TRENDS IN OCCUPATIONAL FATALITIES AND INDUSTRY GROWTH FOR THE CONSTRUCTION INDUSTRY IN THE UNITED STATES

A Thesis

by

YILDIRIM DOGAN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2010

Major Subject: Construction Management

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Approved by:

Chair of Committee,	Nancy Holland
Committee Members,	Jesse Saginor
	J.Russell Peterson
Head of Department,	Joe Horlen

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ABSTRACT

Trends in Occupational Fatalities and Industry Growth for the Construction Industry in the United States. (May 2010)

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Chair of Advisory Committee: Dr. Nancy Holland

The construction industry is one of the largest industries in the United States and in the world. The U.S. construction industry accounted for 4.5% of the U.S. Gross Domestic Product (GDP) in 2006, and 8% of the workforce. Thus, the relationship between GDP, population, and construction volume could show an impact on the number of construction fatalities. The results of this study showed that an increase in GDP is an indicator of an increase in construction volume as well as an increase in population at the state level. The study also shows that an increase in these variables has led to an increase in construction related work fatalities. The relationship between these four variables and union membership (approximated by each state's right to work laws) was also investigated.

It is concluded that population is a strong predictor of fatalities. Statistically the union states have a lower fatality rate than non-union (right to work) states.

DEDICATION

This thesis is dedicated to my love Gokcen K. Dogan and my baby girl Elif Iraz Dogan.

ACKNOWLEDGEMENTS

Without the help of many people, my education at Texas A&M would not be finished. I would like to thank my committee chair, Dr. Holland, for accepting me in the middle of the semester as a student, and providing guidance and support during the research. I also thank my committee members, Dr. Saginor and Dr. Peterson, for being on my committee and providing me freedom and guidance during the research.

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I also would like to thank my friends at Texas A&M University for sharing good times with me. Finally, thanks to my mother and father for their support and special thanks to my wife for her patience, support, love, and sharing life with me.

NOMENCLATURE

GDP	Gross Domestic Product
BLS	Bureau of Labor Statistics
CPWR	Center to Protect Workers Rights
ETA	Employment &Training Administration
CFOI	Census of Fatal Occupational Injuries
OSHA	Occupational Safety and Health Administration

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1. INTRODUCTION

Construction is one of the most important sectors of industry in the world as well as in the United States. It is considered one of the largest sources of employment in the economy [ETA, 2004]. The volume of the work in the construction industry expanded. This expansion shows higher GDP for the construction industry. Construction accounted for 4.5% of the total Gross Domestic Product (GDP) in 2006, and 3.7% in 1992 which is an increase of 0.8 since 1992 [Bureau of Economic Analysis, 2006]. The GDP has a direct impact on construction industry. The increase in GDP means an increase in the volume of construction. The increase in the volume of construction increases the number of employees. The number of employees increased from 7.7 million in 1995 to 11.2 million in 2005 [CPWR 2007]. The high number of employees in the industry resulted in increased occupational fatalities. The construction fatalities are ranked 3rd in the United States. An average of 1157 people per year workers died in construction industry between 1992 and 2006 [CFOI, 2007]. OSHA was created in 1970 to remediate the high number of occupational injuries and fatalities. The mission of the OSHA is to prevent work related injuries, illnesses and occupational fatalities by enforcing regulations. The number of fatalities also varies region to region in the United States. With respect to labor relations in the U.S.A., the states were divided into two categories as right to work states and non-right to work states.

This thesis follows the style of American Journal of Industrial Medicine.

Of the fifty states, twenty-two are right to work and twenty-eight are non-right to work. The principle of the non-right to work states is to bargain for their employees' rights against the employers. As a work rule non-right to work states' employees can work only at one specific job. But the right to work states' employees can be switched in to different job types by their employers when needed. These two have advantages and disadvantages for the industry. For example, if you switched your employees into different job, he or she might be more capable on different jobs so that contractors can keep them working for a long time. However, this is a disadvantage that may cause an occupational injury or death. According to Bureau of Labor of Statistics, non-right to work states have a higher standard for living, more after tax-income and much more purchasing power. When comparing other industries with the construction industry, it seems that non-right to work states became more popular in relation to higher wage opportunities, will be examined in this research.

One of the tenants of the non-right to work states labor movement has been that there is an increase in construction worker safety as a result of union work organization, negotiation, training and enforcement. Thus, two main factors that affected the growth of the construction industry and the safety of the workforce are an increase in GDP and labor organization. Therefore, the relationship, among GDP, worker safety, and construction worker populations, and non-right to work and right to work membership over time needs to be studied.

2. GOALS AND OBJECTIVES

The goal of this study is to explore the relationships between construction volume, construction GDP, right to work states vs. non-right to work states and occupational fatalities by examining the 1992-2006 data of all U.S states.

To accomplish this goal, this study will:

1. Collect available occupational fatality data from Census of Occupational Fatalities and Injuries database from 1992 to 2006 including detailed reports for each state.

2. Collect available construction industry growth and GDP data from the Bureau of Economic Analysis database from 1992 to 2006 including detailed reports for each state.

3. Explore the relationships between construction industry growth and occupational fatalities by analyzing the data sets.

4. Explore the relationships between right to work states and non-right to work states regarding construction employment growth and construction fatalities.

3. REVIEW OF LITERATURE

Only within the last thirty to forty years construction safety has been a major topic of interest and research on a worldwide basis. The occupational safety and health act were passed in the us congress in 1970. This act provides a vehicle for collecting safety data, creating and enforcing safety regulations and research. Prior to the passage of osha, safety statistics were not required to be collected by contractor, and available statistics are not comparable with that of today. With respect to fatalities in the construction industry in 2005, Italy ranked the highest in the number of construction fatalities followed by Spain and United States. Graphically depicted in figure 1 are the international rankings of construction fatalities for the year 2005.

However, in the ranking of the country fatalities there are concerns about the data sets. Some countries like Finland, Spain, and Switzerland exclude self-employed workers while Australia, Germany, Italy, and United States including all the workers when counting the deaths. In addition, countries have different coverage periods for the work related deaths. For example; Australia, Finland, and Switzerland define the deaths if it occurs within one year. Germany and Spain count the work related deaths if it happens within a month, whereat united States, Italy, Norway have no restrictions [CPWR, 2007].

