7
Churchill, NV	24,806	8	24,198	8
Humboldt, NV	16,592	9	16,843	9
White Pine, NV	10,043	10	9,682	10
Pershing, NV	6,744	11	6,560	11
Lander, NV	5,784	12	5,702	12
Lincoln, NV	5,359	13	5,055	13
Mineral, NV	4,771	14	4,449	14
Storey, NV	3,995	15	4,051	15
Eureka, NV	1,993	16	1,917	16
Esmeralda, NV	782	17	790	17
TOTAL	2,703,284		2,940,059	
Nevada (Metropolitan Portion)	2,434,382		2,668,073	
Nevada (Nonmetropolitan Portion)*	268,902		271,985	

Source: U.S. Department of Commerce. (2017). Regional Data: Table CA1. Personal Income Summary: Personal Income, Population, Per capita Income: 1969-2016”. Bureau of Economic Analysis: Washington, D.C.

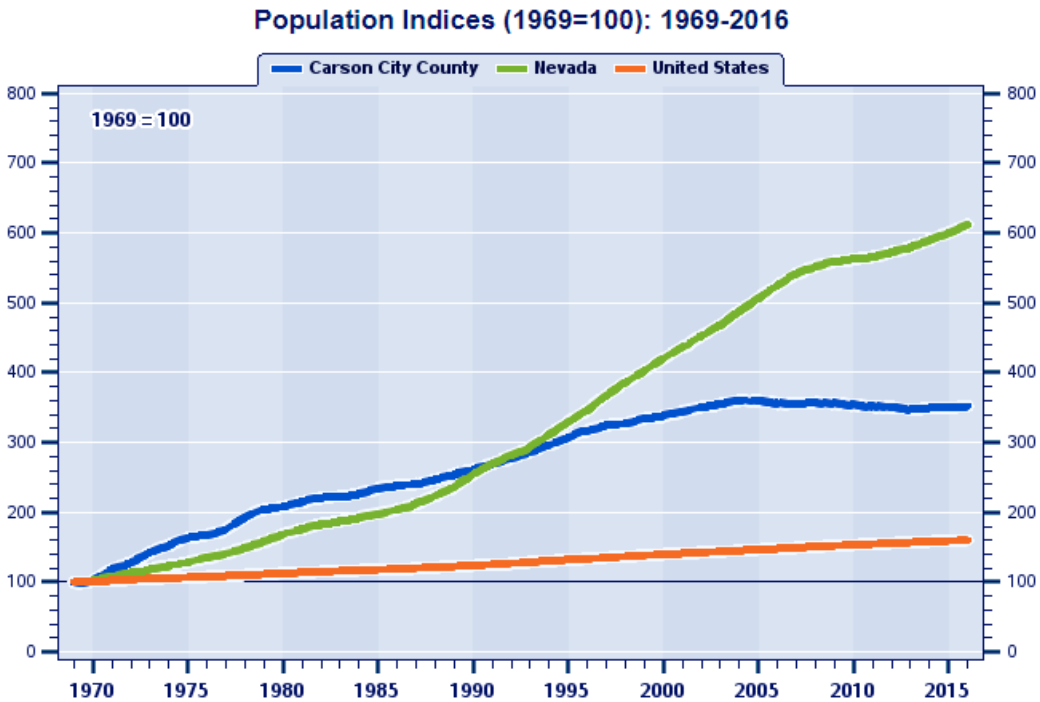
Three metropolitan areas, which are Washoe and Storey Counties, Clark County, and Carson City.

*Nonmetropolitan counties are the remainder 13 counties in the state of Nevada.

- Carson City’s population increased from 15,528 in 1969 to 54,742 in 2016, a population increase of approximately 252.5 percent. From Figure 1, Carson City’s population growth exceeded the nation, but lagged behind the state of Nevada.
- Figure 1 allows for a comparison of population growth between Carson City, Nevada and the nation. The growth indices have a base population from 1969 (designated as 100).

Each year following 1969 is designated as a percentage of 1969. Thus, the nation's population growth of 60.5 percent fell short of Nevada's increase of approximately 512.5 percent and Carson City's population growth of 252.5 percent.

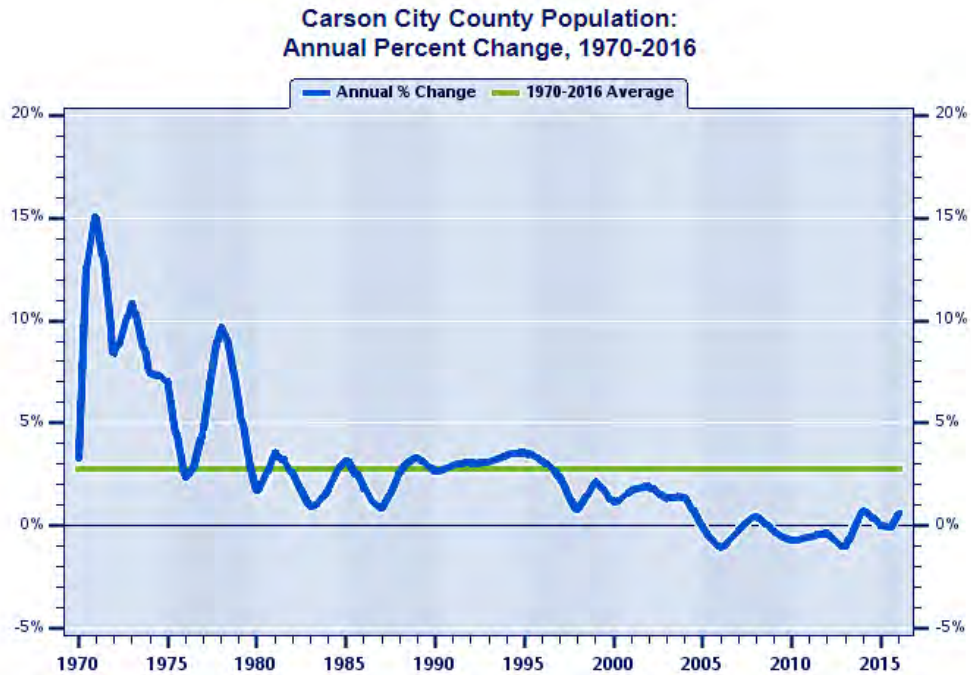
Figure 1. Population Indices for Carson City, State of Nevada, the United States for 1969 to 2016.



Source: Nevada.REAProject.org
Data: Regional Income Division, BEA (11-16-2017)

- Figure 2 highlights the short-run pattern of Carson City's population growth by tracking the year-to-year percentage change from 1969 to 2016. The average annual percentage change for the entire 40 years is also traced on Figure 2 to provide a benchmark for gauging periods of relatively high and relatively low growth against the long-term trend.
- From Figure 2, the average annual percentage growth of population in Carson City was 2.77 percent from 1970 to 2016. Carson City recorded its highest growth rate in 1971 (14.95%) and posted its lowest in 2006 (-1.02%). In 2016, Carson City's population grew by 0.62%.

Figure 2. Annual Percentage Change in Carson City Population, 1970 to 2016.