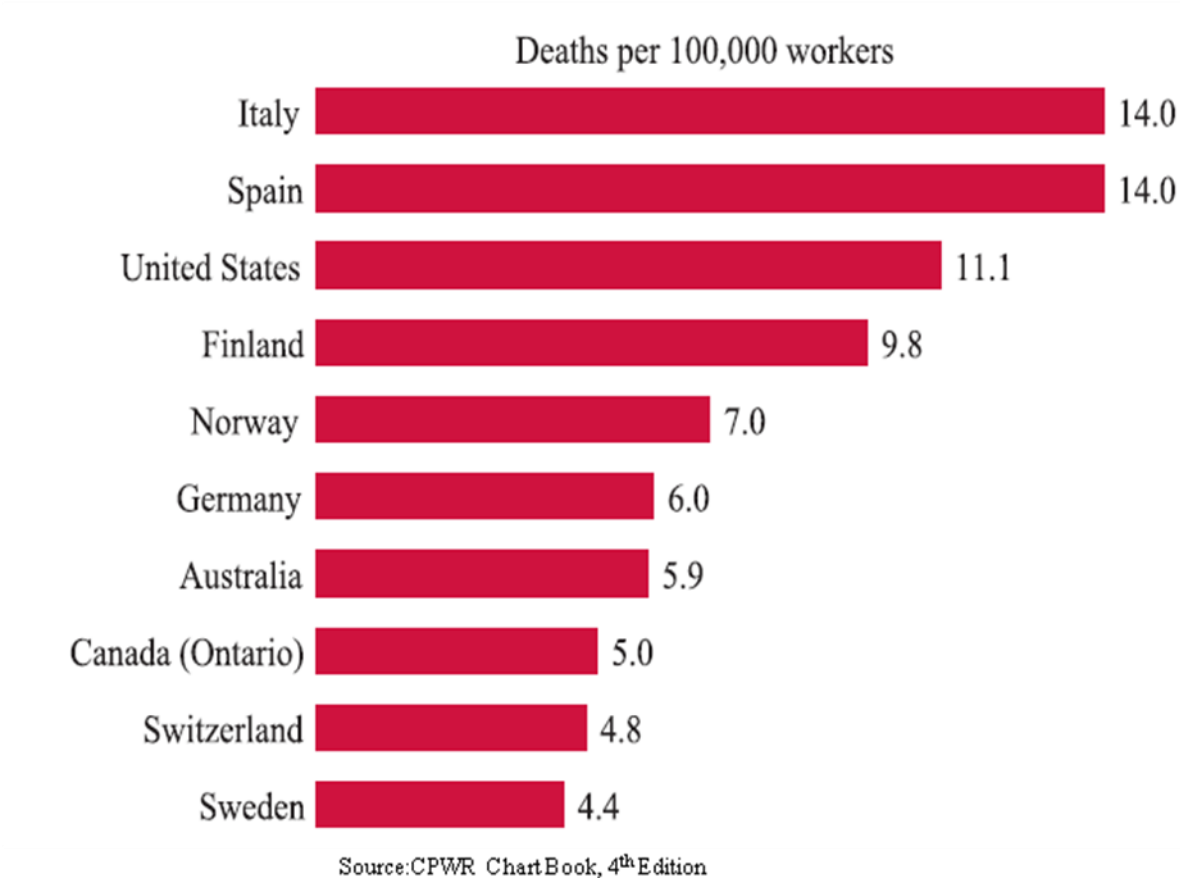


Figure 1: Rate of deaths from injuries in construction industry, selected countries 2005.

In the United States the construction industry accounts for 4.5% of national total gross domestic product (GDP) annually, and it is one of the largest sources of employment in the United States [Lindberg and Monaldo,2008]. Unfortunately, the construction also accounts for a large proportion of work related fatalities. In fact in 2005, the construction industry ranked fourth in the nation with respect to the number of work related fatalities. The construction sector has fewer fatalities than the agriculture,

mining, and transportation sectors. A graphical ranking of U.S. industries and the rate of fatalities per 100,000 full-time employees for 2005 is presented in Figure 2.

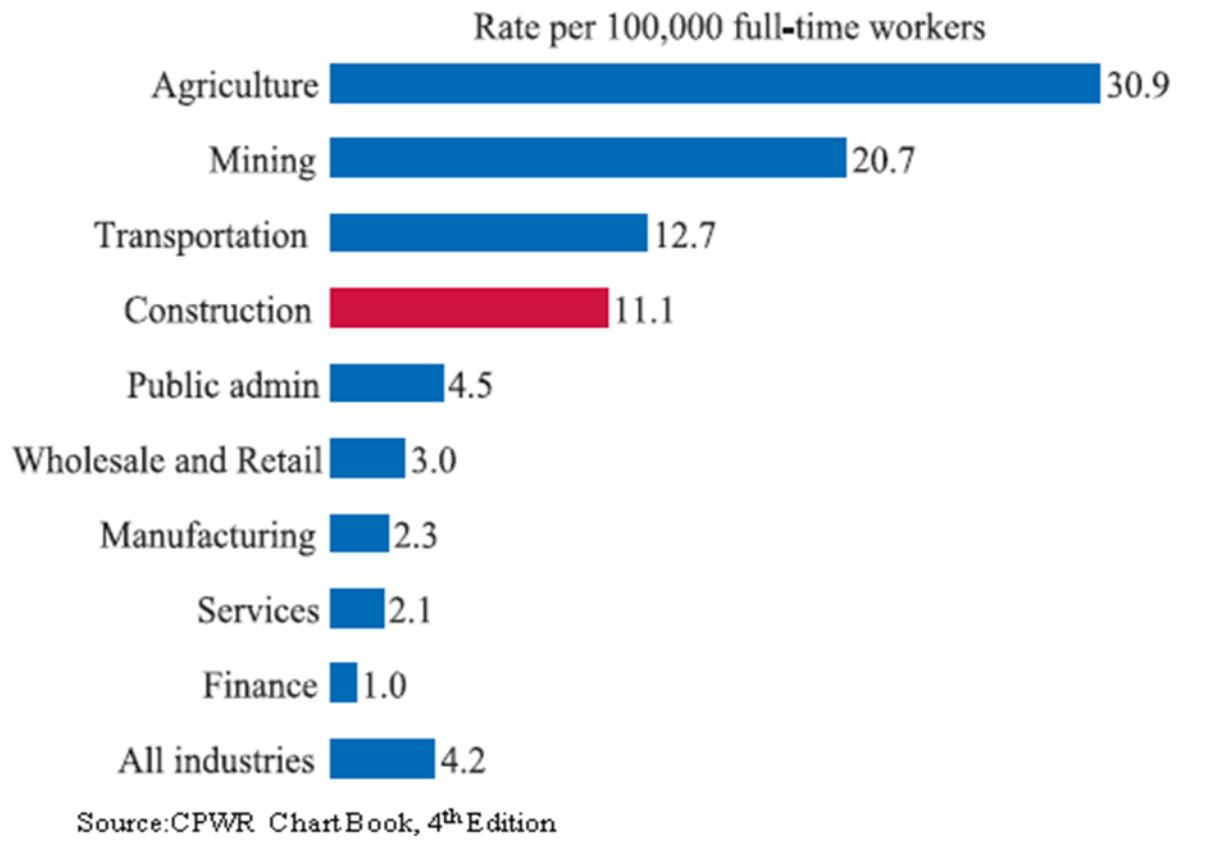
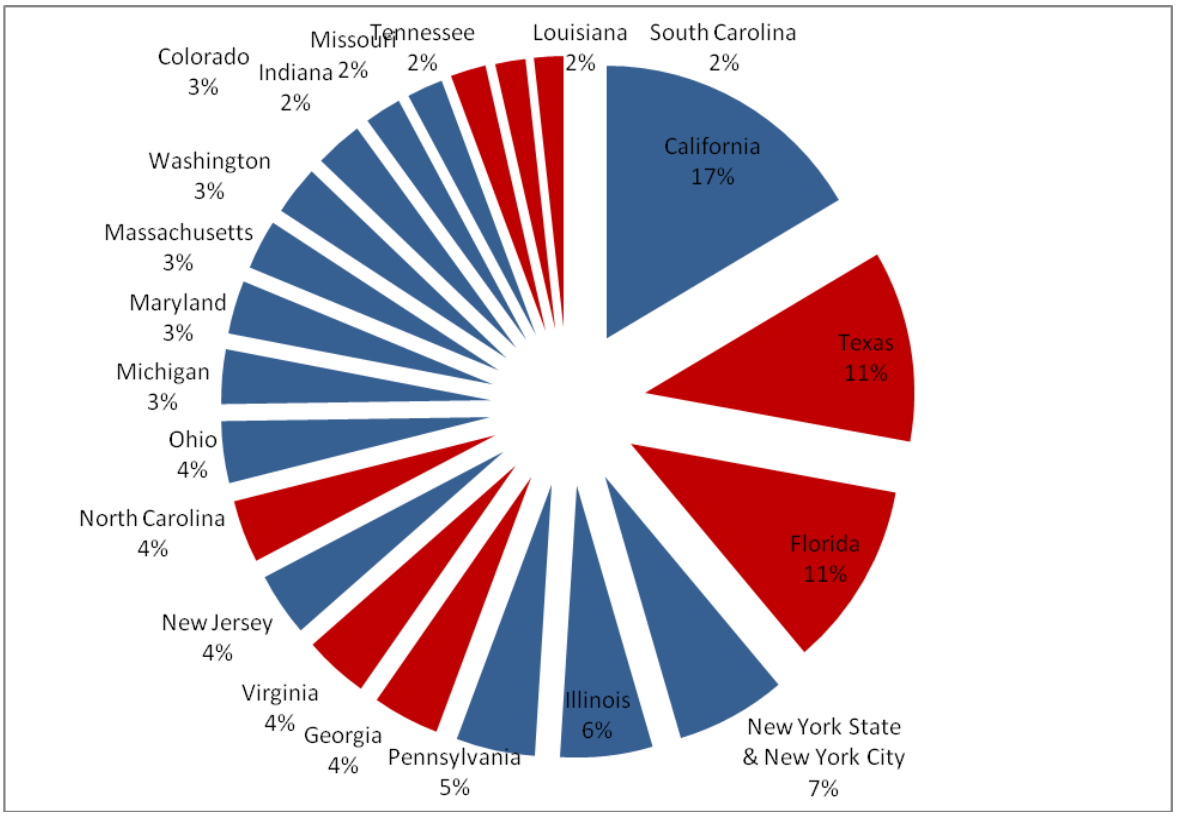


Figure 2: Rate of work related deaths from injuries by major industries, year 2005.

Two of these industries with high fatalities are mining and construction, also rank among the top four industries with respect to economic growth. With respect to economic growth, the top four sectors of the economy are finance, insurance, mining, and construction.

The states are divided into two categories according to the labor relations. In figure 3 the states in blue colors are non-right to work states and the red color ones are right to work states. The percentage distribution shows that 40 percent of the states are right to work states and the rest of them are non-right to work states.



Source: Bureau of Economic Analysis (BEA), 2006

Figure 3: Percent distribution of construction GDP for states in the U.S from 1992 to 2006 period.

3.1 Population Demographics

Construction workers have the largest number of fatal occupational injuries compared to the other workers in different industries in U.S. According to Jackson LL, the largest number of occupational fatalities can be due to the absence of proper job safety training along with the sudden increase in the number of young and inexperienced employees when compared with the previous years. The highest fatal injury rates are young construction workers and workers over 65 years old [Jackson LL, 2001].

The Jackson study was limited to eight years of aggregate data. But in this research the study will be conducted using 15 years data. The study period for this research will include the fifteen years data between 1992 and 2006.

4. METHODOLOGY

The methodology for this study includes three major steps.

4.1 Data Collection

The data on the total population, total occupational fatalities and the gross domestic product (GDP) for construction among all the states in the United States from year 1992 to 2006 will be collected from the various U.S. agencies. These sources of data are shown in Table 1.

Table 1.Sources of Data Collection

Data	**Source**
Total fatalities in construction for all the states in the U.S. from year 1992 to 2006	Census of Fatal Occupational Injuries (CFOI) http://data.bls.gov/GQT/servlet/ProfileState
Gross domestic product for construction in each state in the U.S. from year 1992 to 2006	Gross State Product Database http://bea.gov/bea/regional/gsp
Total population among all the states in the U.S. from year 1992 to 2006	Current population Survey http://www.census.gov/popest/archives

The list of the data like population, occupational fatality and GDP in year 2006 is shown in Table 2. Some of the states data was zero or very low like Maine and District of Colombia. According to the data sets along the years 1992 to 2006 there are not too many changes from the previous years. Because of this less change numbers along the years.

Table 2.Population, Construction GDP, and Construction Fatalities in the United States in 2006.

State	Census 2006 Population	Const. GDP Millions($)	Fatalities in Construction
Alabama	4,599,030	7906	31
Alaska	670,053	1904	3
Arizona	6,166,318	17466	19
Arkansas	2,810,872	4001	16
California	36,457,549	80586	122
Colorado	4,753,377	13915	28
Connecticut	3,504,809	6803	6
Delaware	853,476	2332	4
District of Columbia	581,530	1123	0
Florida	18,089,888	53549	97
Georgia	9,363,941	19546	41
Hawaii	1,285,498	3435	5
Idaho	1,466,465	3204	4
Illinois	12,831,970	27055	35
Indiana	6,313,520	10704	27
Iowa	2,982,085	4976	19
Kansas	2,764,075	4295	13
Kentucky	4,206,074	6004	28
Louisiana	4,287,768	8636	31
Maine	1,321,574	2460	0
Maryland	5,615,727	15464	35
Massachusetts	6,437,193	14444	18
Michigan	10,095,643	15762	33
Minnesota	5,167,101	11042	15
Mississippi	2,910,540	4054	28
Missouri	5,842,713	10560	42
Montana	944,632	2096	6
Nebraska	1,768,331	3179	8
Nevada	2,495,529	11386	18
New Hampshire	1,314,895	2727	3
New Jersey	8,724,560	18456	19
New Mexico	1,954,599	3522	17
New York	19,306,183	32214	67
North Carolina	8,856,505	18144	32
North Dakota	635,867	1214	6

Table 2 Continued.

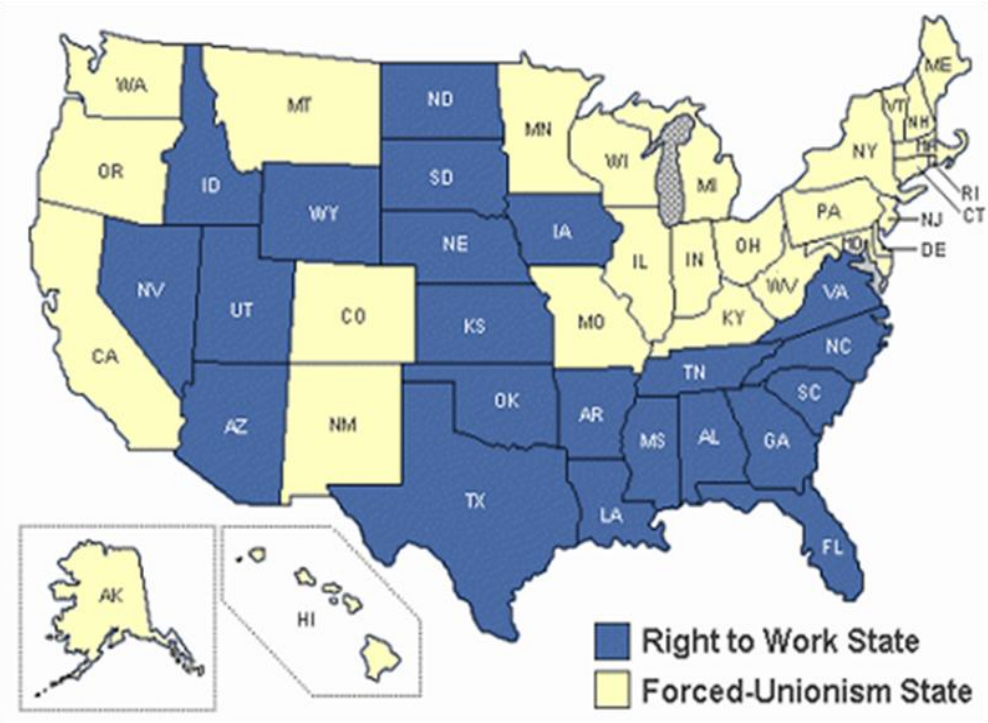
State	Census 2006 Population	Const. GDP Millions($)	Fatalities in Construction
Ohio	11,478,006	17845	37
Oklahoma	3,579,212	4972	17
Oregon	3,700,758	7068	11
Pennsylvania	12,440,621	23132	51
Rhode Island	1,067,610	2259	0
South Carolina	4,321,249	8879	22
South Dakota	781,919	1326	5
Tennessee	6,038,803	10357	22
Texas	23,507,783	55325	134
Utah	2,550,063	6014	15
Vermont	623,908	1284	3
Virginia	7,642,884	18806	36
Washington	6,395,798	14348	24
West Virginia	1,818,470	2477	17
Wisconsin	5,556,506	10068	17
Wyoming	515,004	1706	4

According to the labor relations in the United States, right to work and non-right to work states geographical map is shown in figure 5.According to the map right to work states are located basically on the south, southeast and center(Texas, Florida). Non-right to work states is located on the west, north and northeast (California, New York).For data analysis twenty one states were selected. These states had several parameters in common. First the top twenty five most populous were selected. These states also had the highest GDP of the fifty states and were predominantly the highest in the number of fatalities. Of these four parameters, twenty one had all in common. Of the twenty one, eight were right to work and thirteen were non-right to work. Thus, the states selected were: Texas, California, Florida, New York, Georgia, Illinois, Pennsylvania, North

Carolina, Virginia, Ohio, Michigan, Tennessee, Missouri, New Jersey, Indiana, Louisiana, South Carolina, Colorado, Maryland, Washington, Massachusetts.

The right to work states selected are: Texas, Florida, Georgia, North Carolina, Virginia, Tennessee, South Carolina, and Louisiana.

The non-right to work states selected are: California, New York, Illinois, Pennsylvania, Ohio, Michigan, Missouri, New Jersey, Indiana, Colorado, Maryland, Massachusetts, and Washington.



Source: National Right to Work Legal Defense Foundation web site

Figure 4: Geographical locations of the states according to the labor relations as right to work and non-right to work states for all 50 states in USA.