Source: Nevada.REAProject.org
Data: Regional Income Division, BEA (11-16-2017)

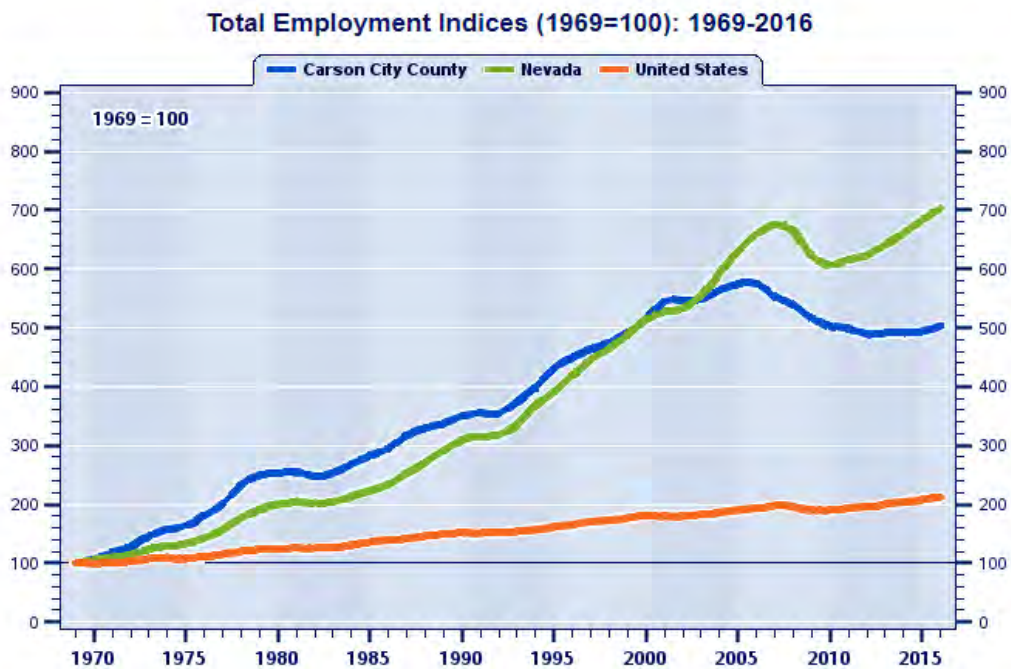
Employment

According to Smith (2010), “Employment numbers remain the most popular and frequently cited statistic used for tracking local area economic conditions and trends”. The employment data used for Figure 3 are both full-time and part-time employment by place of work. As one person can hold more than one job, the numbers are not necessarily the number of people employed. These employment numbers are by place-of-work not place-of-residence. Therefore, jobs held by neighboring county residents who commute to Carson City are included in the employment count of Carson City.

- From 1969 to 2016, Carson City employment grew from 7,636 to 30,809 or an employment increase of 403.5 percent. Figure 3 also shows that Carson City

employment growth was insufficient to keep pace with the state of Nevada employment growth rate of 603.3 percent. However, Carson City’s employment growth rate was greater than the national employment growth rate of 112.7 percent for the same time period.

Figure 3. Employment Indices (1969 = 100) for Carson City, State of Nevada, and the United States, 1969 to 2016.



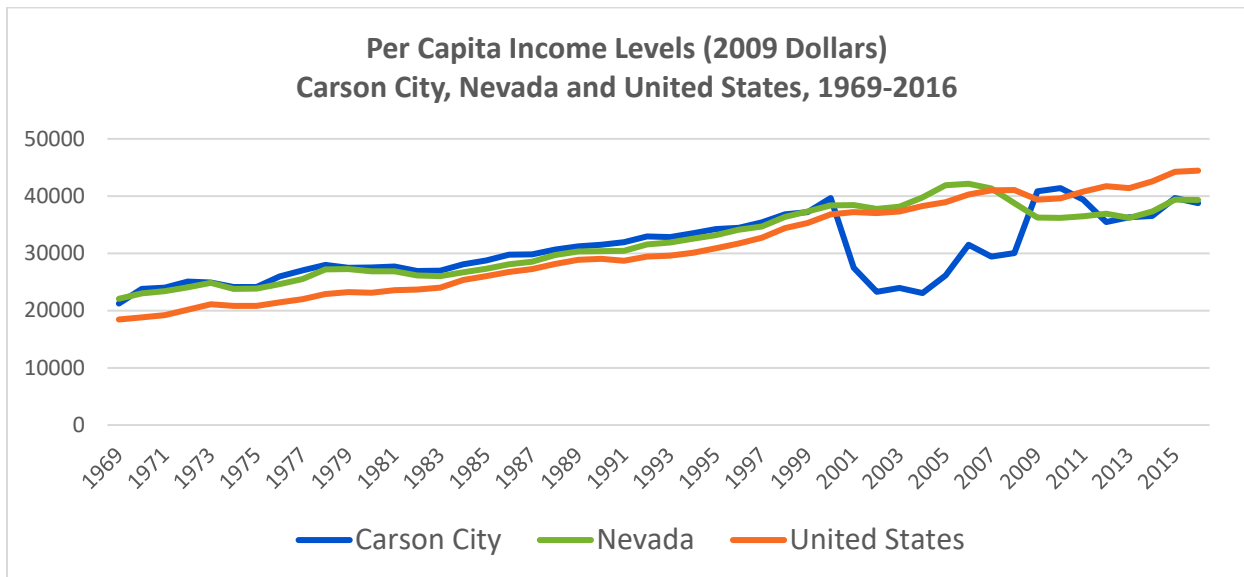
Source: Nevada.REAProject.org
Data: Regional Income Division, BEA (11-16-2017)

Per Capita Income

From Smith (2010), “Per Capita Income is one of the most widely used indicators for gauging the economic performance and changing fortunes of local economies. It is used as a yardstick to assess the economic well-being of a region’s residents and the quality of consumer markets. Per capita serves as a barometer for calibrating the economic performance of a county over time and to judge differences in relative economic prosperity between counties.”

- Real per capita income also grew in Carson City since 1969 from \$21,229 in constant 2009 dollars to \$38,772 in 2016. Of interest is the variability in per capita income from 2000 to 2016. Carson City per capita income decreased from \$39,649 in 2000 to \$27,478 in 2001 subsequently grew to \$41,395 in 2010 again declined to \$36,283 in 2013 and increased once again to \$38,772 in 2016.
- In comparison, real per capita income nationally grew from \$18,441 in 1969 to \$44,450 in 2016. For the state of Nevada, real per capita income grew from \$16,124 in 1969 to \$39,612 in 2016.
- Figure 4 shows a time trend of per capita income (expressed in 2009 dollars) for Carson City, the state of Nevada, and the United States. Notice the variability in Carson City per capita income since 2000 to 2016.

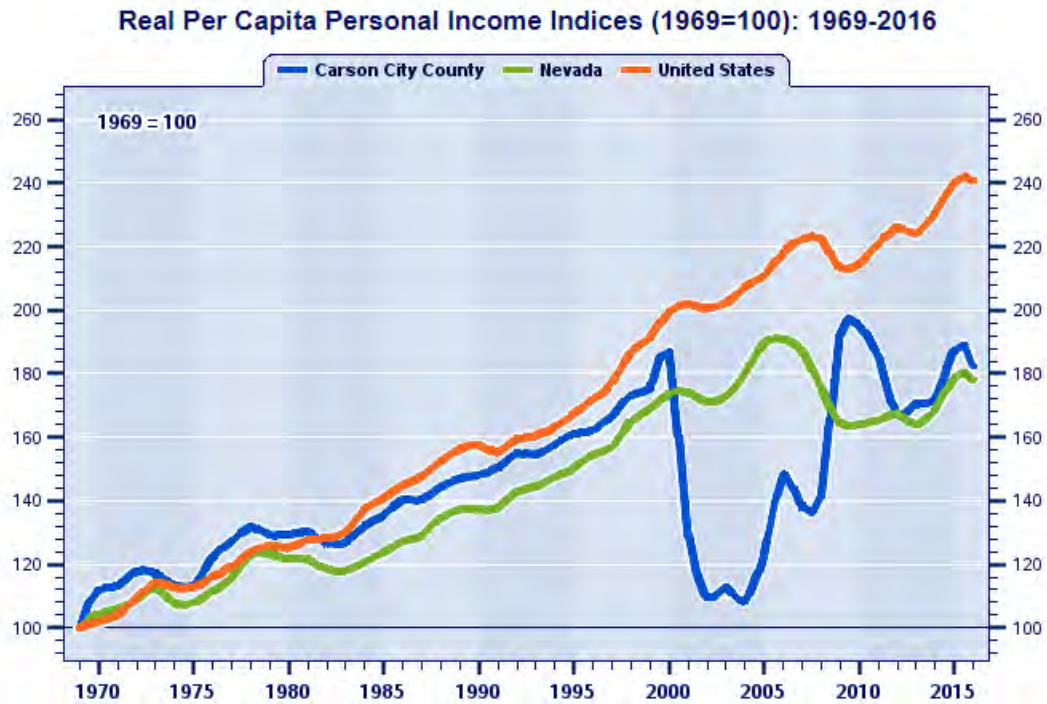
Figure 4. Per Capita Income Levels (2009 Dollars) for Carson City, State of Nevada, and the United State from 1969 to 2016.



Data: Nevada.REAProject.org
 Data: Regional Income Division, BEA (11-16-2017)

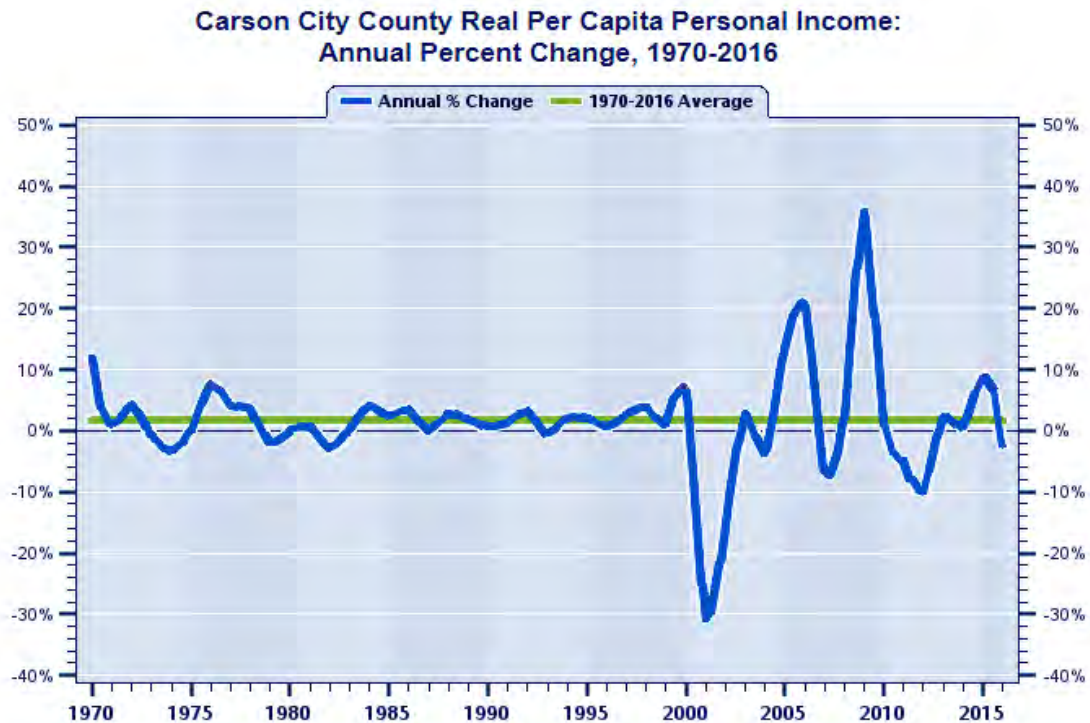
- Figure 5 highlights the short-run pattern of Carson City’s real per capita income growth by tracking the year-to-year percentage change from 1969 to 2016. Again, the notice the variability in per capita income graph for Carson City since 2000.
- From Figure 5, Carson City’s real per capita income grew from 1969 to 2016 by 82.6%. In comparison, the growth in real per capita income from 1969 to 2016 was 131.0% for the nation and state of Nevada grew by 79.5%.

Figure 5. Per Capita Income Indices (1969 = 100) for Carson City, State of Nevada, and the United States, 1969 to 2016.



Source: Nevada.REAProject.org
 Data: Regional Income Division, BEA (11-16-2017)

Figure 6. Carson City Real Per Capita Income: Annual Percentage Change, 1970 to 2016.



Source: Nevada.REAProject.org
Data: Regional Income Division, BEA (11-16-2017)

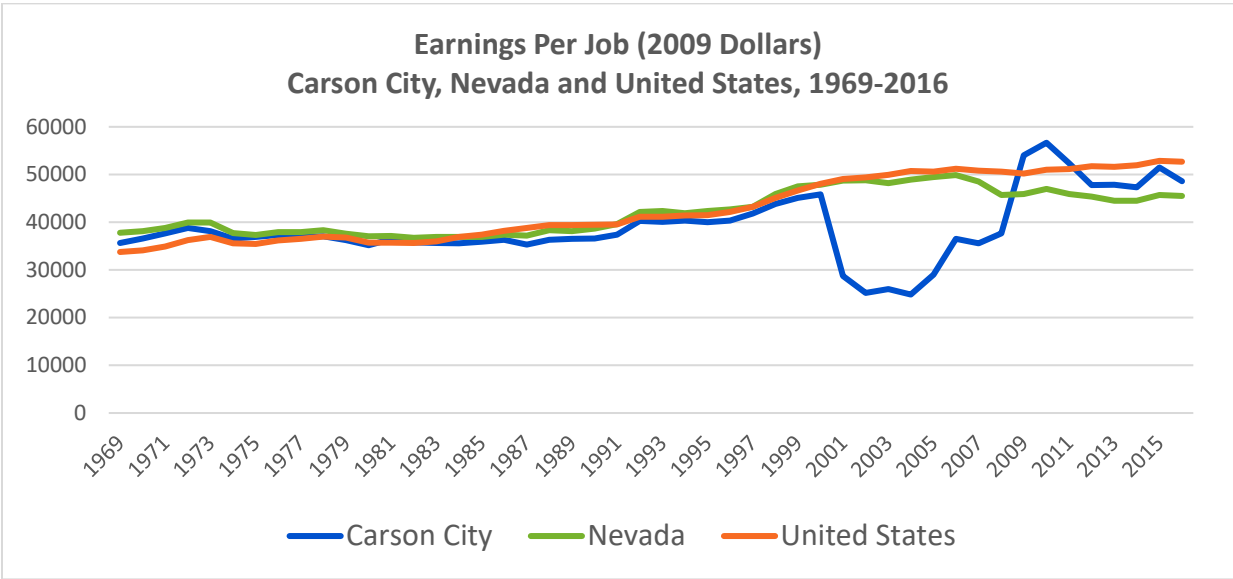
- The growth of Carson City’s per capita income is shown in Figure 6 as the real annual percentage change, tracked from year to year. The blue line shows the short-term changes in real per capita income and the green line is a long-term view of the changes. Over the 47-year study period, real annual per capita income growth for Carson City has been 1.68 percent. However, notice the variability since 2000.

Earnings Per Job

From Smith (2010): “Average annual earnings per job are computed by dividing U.S. Bureau of Economic analysis total industry earnings estimates by U.S. Bureau of Economic Analysis total fulltime and part-time job estimates.” There is no convenient way to convert the job estimate to fulltime equivalents.

- In constant 2009 dollars, average earnings per job in Carson City increased from \$35,671, in 1969 to \$48,625 in 2016.
- Figure 7 shows the comparison of the average amount earned per job for the nation, the state, and Carson City (in 2009 Dollars). The average earnings per job in 2016 were the highest in the U.S., second in Carson City, and lowest in Nevada. The average real earnings per job in 2016 for Carson City, Nevada, and the U.S. are approximately \$48,625, \$45,530, and \$52,687, respectively. Again, notice the variability in earnings per job in Carson City since 2000.