4.2 Visual Representation of Relationships

While there are all of the states' data are available like population, construction GDP, number of occupational fatalities in construction industry between 1992 and 2006, the data may visually be represented by different types of graphs, charts (Appendix A and Appendix B).In this graphs the relationship between population vs. GDP, GDP vs. fatality, and population vs. fatality one may compare them with their labor relations method. For example in California, the data for each year between population and GDP or population and fatality is constantly increasing. That might be a direct relation between them by visual examination.

In Figure 5, the high number of fatalities represents the largest states like Texas, California, Florida, and New York. These states have the largest population, and GDP. According to these chart there might be some visual conclusion.

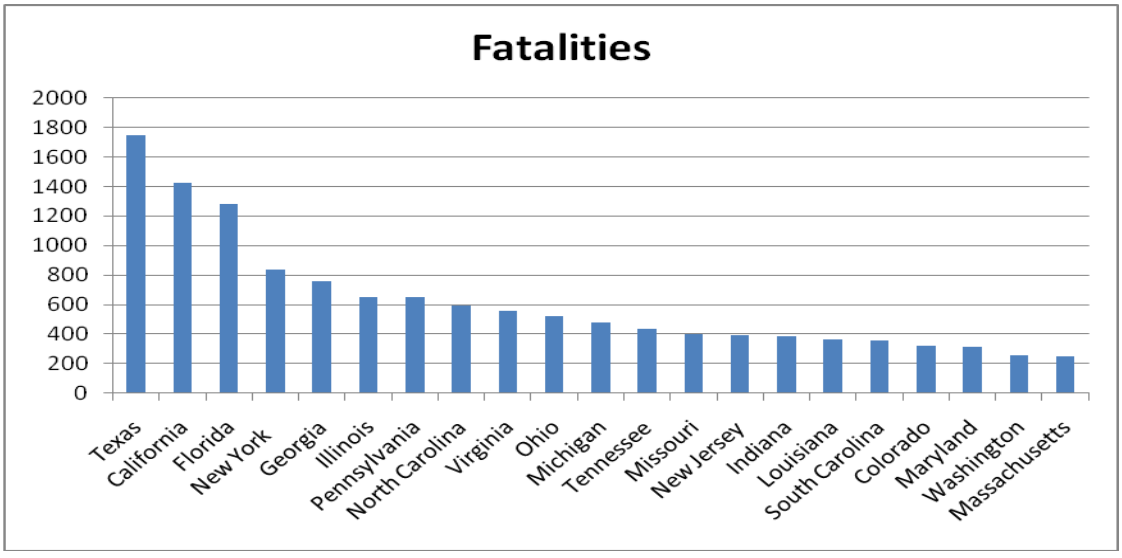


Figure 5: Total number of occupational fatalities in construction industry for states in the U.S from year 1992 to 2006. (Source: Bureau of Labor Statistics, Census of Fatal Occupational Injuries Data).

4.3 Statistical Analysis of the Relationships

The statistical method, Pearson`s Correlation Test, is used for analyzing and comparing the relationships between the data sets of construction GDP, construction volume, and occupational fatalities for each year from 1992 to 2006 in following tables. Pearson's Correlation Test determines the strength of the variables by looking at the Correlation coefficient values. With the significance test, it determines how strong the relationship between the inputted variables is. If the Correlation Coefficient factor is close to +1 or -1 and if the p-value is less than the value at the significance level, there is a strong relationship between the parameters. Analysis of covariance (ANCOVA) was also performed to check the group difference (union vs. non-union) on the dependent variable, fatalities. SPSS statistical software was used to analyze the data sets.

5. RESULTS

According to the results of analysis presented in Table 3, the construction GDP vs. population variables for year 1992 were analyzed and the Pearson's Correlation factor was 0.950 which is very close to 1 and p-value was 0 which is significant at 0.05 levels. Therefore, there is a strong relationship between the construction GDP and population in year 1992.When the results of construction GDP vs. fatalities for year 1994 were analyzed, the Pearson's Correlation factor was 0.853 that is close to 1 and the p-value was 0 which is significant at 0.05 levels, there is a strong relation between construction GDP and population. When the results of fatality vs. population for year 1993 were analyzed, the Pearson's Correlation factor was 0.782 that is close to 1 and the p-value was 0 which is significant at 0.05 levels, and thus, a strong relation between fatality and population.

The construction GDP vs. population variables for year 1998 were analyzed and the Pearson's Correlation factor was 0.968 which is very close to 1 and p-value was 0 which is significant at 0.05 levels, thus a strong relationship exists between the construction gdp and population in year 1998. The results of construction GDP vs. fatalities for year 1999 resulted in a Pearson's Correlation factor was 0.841 that is close to 1 and the p-value was 0 which is significant at 0.05 levels, there is a strong relation between construction GDP and population. When the results of fatality vs. population for year 2000 were analyzed, the Pearson's Correlation factor was 0.735 that is close to 1 and the p-value was 0 which is significant at 0.05 levels, there is a strong relation between fatality and population.

The results to the Pearson Correlation test for years 1992-1994 between GDP, Population, and Fatalities are presented in Table 3.

Table 3. Pearson's Correlation Test between Population, GDP, and Fatalities (1992, 1993, 1994) for 21 States.

		(1)1992	(1)1993	(1)1994	(2)1992	(2)1993	(2)1994	(3)1992	(3)1993	(3)1994
(1)1992	Pearson Correlatio	1	.976**	.977**	.950**	.956**	.956**	.848**	.771**	.796**
	Sig. (2-tailed)		0	0	0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(1)1993	Pearson Correlatio	.976**	1	.976**	.946**	.965**	.965**	.852**	.781**	.829**
	Sig. (2-tailed)	0		0	0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(1)1994	Pearson Correlatio	.977**	.976**	1	.957**	.968**	.968**	.873**	.798**	.853**
	Sig. (2-tailed)	0	0		0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)1992	Pearson Correlatio	.950**	.946**	.957**	1	.993**	.993**	.820**	.751**	.810**
	Sig. (2-tailed)	0	0	0		0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)1993	Pearson Correlatio	.956**	.965**	.968**	.993**	1	1.000**	.859**	.782**	.842**
	Sig. (2-tailed)	0	0	0	0		0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)1994	Pearson Correlatio	.956**	.965**	.968**	.993**	1.000**	1	.859**	.782**	.842**
	Sig. (2-tailed)	0	0	0	0	0		0	0	0
	N	21	21	21	21	21	21	21	21	21
(3)1992	Pearson Correlatio	.848**	.852**	.873**	.820**	.859**	.859**	1	.896**	.939**
	Sig. (2-tailed)	0	0	0	0	0	0		0	0
	N	21	21	21	21	21	21	21	21	21
(3)1993	Pearson Correlatio	.771**	.781**	.798**	.751**	.782**	.782**	.896**	1	.915**
	Sig. (2-tailed)	0	0	0	0	0	0	0		0
	N	21	21	21	21	21	21	21	21	21
(3)1994	Pearson Correlatio	.796**	.829**	.853**	.810**	.842**	.842**	.939**	.915**	1
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	
	N	21	21	21	21	21	21	21	21	21

**. Correlation is significant at the 0.01 level (2-tailed).

(1):GDP
(2):Population
(3):Fatalities

The results to the Pearson correlation test for years 1995-1997 between GDP, Population, and Fatalities are presented in Table 4.

Table 4. Pearson's Correlation Test between Population, GDP, and Fatalities (1995, 1996, 1997) for 21 States.

		(1)1995	(1)1996	(1)1997	(2)1995	(2)1996	(2)1997	(3)1995	(3)1996	(3)1997
(1)1995	Pearson Correlati	1	.977**	.980**	.978**	.978**	.978**	.829**	.871**	.805**
	Sig. (2-tailed)		0	0	0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(1)1996	Pearson Correlati	.977**	1	.986**	.970**	.970**	.970**	.840**	.890**	.833**
	Sig. (2-tailed)	0		0	0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(1)1997	Pearson Correlati	.980**	.986**	1	.969**	.969**	.969**	.844**	.889**	.844**
	Sig. (2-tailed)	0	0		0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)1995	Pearson Correlati	.978**	.970**	.969**	1	1.000**	1.000**	.835**	.875**	.828**
	Sig. (2-tailed)	0	0	0		0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)1996	Pearson Correlati	.978**	.970**	.969**	1.000**	1	1.000**	.835**	.875**	.828**
	Sig. (2-tailed)	0	0	0	0		0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)1997	Pearson Correlati	.978**	.970**	.969**	1.000**	1.000**	1	.835**	.875**	.828**
	Sig. (2-tailed)	0	0	0	0	0		0	0	0
	N	21	21	21	21	21	21	21	21	21
(3)1995	Pearson Correlati	.829**	.840**	.844**	.835**	.835**	.835**	1	.965**	.939**
	Sig. (2-tailed)	0	0	0	0	0	0		0	0
	N	21	21	21	21	21	21	21	21	21
(3)1996	Pearson Correlati	.871**	.890**	.889**	.875**	.875**	.875**	.965**	1	.950**
	Sig. (2-tailed)	0	0	0	0	0	0	0		0
	N	21	21	21	21	21	21	21	21	21
(3)1997	Pearson Correlati	.805**	.833**	.844**	.828**	.828**	.828**	.939**	.950**	1
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	
	N	21	21	21	21	21	21	21	21	21

**. Correlation is significant at the 0.01 level (2-tailed).

The results to the Pearson Correlation Test for years 1998-2000 between GDP, Population, and Fatalities are presented in Table 5.

Table 5. Pearson's Correlation Test between Population, GDP, and Fatalities (1998, 1999, 2000) for 21 States.

		(1)1998	(1)1999	(1)2000	(2)1998	(2)1999	(2)2000	(3)1998	(3)1999	(3)2000
(1)1998	Pearson Correlatio	1	.976**	.980**	.968**	.968**	.954**	.825**	.858**	.794**
	Sig. (2-tailed)		0	0	0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(1)1999	Pearson Correlatio	.976**	1	.987**	.956**	.956**	.941**	.814**	.841**	.784**
	Sig. (2-tailed)	0		0	0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(1)2000	Pearson Correlatio	.980**	.987**	1	.954**	.954**	.946**	.852**	.876**	.820**
	Sig. (2-tailed)	0	0		0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)1998	Pearson Correlatio	.968**	.956**	.954**	1	1.000**	.991**	.783**	.832**	.730**
	Sig. (2-tailed)	0	0	0		0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)1999	Pearson Correlatio	.968**	.956**	.954**	1.000**	1	.991**	.783**	.832**	.730**
	Sig. (2-tailed)	0	0	0	0		0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)2000	Pearson Correlatio	.954**	.941**	.946**	.991**	.991**	1	.790**	.844**	.735**
	Sig. (2-tailed)	0	0	0	0	0		0	0	0
	N	21	21	21	21	21	21	21	21	21
(3)1998	Pearson Correlatio	.825**	.814**	.852**	.783**	.783**	.790**	1	.975**	.977**
	Sig. (2-tailed)	0	0	0	0	0	0		0	0
	N	21	21	21	21	21	21	21	21	21
(3)1999	Pearson Correlatio	.858**	.841**	.876**	.832**	.832**	.844**	.975**	1	.956**
	Sig. (2-tailed)	0	0	0	0	0	0	0		0
	N	21	21	21	21	21	21	21	21	21
(3)2000	Pearson Correlatio	.794**	.784**	.820**	.730**	.730**	.735**	.977**	.956**	1
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	
	N	21	21	21	21	21	21	21	21	21

**. Correlation is significant at the 0.01 level (2-tailed).

The results to the Pearson Correlation Test for years 2001-2003 between GDP, Population, and Fatalities are presented in Table 6.

Table 6. Pearson's Correlation Test between Population, GDP, and Fatalities (2001, 2002, 2003) for 21 States.

		(1)2001	(1)2002	(1)2003	(2)2001	(2)2002	(2)2003	(3)2001	(3)2002	(3)2003
(1)2001	Pearson Correlatio	1	.986**	.973**	.922**	.934**	.934**	.843**	.808**	.888**
	Sig. (2-tailed)		0	0	0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(1)2002	Pearson Correlatio	.986**	1	.986**	.918**	.928**	.928**	.816**	.785**	.872**
	Sig. (2-tailed)	0		0	0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(1)2003	Pearson Correlatio	.973**	.986**	1	.935**	.936**	.936**	.829**	.818**	.895**
	Sig. (2-tailed)	0	0		0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)2001	Pearson Correlatio	.922**	.918**	.935**	1	.994**	.994**	.796**	.780**	.821**
	Sig. (2-tailed)	0	0	0		0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)2002	Pearson Correlatio	.934**	.928**	.936**	.994**	1	1.000**	.810**	.795**	.833**
	Sig. (2-tailed)	0	0	0	0		0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)2003	Pearson Correlatio	.934**	.928**	.936**	.994**	1.000**	1	.810**	.795**	.833**
	Sig. (2-tailed)	0	0	0	0	0		0	0	0
	N	21	21	21	21	21	21	21	21	21
(3)2001	Pearson Correlatio	.843**	.816**	.829**	.796**	.810**	.810**	1	.948**	.961**
	Sig. (2-tailed)	0	0	0	0	0	0		0	0
	N	21	21	21	21	21	21	21	21	21
(3)2002	Pearson Correlatio	.808**	.785**	.818**	.780**	.795**	.795**	.948**	1	.934**
	Sig. (2-tailed)	0	0	0	0	0	0	0		0
	N	21	21	21	21	21	21	21	21	21
(3)2003	Pearson Correlatio	.888**	.872**	.895**	.821**	.833**	.833**	.961**	.934**	1
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	
	N	21	21	21	21	21	21	21	21	21

**. Correlation is significant at the 0.01 level (2-tailed).

The results to the Pearson Correlation Test for years 2004-2006 between GDP, Population, and Fatalities are presented in Table 7.

Table 7. Pearson's Correlation Test between Population, GDP, and Fatalities (2004, 2005, 2006) for 21 States.

		(1)2004	(1)2005	(1)2006	(2)2004	(2)2005	(2)2006	(3)2004	(3)2005	(3)2006
(1)2004	Pearson Correlatio	1	.981**	.982**	.936**	.936**	.953**	.853**	.814**	.863**
	Sig. (2-tailed)		0	0	0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(1)2005	Pearson Correlatio	.981**	1	.994**	.932**	.932**	.948**	.864**	.809**	.850**
	Sig. (2-tailed)	0		0	0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(1)2006	Pearson Correlatio	.982**	.994**	1	.925**	.925**	.941**	.861**	.795**	.838**
	Sig. (2-tailed)	0	0		0	0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)2004	Pearson Correlatio	.936**	.932**	.925**	1	1.000**	.994**	.820**	.771**	.851**
	Sig. (2-tailed)	0	0	0		0	0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)2005	Pearson Correlatio	.936**	.932**	.925**	1.000**	1	.994**	.820**	.771**	.851**
	Sig. (2-tailed)	0	0	0	0		0	0	0	0
	N	21	21	21	21	21	21	21	21	21
(2)2006	Pearson Correlatio	.953**	.948**	.941**	.994**	.994**	1	.843**	.787**	.852**
	Sig. (2-tailed)	0	0	0	0	0		0	0	0
	N	21	21	21	21	21	21	21	21	21
(3)2004	Pearson Correlatio	.853**	.864**	.861**	.820**	.820**	.843**	1	.954**	.909**
	Sig. (2-tailed)	0	0	0	0	0	0		0	0
	N	21	21	21	21	21	21	21	21	21
(3)2005	Pearson Correlatio	.814**	.809**	.795**	.771**	.771**	.787**	.954**	1	.954**
	Sig. (2-tailed)	0	0	0	0	0	0	0		0
	N	21	21	21	21	21	21	21	21	21
(3)2006	Pearson Correlatio	.863**	.850**	.838**	.851**	.851**	.852**	.909**	.954**	1
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	
	N	21	21	21	21	21	21	21	21	21

**. Correlation is significant at the 0.01 level (2-tailed).

According to the results of analysis presented in Table 7, the construction GDP vs. population variables for year 2004 were analyzed and the Pearson's Correlation factor was 0.936 which is very close to 1 and p-value was 0 which is significant at 0.05 level. That results explain that there is a strong relationship between the construction GDP and population in year 2004.When the results of construction GDP vs. fatalities for year 2005 were analyzed, the Pearson's correlation factor was 0.809 that is close to 1 and the p-value was 0 which is significant at 0.05 level, there is a strong relation between construction GDP and population. When the results of fatality vs. population for year 2006 were analyzed, the Pearson's Correlation factor was 0.852 that is close to 1 and the p-value was 0 which is significant at 0.05 levels, there is a strong relation between fatality and population.