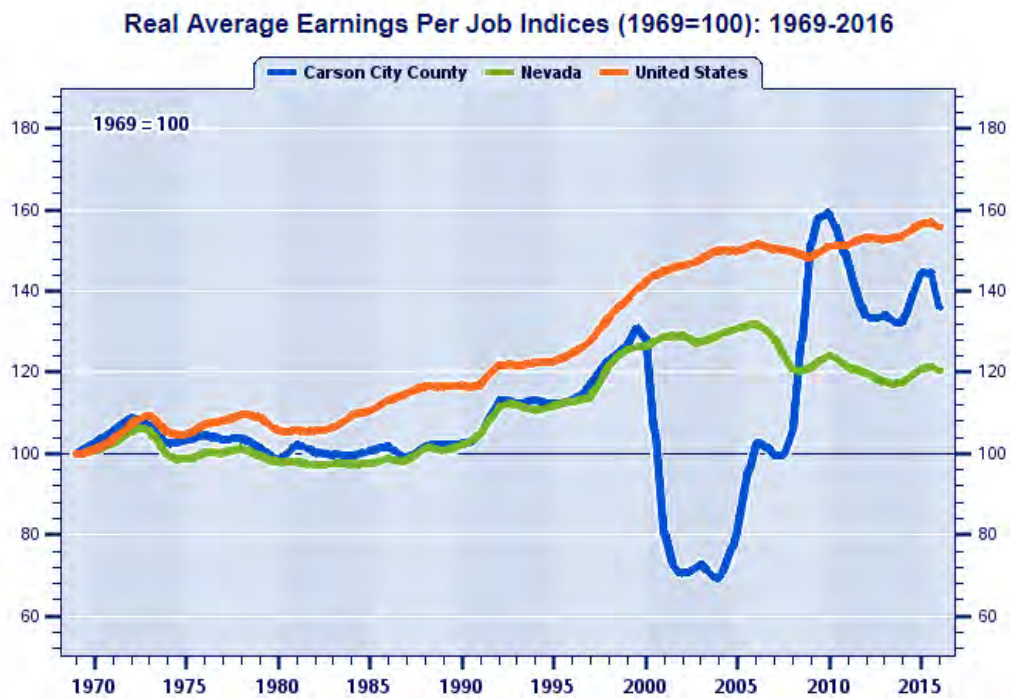
Figure 7. Earnings Per Job (2009 Dollars) Carson City, Nevada and the United States, 1969 to 2016.



Data: Nevada.REAProject.org
 Data: Regional Income Division, BEA (11-16-2017)

- Figure 8 tracks the changes in real average earnings per job in Carson City, relative to the state and the nation, and is indexed to the initial year of 1969. Carson City’s growth of 36.3 percent in real average earnings per job over the 47 years surpassed the state at 20.4 percent but fell short of the nation at 56.0 percent.

Figure 8. Average Earnings Per Job Indices (1969 = 100): Carson City, Nevada and the United States, 1969 to 2016

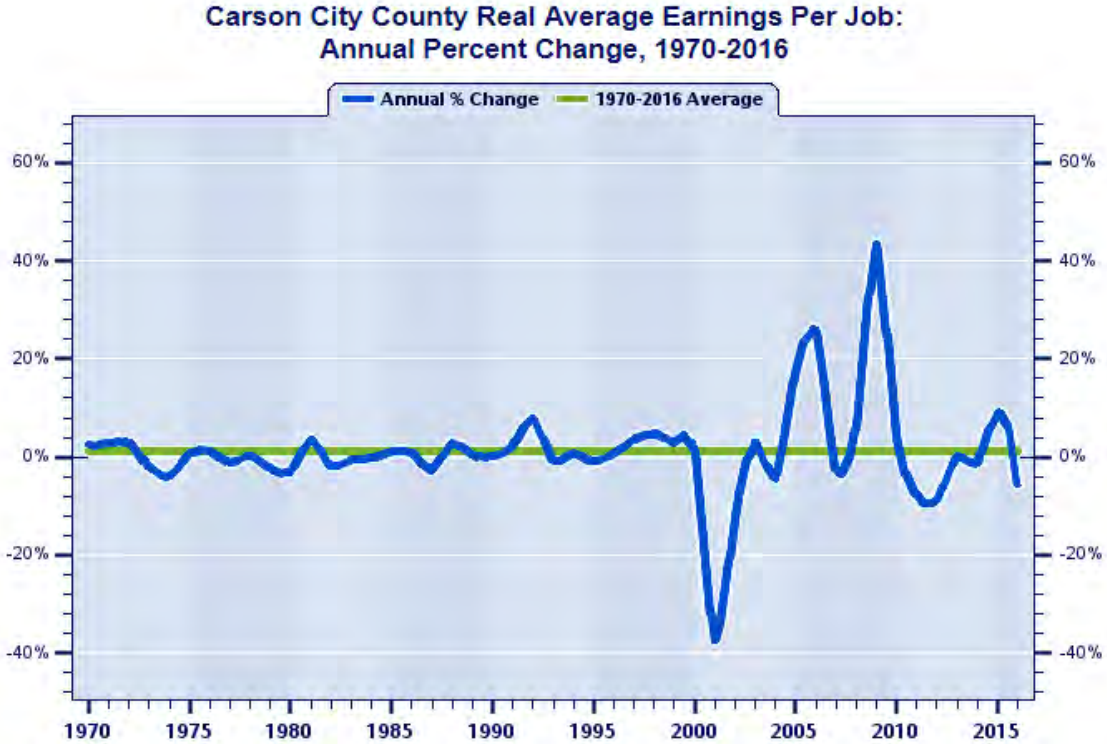


Source: Nevada.REAProject.org
 Data: Regional Income Division, BEA (11-16-2017)

- The average annual percentage change in earnings per job in Carson City can be characterized as variable over the past 47 years in Table 9. Carson City realized its highest growth in 2009 (43.45%) and recorded its lowest growth in 2001 (-37.38%). In

2016, Carson City's real average earnings per job declined by -5.53 percent. Overall, Carson City's real average earnings per job grew on average at an annual rate of 1.18 percent over the 47-year study period.

Figure 9. Carson City Average Annual Percentage Change in Earnings Per Job from 1970 to 2016.

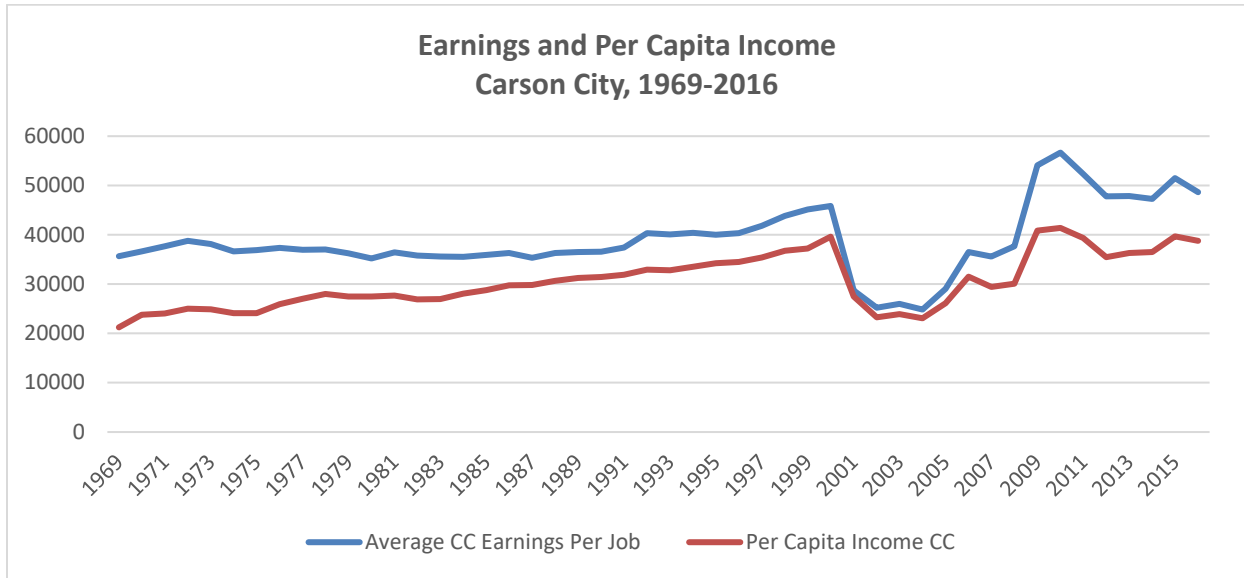


Source: Nevada.REAProject.org
Data: Regional Income Division, BEA (11-16-2017)

Comparison between Earnings and Income Per Capita

- Figure 10 provides a comparison of the average earnings per job and per capita income in Carson City. Figure 10 shows the difference in place of work and place of residence income. This figure shows that the average earnings per job for Carson City have been continuously higher than the per capita income. This also shows that an economic development goal of Carson City could be capturing earning by workers who may live outside of Carson City but work in Carson City.

Figure 10. Average Earnings per Job and Per Capita Income Carson City, 1969 to 2016.



Data: Nevada.REAProject.org
 Data: Regional Income Division, BEA (11-16-2017)

Earnings

In 2016, Carson City residents received approximately \$2,351.4 million in personal income. Of this amount, approximately \$2,071.1 million were total earnings in the county in the form of wages and salaries, other labor income, and proprietor’s income. This number is adjusted to net earnings of approximately \$1,281.5 million, taking into account social security contributions and commuting adjustments. Almost \$515.5 million was in the form of unearned income from dividends, interest and rents. Approximately \$554.5 million came from transfer payments such as social security, food stamps, unemployment payments, and veteran’s benefits. These income figures are shown in Table 2.

Table 2. Personal Income of Carson City Residents, 2016.

Income Category	(1,000)	(1,000)
Wages and Salaries	\$1,399,544	
Other Labor Income	\$495,877	
Proprietor's Income	\$125,672	
Total Earnings in Carson City		\$2,021,093
Less Personal Social Security Contributions	\$188,220	
Plus Residence/Commuting Adjustment	-\$601,413	
Net Earnings of Carson City Residents		\$1,231,460
Dividends, Interest and Rents	\$515,503	
Transfer Payment	\$554,457	
Total Personal Income, Carson City Residents		\$2,301,420
Per Capita Personal Income (dollars)		\$42,041

Source: U.S. Department of Commerce. "Regional Economic Information System." Bureau of Economic Analysis: Washington, D.C., 2009.

Social Security contributions are subtracted from total earnings in order to better measure income available to Carson City residents before income taxes (a concept called personal income by economists). Approximately \$188.2 million of contributions to social insurance programs such as Social Security, Medicare, unemployment, etc. were paid by residents of Carson City.

A commuting adjustment is made to total earnings since some people who earn income in Carson City are not county residents. These people commute into the county to work and take their paycheck back to their county of residence. Some Carson City residents do the same when they work outside Carson City and bring income back to Carson City. Approximately \$601.4 million more in income is earned by workers who live outside Carson City but work in Carson City, than by residents who live in Carson City but work outside Carson City. This value is subtracted from total earnings in Carson City to derive net earnings for Carson City residents.

Table 3 gives the percentage breakdown of Carson City’s income by source and presents similar data for the state and nation. Net earnings by Carson City residents are approximately 54.5 percent of total personal income compared to 59.8 percent, and 63.2 percent for the state and nation, respectively. Dividends, interest and rents, and transfer payments in Carson City account for a greater percentage of total personal income than in the state or nation. However, disaggregating the segments of non-earned income yields a different perspective. Dividends, interest and rents in Carson City are a smaller proportionate share (21.9 percent) than the state (23.3 percent) but longer than the nation (19.4 percent). However, transfer payments are a larger percentage of total personal income in Carson City (23.6 percent) than the state (16.9 percent) and the nation (17.4 percent).

The last line of Table 3 shows that Carson City’s per capita income was lower than the nation and the state. At \$42,955, Carson City’s 2016 income per capita was approximately 1.6 percent less than the state’s \$43,567 and approximately 12.8 percent less than the nation’s average of \$49,246.

Table 3. Comparison of Personal Income Sources, Carson City, State of Nevada and the United States, 2016.

Personal Income Source	Carson City (%)	Nevada (%)	U.S. (%)
Wages and Salaries	59.5%	50.3%	50.8%
Other Labor Income	21.1%	12.0%	11.9%
Proprietor’s Income	7.5%	5.3%	8.2%
Less Personal Social Insurance Contributions	8.0%	7.7%	7.8%
Plus Residence/Commuting Adjustments	-25.6%	0.0%	0.0%
Net Earnings of Residents	54.5%	59.8%	63.2%
Dividends, Interest and Rents	21.9%	23.3%	19.4%
Transfer Payments	23.6%	16.9%	17.4%
Total	100.0%		100.0%
Per Capita Personal Income	\$42,041	\$43,567	\$49,246

Source: U.S. Department of Commerce, “Regional Economic Information system.” Bureau of Economic Analysis, Washington, D.C., 2009.

Carson City income can be summarized as follows:

- Per capita income for Carson City in 2016 was \$42,041, which is less than the state's and nation's averages.
- Total 2016 place of work earnings for Carson City were \$2,071.1 million. Place of work earnings are adjusted by adding the net resident adjustment to derive resident earnings for Carson City, the net residence adjustment for 2016 was -\$601.4 million. This means \$601.4 million more was earned by people living outside Carson City but working inside Carson City than by people living inside Carson City and working outside Carson City. These are incomes leaked out of the county.
- Proportionate share of total earnings from dividends, interest and rents and transfer payments are 45.5 percent in Carson City. This proportionate share is higher than the state value of 40.2 percent and the national value of 36.8 percent. This might mean a higher retiree population base for Carson City.

Employment and Occupational Projections for Carson City

A criticism of targeted economic development by Barkley et al. (1998) was that an economic sector or occupation selected based on past economic growth might be at the end of a growth phase. Past sectoral employment or occupation growth may be a poor predictor of future sectoral employment or occupational sector growth. Therefore, for this section of the analysis, sectoral projected employment and occupation growth will be incorporated into targeted economic development analysis.

Obtaining employment and occupational projection data from 2010 to 2020 will provide useful information for Carson City economic practitioners and show how Carson City airport

will play in future Carson City economic development. These employment and occupational projections were developed by Economic Modeling Specialists, Inc. (EMSI). They used employment and occupational data from the state of Nevada Department of Employment, Training, and Rehabilitation; the U.S. Bureau of Labor; Regional Economic Information System data from the U.S. Department of Commerce, Bureau of Economic Analysis; and occupational staffing patterns from the Occupational Employment Statistics. Projections are based on latest available EMSI industry data; fifteen year past local trends in each industry; growth rates in statewide and, where available, sub-state area industry projections published by individual state agencies; and in part, growth rates in national projections from U.S. Bureau of Labor Statistics.

Employment Projections

Table 4 shows projected sectoral employment growth in Carson City. Given that Carson City is the capital of the state of Nevada, it is not surprising that the Government Sector is Carson City's largest employer. It is also projected to grow by 14.87% by 2028 and still Carson City's largest employer. Also, from 2018 to 2028, Carson City's total employment is forecasted to increase from 32,789 to 37,705 or a 14.99% employment increase over ten years.