The correlation factor values for each comparison are highlighted in each of the tables to aid the reader in identifying the results.

According to the results of analysis presented in Table 8, variables for overall years were analyzed and the Pearson's Correlation factor was for construction GDP vs. population 0.941, for construction GDP vs. fatalities was 0.858, and for fatality vs. population was 0.878 which are very close to 1 and p-values were 0 which is significant at 0.05 levels. These results explain that there is a strong relationship between the construction GDP vs. population, construction GDP vs. fatalities, and fatality vs. population for overall years. As it is seen according to the results along the years 1992-2006; construction fatalities, construction GDP, and fatalities have a strong relationships.

According to the labor relations like right to work and non-right to work states, SPSS is being run to analyze the relationships between population, GDP, and fatalities. The results of analysis presented in Table 9 shows that; population vs. fatalities for right to work states' Correlation factor is 0.954 and p-value is 0, fatalities vs. GDP for non-right to work states' correlation factor is 0.966 and p-value is 0, and population vs. GDP for right to work states' correlation factor is 0.977 and p-value is 0 which are very good .These results show that there is a strong relationship between the parameters in right to work and non-right to work states.

A summary of the cumulative analysis results for years 1992-2006 sixteen years for Pearson Correlation test with respect to GDP, Population, and Fatality are presented in Table 8.The results indicate that these is a direct correlation between GDP, Population, and Fatalities at the 1% level of confidence. The Pearson Correlation factors are highlighted in the table 8.

Table 8. Pearson's Correlation Test between Population, GDP, and Fatalities for 16 Years.

		GDP	POPULATION	FATALITY
GDP	Pearson Correlation	1.000	.941**	.858**
	Sig. (2-tailed)		.000	.000
	N	21	21	21
POPULATION	Pearson Correlation	.941**	1.000	.878**
	Sig. (2-tailed)	.000		.000
	N	21	21	21
FATALITY	Pearson Correlation	.858**	.878**	1.000
	Sig. (2-tailed)	.000	.000	
	N	21	21	21

**. Correlation is significant at the 0.01 level (2-tailed).

The data presented in Table 9 and Table 10 is used to analyze the correlation between right to work and non-right to work states with respect to GDP, Population, and Fatalities. The results indicate that with respect to fatalities the right to work states there is a statistically significant difference, at the 1% level of confidence between right to work and non-right to work states. However, with respect to levels of GDP, There is no statistically significant difference between right to work and non-right to work states.

Table 9. Pearson's Correlation Test between Population, GDP, and Fatalities for 16 Years According to the Labor Relations.

		Population Right to work	Fatality Non-right to work	Population Non-right to work	Fatality Right to work	GDP right to work	GDP Non-right to work
Population right to work	Pearson Correlation	1.000	0.903	0.960	0.954	0.977	0.862
	Sig. (2-tailed)		0.002	0.000	0.000	0.000	0.006
	N	8	8	8	8	8	8
Fatality Non-right to work	Pearson Correlation	0.903	1.000	0.969	0.969	0.849	0.966
	Sig. (2-tailed)	0.002		0.000	0.000	0.008	0.000
	N	8	13	13	8	8	13
Population non-right to work	Pearson Correlation	0.960	0.969	1.000	0.962	0.925	0.945
	Sig. (2-tailed)	0.000	0.000		0.000	0.001	0.000
	N	8	13	13	8	8	13
Fatality right to work	Pearson Correlation	0.954	0.969	0.962	1.000	0.914	0.949
	Sig. (2-tailed)	0.000	0.000	0.000		0.002	0.000
	N	8	8	8	8	8	8
GDP Right to work	Pearson Correlation	0.977	0.849	0.925	0.914	1.000	0.826
	Sig. (2-tailed)	0.000	0.008	0.001	0.002		0.012
	N	8	8	8	8	8	8
GDP non-right to work	Pearson Correlation	0.862	0.966	0.945	0.949	0.826	1.000
	Sig. (2-tailed)	0.006	0.000	0.000	0.000	0.012	
	N	8	13	13	8	8	13

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

To examine the labor relation between the Union and Non-Union states a new dependent variable, Fatality Population (Fat Pop), was defined and declared as a division of fatality by population. Analysis of covariance (ANCOVA) was performed to check the group difference (union vs. non-union) on this dependent variable. Levene's Test of Homogeneity of Variance and Box's M Test of Homogeneity of Covariance revealed no violation of assumptions. Bartlett's test was not considered because it is sensitive to departures from normality as well as heteroscedasticity, so Levene's test was used

instead. GDP as a covariate was tested within the overall ANCOVA to examine its relative contribution to any observed effects on the dependent variable.

GDP (F (1, 18) = 3.844, $p > .05$) did not account for a statistically significant proportion of the variance; therefore, it was not considered as a covariate in the model, but examination of univariate ANOVA (see Table 10) yielded statistically significant dependent measure, Fat Pop, among the two group levels (F (1, 19) = 39.321, $p < .001$).

Table 10. Univariate and Descriptive Analysis Results for Group on a Dependent Measure
*$p < .05$.

States	N	F(1, 19)	Mean	Std. Dev.
Non-Union	8		.000075749	.0000063101
Union	13	39.321*	.000050361	.0000102619
Total	21		.000060032	.0000153859

6. CONCLUSION AND DISCUSSION

Construction is an important industry that has a direct effect on the United States economy. The volume of the construction industry in United States can be expressed by construction GDP. Because of the construction activity it counts for the largest number of employees. A large number of employees mean a large number of occupational safety incidents. The rank in occupational fatalities compared with other industries is third in United States. That rate varies according to the states. There are two types of employment statues in United States. These are right to work and non-right to work states. Twenty two of the fifty states are right to work states and the remaining twenty eight are non-right to work states. But in our analyze data there were 8 right to work states out of 22 were selected in our data .Overall this represents 37 %, and there were 13 non-right to work states out of 28 were fallen which represents 46 % overall of our analyze data.

According to the results from the statistical analyze tables there is a strong relation between construction gdp, construction volume, and occupational fatalities along with the right to work states and non-right to work states. When the population and construction gdp compared along with the years, it can be said that there is a positive direct relation, and when population and fatalities are compared it can also be said that there is a positive relation between population and fatalities. Therefore, population is a strong predictor of fatalities. As concluded for the analysis of the data presented in Table 10, one can conclude that statistically the union states have a lower fatality rate than non-union (Right to work) states. In addition it is apparent that union states also have a

higher wage rate and thus, a higher standard for living, but in many union states GDP is lower for this group and thus, the overall wages on an annual basis many indeed be lower.

In addition, the higher fatality rate in right to work states may be increased due to the employees switching from other segments of the economy when jobs are hard to find and working in construction industry as unskilled workers. They possibly range from unskilled workers, lack of safety training, a lack of safety standard enforcement, and an increase in young and older employees. In addition, the increased number of recent immigrants with limited English language skills could also play a role in the increased fatality rates nationwide.