Table 4. Projected Sectoral Employment Growth from 2018 to 2028.

SECTORS	2018 Employment	2028 Employment	2018 - 2028 Change	2018 - 2028 % Change
Agriculture, Forestry, Fishing and Hunting	86	131	45	52.33%
Utilities	113	90	-23	(20.35%)
Construction	1,840	2,184	344	18.70%
Manufacturing	2,743	2,973	230	8.38%
Wholesale Trade	598	714	116	19.40%
Retail Trade	3,403	3,833	430	12.64%
Transportation and Warehousing	233	216	-17	(7.30%)
Information	339	390	51	15.04%
Finance and Insurance	937	971	34	3.63%
Real Estate and Rental and Leasing	541	523	-18	(3.33%)
Professional, Scientific, and Technical Services	1,023	992	-31	(3.03%)
Management of Companies and Enterprises	359	467	108	30.08%
Administrative and Support and Waste Management and Remediation Services	1,009	943	-66	(6.54%)
Educational Services	115	161	46	40.00%
Health Care and Social Assistance	4,593	6,475	1,882	40.98%
Arts, Entertainment, and Recreation	1,170	1,059	-111	(9.49%)
Accommodation and Food Services	2,544	2,866	322	12.66%
Other Services (except Public Administration)	1,074	1,150	76	7.08%
Government	10,046	11,540	1,494	14.87%
Unclassified Industry	23	27	4	17.39%
TOTAL	32,789	37,705	4,916	14.99%

Source: EMSI Complete Employment - 3rd Quarter 2018

Table 5. Projected Occupational Growth from 2018 to 2028.

Occupations	2018 Jobs	2028 Jobs	2018 - 2028 Change	2018 - 2028 % Change
Management Occupations	1,956	2,234	278	14.21%
Business and Financial Operations Occupations	2,224	2,495	271	12.19%
Computer and Mathematical Occupations	911	986	75	8.23%
Architecture and Engineering Occupations	733	775	42	5.73%
Life, Physical, and Social Science Occupations	529	600	71	13.42%
Community and Social Service Occupations	596	766	170	28.52%
Legal Occupations	438	477	39	8.90%
Education, Training, and Library Occupations	1,438	1,947	509	35.40%
Arts, Design, Entertainment, Sports, and Media Occupations	425	489	64	15.06%
Healthcare Practitioners and Technical Occupations	2,349	3,208	859	36.57%
Healthcare Support Occupations	961	1,314	353	36.73%
Protective Service Occupations	1,009	1,082	73	7.23%
Food Preparation and Serving Related Occupations	2,792	3,218	426	15.26%
Building and Grounds Cleaning and Maintenance Occupations	992	1,101	109	10.99%
Personal Care and Service Occupations	1,394	1,619	225	16.14%
Sales and Related Occupations	3,025	3,315	290	9.59%
Office and Administrative Support Occupations	5,627	6,004	377	6.70%
Farming, Fishing, and Forestry Occupations	55	84	29	52.73%
Construction and Extraction Occupations	1,221	1,480	259	21.21%
Installation, Maintenance, and Repair Occupations	1,330	1,467	137	10.30%
Production Occupations	1,634	1,764	130	7.96%
Transportation and Material Moving Occupations	1,080	1,195	115	10.65%
Military-only occupations	70	85	15	21.43%
Unclassified Occupation	0	0	0	#DIV/0!
TOTAL	32,789	37,705	4,916	14.99%

Source: EMSI Complete Employment – 3rd Quarter 2018.

Occupational Projections

Table 5 shows projected occupational growth in Carson City. The occupation estimated with the largest growth from 2018 to 2028 is the Health Care Practitioners and Technical

Occupation. The Office and Administrative Support Occupation are forecasted to have the largest absolute occupation. Given that Carson City is the state capital it is not surprising that the Office and Administrative Support Occupation is so large. All of these growing economic sectors and occupations will have linkages with the Carson City airport.

Carson City employment and occupational projections can be summarized as follows:

- Employment in Carson City is forecasted to increase from 32,789 in 2018 to 37,705 in 2028. This is a forecasted 14.99 percent increase in employment.
- The Government Sector is forecasted to realize the largest employment increase by size from 2018 to 2028. This sector's employment is forecasted to increase by 1,494 employees.
- As for occupations, the Healthcare Practitioners and Technical Occupations, Maintenance, are forecasted for the largest size increase from 2018 to 2028.
- For Carson City, the occupation forecasted to have the largest absolute number in 2028 is the Office and Administrative Support Occupations.

SECTION 4: IMPACT OF CARSON CITY AIRPORT ON THE CARSON CITY ECONOMY

The Multiplier Effects

The impact of airport related operation and construction expenditures and airport related employee expenditures are called multiplier effects. Multiplier effects are a simplified and compact way of representing these effects on the local economy. The multiplier is interpreted as the impact of a one-unit change in sales, employment, or income that results in a corresponding total impact on sales, employment, or income in the larger economy. The multiplier represents the recycling of dollars and income in a specified geographic unit, such as the Carson City economy. This recycling creates new job opportunities and higher wages for individuals.

There are three types of multiplier effects based on the type of economic impact analysis undertaken: direct, indirect, and induced. These types are illustrated in Table 10 below. The *direct multiplier effect* is based on an industry's initial economic impact on the region's economy. For example, if the airport has revenue of \$5 million, then this figure becomes the direct economic impact on the community. The *indirect multiplier effect* is based on industry-to-industry transactions only. For example, the airport sector purchases local accounting services, food, and other contracted services. However, the indirect multiplier effect does not include the effect of airport related sector employee spending on retail and service sectors such as housing, groceries, and real estate. Alternatively, the *induced multiplier effect* includes both the industry-to-industry transactions and household purchases, including employee spending. The *total economic impact* is defined as the direct plus indirect and induced economic impacts.

Table 6. Airport Operation (Construction) Related Economic Impact Multipliers.

Type of Multiplier	Direct	Indirect	Induced
Output Multiplier	Airport Expenditures (Construction)	Airport Supplier Expenditures (Construction)	Local retail & service expenditures related to airport spending (Construction spending)
Employment Multiplier	Airport Jobs (Construction)	Airport (Construction) Supplier Jobs	Local retail & service jobs related to airport employee spending (Construction employee spending)
Income Multiplier	Airport (Construction) Employee Income	Airport Supplier (Construction) Employee Income	Local retail & service income related employee spending

The direct, indirect, induced, and total impact multiplier effects can be classified as output, employment and income multipliers. An output multiplier of 2.0 indicates that if one dollar is spent by the airport, an additional dollar is spent in other sectors due to business and household spending. An employment multiplier of 2.0 indicates that if one job is created in the airport sector, 1.0 additional job is created in other sectors due to business and household spending. Likewise, an income multiplier of 2.0 indicates that for every dollar of income created in the airport sector, an additional dollar of income is created in other sectors due inter-industry spending by airport related businesses and employees. The measurement of multiplier effects, the input-output model, and IMPLAN data utilized in this report are explained in Appendix A.

The Impact of the Carson City Airport Operations on Carson City Economy

Table 7 summarizes the impact of CCA on expenditures, employment, and labor income in the Carson City economy. Table 7 reveals that CCA spent \$724.4 thousand locally on operations, which created total economic activity in the Carson City economy of \$1.090 million. This means that the CCA created an additional \$365.8 thousand in economic activity in Carson City through indirect and induced economic activity. As for employment, CCA directly hired two employees but through its economic linkages created a total employment impact in Carson City of 5.1 employees. This means that the CCA created an additional 3.1 jobs through its indirect and induced linkages in the Carson City economy. Finally, CCA directly had labor incomes of \$123.2 thousand but through its economic linkages created a total of \$371.9 thousand in labor income in the Carson City economy. This means that the CCA created an additional \$248.7 thousand in labor income in the Carson City economy through its indirect and induced linkages in the local economy.

Table 7. Economic, Employment, and Labor Income Impacts of CCA on the Carson City Economy.

IMPACT TYPE	Value of Output	Employment	Labor Income
Direct	\$724,365	2.0	\$123,158
Indirect and Induced	\$365,786	3.1	\$248,753
TOTAL	\$1,090,151	5.1	\$371,911

The Impact of Airport Related Industries to the Carson City Airport on Carson City

Economy

Table 8 summarizes the impact of CCA related industries to the Carson City economy. Working with the CCA manager a list of industries related to the CCA were determined. Their employment, value of production, and labor income were estimated from data provided by Nevada Department

of Employment, Training, and Rehabilitation and IMPLAN. Table 8 reveals that CCA related economic sectors spent \$13.863 million locally on operations, which created total economic activity in the Carson City economy of \$18.254 million. This means that the CCA related sectors created an additional \$4.391 million in economic activity in Carson City through indirect and induced economic activity. As for employment, CCA related economic sectors directly hired 80.7 employees but through its economic linkages created a total employment impact in Carson City of 113.4 employees. This means that the CCA created an additional 32.7 jobs through its indirect and induced linkages in the Carson City economy. Finally, CCA related economic sectors directly had labor incomes of \$2.041 million but through its economic linkages created a total of \$3.496 million in labor income in the Carson City economy. This means that the CCA related economic sectors created an additional \$1.455 million in labor income in the Carson City economy through its indirect and induced linkages in the local economy.

Table 8. Economic, Employment, and Labor Income Impacts of CCA Related Economic Sectors in the Carson City Economy.

Impact	Value of Output	Employment	Labor Income
Direct	\$13,862,919	80.7	\$2,040,699
Indirect and Induced	\$4,391,271	32.7	\$1,455,338
Total	\$18,254,190	113.4	\$3,496,037

The Impact of General Aviation Visitors to Carson City Airport on the Carson City

Economy

From previous study by Marx and Harris (2005), general aviation visitors to CCA economic impacts on the Carson City economy were estimated. Under the previous study, visitor questionnaires were given to general aviation visitors to record expenditures in Carson City from

their visit. For this study, a questionnaire of general aviation visitors was not attempted so the previous studies impacts were employed with values inflated to 2018 values and expansion of tourism in Carson City. Table 9 shows that CCA general aviation visitors had direct expenditures in Carson City of \$11.283 million, which created total economic activity in the Carson City economy of \$16.360 million. This means that the CCA general aviation tourism expenditures created an additional \$5.077 million in economic activity in Carson City through indirect and induced economic activity. As for employment, CCA general aviation tourism expenditures directly created 105.7 jobs but through its economic linkages created a total employment impact in Carson City of 151.1 jobs. This means that the CCA general aviation tourist created an additional 45.4 jobs through its indirect and induced linkages in the Carson City economy. Finally, CCA general aviation tourist directly created labor incomes of \$4.130 million but through its economic linkages created a total of \$5.907 million in labor income in the Carson City economy. This means that the CCA general aviation tourist created an additional \$1.777 million in labor income in the Carson City economy through its indirect and induced expenditure linkages in the local economy.

Table 9. Economic, Employment, and Labor Income Impacts of General Aviation Visitors to CCA on the Carson City Economy.

Impact	Value of Output	Employment	Labor Income
Direct	\$11,282,623	105.7	\$4,130,340
Indirect and Induced	\$5,076,947	45.4	\$1,776,592
Total	\$16,359,570	151.1	\$5,906,933

The Impacts of Carson City Airport Construction Activities on the Carson City Economy

The economic impact of construction activities of CCA, as measured by value of output, employment and labor income is large. Construction activities from 2003 to 2018 are shown in Table 10. These one-time construction costs were inflated to 2018 values for impact analysis.

Table 10. Carson City Airport Construction Cost History Since 2003.

Year	Project Name	Project Cost
2003	Seal and Stripe Taxiway	\$305,892
2005	Environmental Assessment and Benefit Cost Analysis	\$400,000
2006	Land Acquisition - Beehive, Serpa, and Sheldon	\$5,263,158
2007	Land Acquisition - Serpa Phase 2	\$5,263,158
2008	Hill Removal - Design & Construction	\$2,943,061
2008	Runway/Taxiway Design	\$349,931
2009	AWOS* - Design & Construction	\$182,222
2009	Rehabilitate and Realign Runway 9-27 and Taxiway A Cor	\$9,724,947
2010	North Apron Environmental Assessment	\$36,000
2010	Runway 9 Connector and Taxiway D East - Construction	\$1,755,517
2011	Taxiway D West - Design & Construction	\$1,332,184
2012	North Apron Environmental Assessment Phase 2	\$48,818
2012	Rehabilitate Taxiways B & C - Design & Construction	\$146,000
2012	Main Apron Design	\$275,000
2013	Main Apron Reconstruction Phase 1	\$1,471,357
2013	Main Apron Reconstruction Phase 2	\$1,065,065
2014	Main Apron Reconstruction Phase 3/ Runway Restripe	\$1,128,393
2015	North Apron Design	\$160,000
2016	North Apron Reconstruction	\$2,745,000
2017	Airport Master Plan Update	\$440,000
2018	Taxiway	\$332,126
	TOTAL:	\$35,367,829

From IMPLAN data, it was estimated that 30% of construction costs occurred in Carson City. Therefore, cumulative real one-time direct construction expenditures by CCA were estimated to be \$22.217 million. Also using IMPLAN data, it was estimated that cumulative direct hiring for

these construction activities would be 156.1 employees with cumulative direct labor income impacts of \$9.772 million. Employing the IMPLAN Carson City input-output model, it was estimated that cumulative one-time total economic, employment, and household income impacts would be \$31.458 million, 221.9 jobs, and \$12.581 million, respectively from CCA construction activities since 2002. This means that the CCA construction one-time impacts created an additional \$9.241 million in cumulative economic activity, 65.8 in cumulative employees, and \$2.809 million in cumulative labor income in the Carson City economy through its indirect and induced expenditure linkages in the local economy.

Table 11. Cumulative One Time Economic, Employment, and Labor Income Impacts of Carson City Airport Construction on the Carson City Economy.

Impact	Value of Output	Employment	Labor Income
Direct	\$22,217,376	156.1	\$9,772,346
Indirect and Induced	\$9,240,319	65.8	\$2,808,408
Total	\$31,457,695	221.9	\$12,580,754

SECTION 5: SUMMARY and CONCLUSIONS

The output, employment and labor income data presented in this report document the contribution of the Carson City Airport (CCA) on the Carson City economy. The data and analysis presented in this report indicates that:

- For residents of Carson City, CCA provides access to airport services 24 hours a day, seven days a week, and 365 days a year.
- Utilizing data provided by CCA and other sources, Table 12 shows the aggregate direct impacts of CCA, CCA related economic sectors, and general aviation visitors on the Carson City economy was \$25.870 million. When the expenditures by other businesses because of CCA are included in the analysis, total economic impacts of CCA on the Carson City economy is estimated to be \$35.704 million.

Table 12. Summary of CCA Expenditures, Tenants and Visitor Economic Activity, Employment and Labor Income Impacts on the Carson City Economy.