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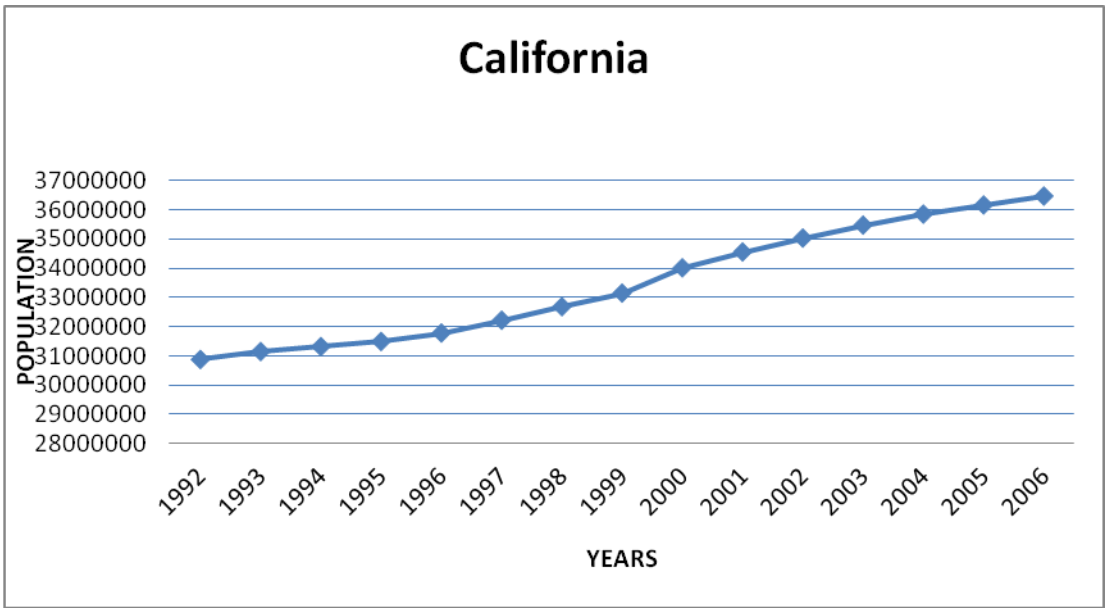
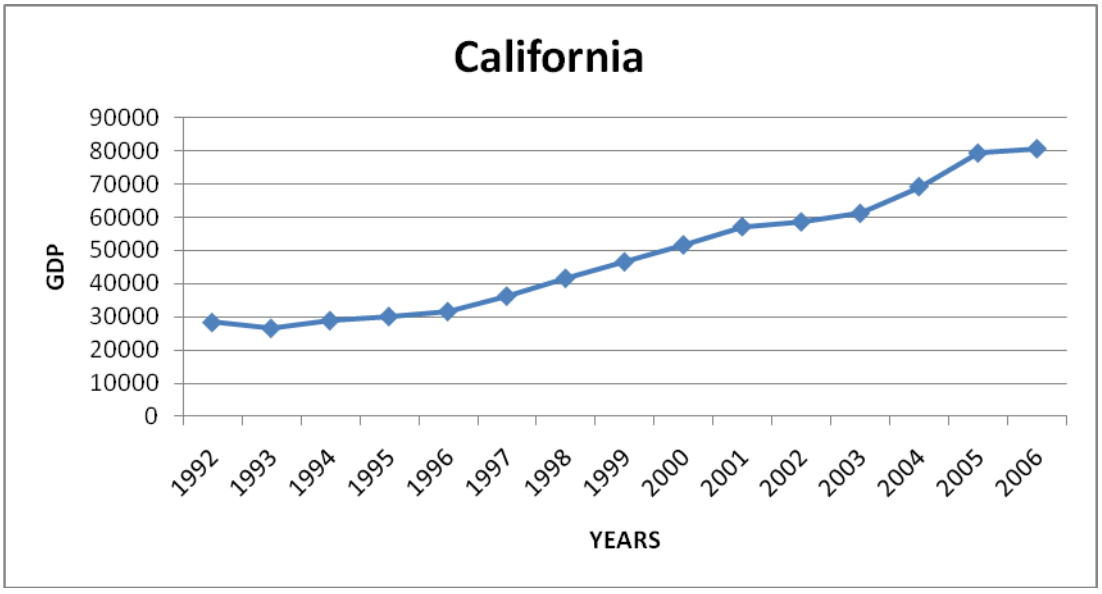
APPENDIX A

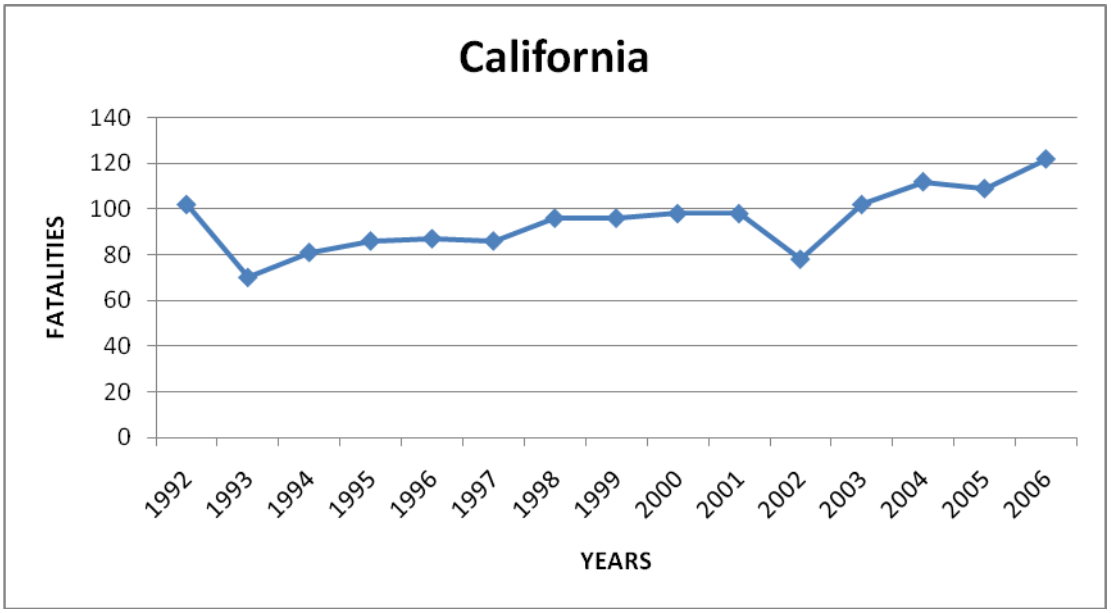
GRAPHS FOR POPULATION, CONSTRUCTION GDP, AND OCCUPATIONAL FATALITIES IN NON-RIGHT TO WORK STATES



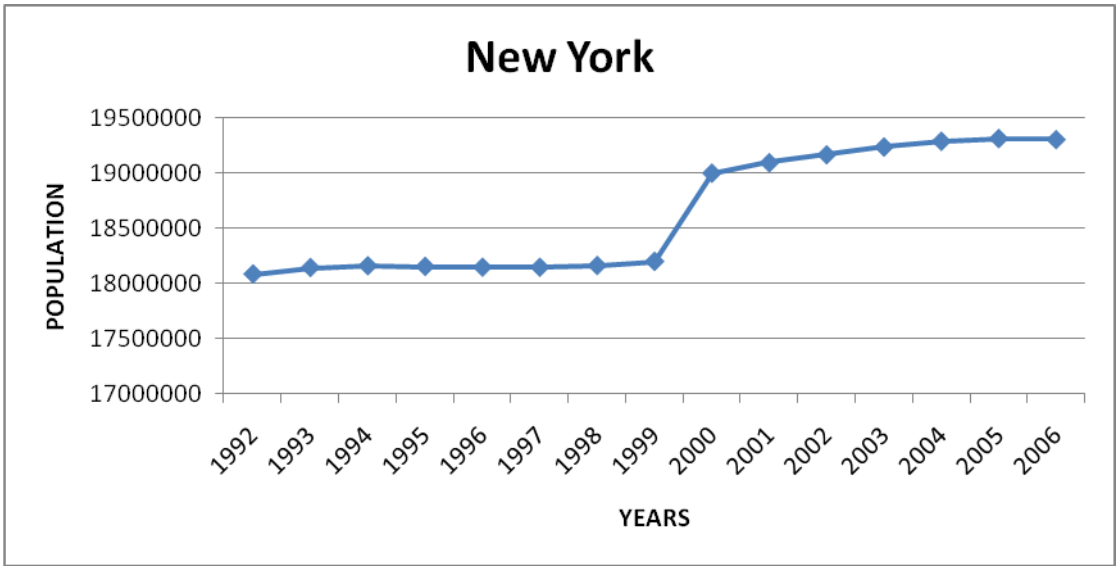
Population Change in years (1992-2006) in California.