Impact	Value of Output	Employment	Labor Income
Direct	\$25,869,907	188.4	\$6,294,197
Indirect and Induced	\$9,834,004	81.2	\$3,480,684
Total	\$35,703,911	269.6	\$9,774,881

- CCA, CCA related economic sectors and CCA general aviation tourist have direct employment impacts in Carson City of 188.4 jobs. When the employment created by other businesses because of CCA is included in the analysis, CCA generated and supported a total of 269.6 jobs in the Carson City economy.

- CCA, CCA related economic sectors, and CCA general aviation tourists generated direct labor income in Carson City of \$6.294 million. When the income created by other businesses because of all CCA activities is included in the analysis, CCA, CCA related economic sectors, and expenditures by CCA general aviation visitors was responsible for \$9.775 million in labor income in the Carson City economy.
- Direct economic activity, employment, and household income impacts for CCA operations from the Marx and Harris (2005) publication were \$20.1 million, 150.8 jobs, and \$4.265 million. Given the interindustry economic relationships between CCA and the Carson City economy, total economic, employment, and household income impacts were estimated to be \$30.762 million, 299.5 jobs, and \$10.157 million, respectively. These values compare favorably with the results of the current study.
- Also, CCA impacts the Carson City economy when there are construction activities. From 2003 to 2018 as shown from Table 11, CCA direct cumulative construction activities in Carson City was estimated to be \$22.217 million with cumulative direct employment and labor income one-time impacts of 156.1 jobs and \$9.772 million, respectively. With economic linkages between CCA and its construction activities, the cumulative one-time, economic, employment, household impacts were estimated to be \$31.458 million, 221.9 jobs, and \$12.581 million, respectively.
- Table 13 shows the CCA impacts when operations and one-time construction activities are combined. Table 12 shows the aggregate direct impacts of CCA operations and one-time construction activities on the Carson City economy was \$48.087 million. When the expenditures by other businesses because of CCA operations and construction activities

are included in the analysis, total economic impacts of CCA operations and construction activities on the Carson City economy is estimated to be \$67.162 million.

Table 13. Summary of CCA Operation and Construction Impacts on Economic Activity, Employment, and Labor Income on the Carson City Economy.

Impact	Value of Output	Employment	Labor Income
Direct	\$48,087,283	344.5	\$16,066,543
Indirect and Induced	\$19,074,323	147.00	\$6,289,092
Total	\$67,161,606	491.5	\$22,355,635

- CCA operation and one-time construction activities have direct employment impacts in Carson City of 344.5 jobs. When the employment created by other businesses because of CCA operation and construction activities is included in the analysis, CCA operation and construction activities generated and supported a total of 491.5 jobs in the Carson City economy.
- CCA operation and construction activities generated direct labor income in Carson City of \$16.067 million. When the income created by other businesses because of all CCA operation and construction activities is included in the analysis, CCA operation and construction activities was responsible for \$22.356 million in labor income in the Carson City economy.
- In addition to its quantitative impacts of CCA, the presence of a local airport improves the region’s attractiveness. Businesses consider airport proximity in their location decisions.

REFERENCES

- Alward, G. et al. 1989. **Micro IMPLAN Software Manual**. Stillwater MN: University of Minnesota Press.
- Bucher Willis and Ratliff Corporation. 2001. **Economic Impacts of Washington Airports**. Washington State Department of Transportation: Olympia, Washington.
- Doeksen, G. A. et al. 1997. **Measuring the Importance of the Health Sector on the Local Economy: A Brief Literature Review and Procedures to Measure Local Impacts**. Mississippi State MS: Southern Rural Development Center.
- Economic Modeling Specialist. 2018. **EMSI Complete Employment-3rd Quarter 2018**. Moscow, Idaho.
- Marx, A. and T. Harris. 2005. **Statewide Analysis: Nevada General Aviation Airport Economic Impact Study**. University of Nevada, Reno, Bureau of Business and Economic Research.
- Miernyk, W.H. 1965. **The Element of Input-Output Analysis**. New York: Random House.
- Minnesota IMPLAN Group, Inc. (MIG). 2004. **User's Guide, Analysis Guide, Data Guide: IMPLAN Professional Version 2.0 Social Accounting and Impact Analysis Software**, Third Edition. Stillwater MN: MIG. www.implan.com.
- U.S. Department of Transportation. 2016. **National Plan of Integrated Airport Systems (NPIAS). 2017-2012**. Federal Aviation Administration, Washington, D.C.

U.S. Department of Transportation. 2015. **The Economic Impact of Civil Aviation on the U.S. Economy: Economic Impact of Civil Aviation by State**, Federal Aviation Administration: Washington, D.C.

Appendix A: Model and Data Used to Estimate Employment and Income Multipliers

The economic impacts and secondary benefits of economic activity presented in this report are measured by multipliers using an input-output model and data from IMPLAN, a model that is widely used by economists and other academics in the United States. A computer spreadsheet that uses state IMPLAN multipliers was developed by to enable community development specialists to measure the secondary benefits of the airport sector on state, regional, or county economies.

Input-output (I/O) analysis is designed to analyze the transactions among industries in an economy (Miernyk 1965). These models are largely based on the work of Wassily Leontief during the 1930s. Detailed I/O analysis captures the indirect and induced interrelated circular behavior of the economy. For example, an increase in the demand for airport services requires more equipment, more labor, and more supplies, which, in turn, requires more labor to produce the supplies, and so on. By simultaneously accounting for structural interaction between sectors and industries, I/O analysis gives expression to the general economic equilibrium systems. The analysis utilizes assumptions based on linear and fixed coefficients and limited substitutions among inputs and outputs. The analysis assumes that average and marginal I/O coefficients are equal. Nonetheless, the framework has been widely accepted and used by economists and policymakers. I/O analysis is useful when carefully executed and interpreted in defining the structure of a region, the interdependencies among industries, and forecasting economic outcomes. The I/O model coefficients describe the structural interdependencies of an economy. From the coefficients, various predictive devices can be computed, which can be useful in analyzing economic changes in a state, region, or county. Multipliers indicate the relationship between some observed change in the economy and the total change in economic activity created through the economy.

MicroIMPLAN is a computer program developed by the United States Forest Service to construct I/O accounts and models (Alward, et al. 1989). Typically, the complexity of I/O modeling has hindered practitioners from constructing models specific to a community requesting an analysis. Too often, inappropriate multipliers have been used to estimate local economic impacts. In contrast, IMPLAN can construct a model for any state, region, county, or zip code area in the United States by using available state, region, county, or zip code data. Impact analysis can be performed once a regional I/O model is constructed.

Five different sets of multipliers are estimated by IMPLAN, corresponding to five measures of regional economic activity: (1) total industry output, (2) personal income, (3) total income, (4) value added, and (5) employment. Three types of multipliers are generated. Type I multipliers measure the impact in terms of direct and indirect effects. Direct impacts are the changes in the activities of the focus industry or firm, such as the operation of the local airport. The focus business changes its purchases inputs as a result of the direct impacts. This produces indirect impacts in other business sectors. However, the total impact of a change in the economy consists of direct, indirect, and induced changes. Both the direct and indirect impacts change the flow of dollars to the state, region, or county's households. Subsequently, the households alter their consumption. The effect of the changes in household consumption on businesses in a community is referred to as an induced effect. To measure the total impact, a Type II multiplier is used. The Type II multiplier compares direct, indirect, and induced effects with the direct effects generated by a change in final demand (the sum of direct, indirect, and induced effects divided by direct effects). IMPLAN also estimates a modified Type II multiplier that also includes the direct, indirect, and induced effects. The Type III multiplier further modifies the induced effect to include spending patterns of households based on a breakdown of households by nine different income groups.

Additional information on the data, methodology, and software requirements of I/O modeling and IMPLAN analysis can be found in guides developed by Doeksen, et al. (1997), Alward, et al., (1989), and the IMPLAN Group, Inc. (2004).