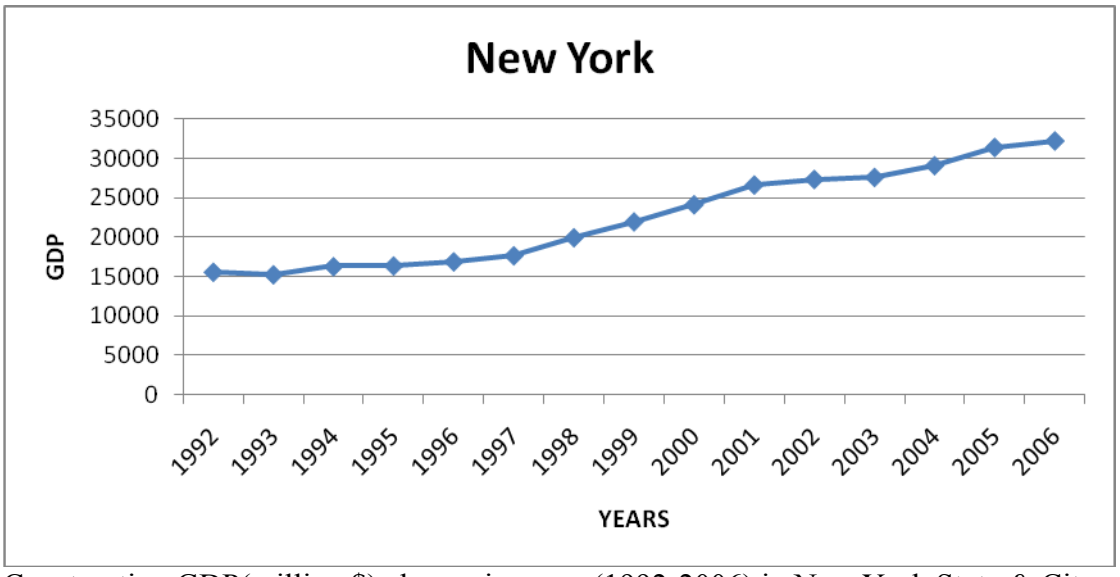
Construction GDP (million $) change in years (1992-2006) in California.



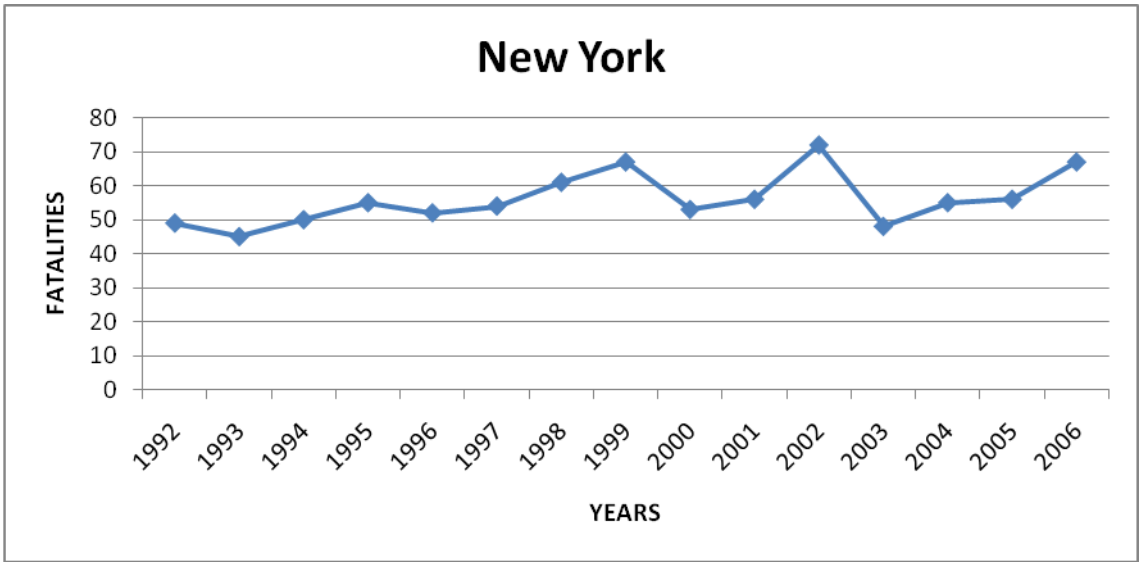
Occupational Fatality Change in years (1992-2006) in California.



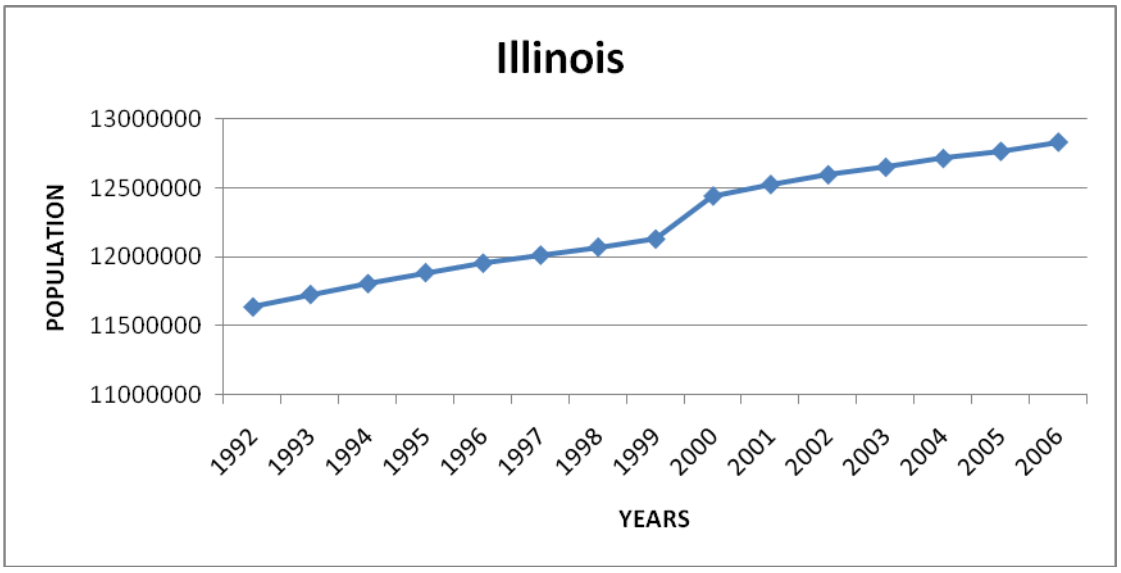
Population Change in years (1992-2006) in New York State & City.



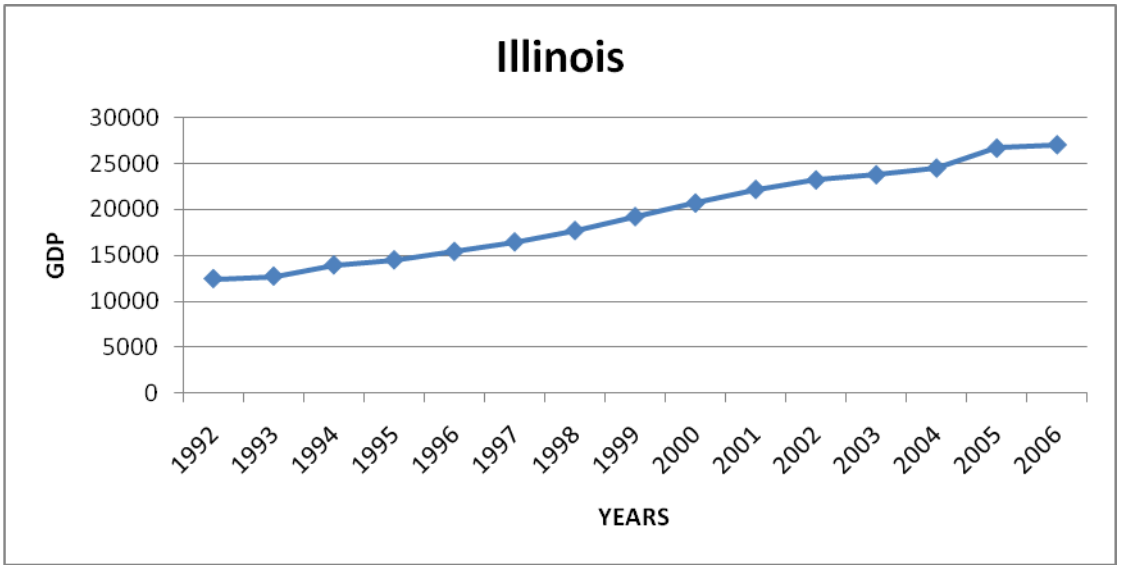
Construction GDP(million $) change in years (1992-2006) in New York State & City.



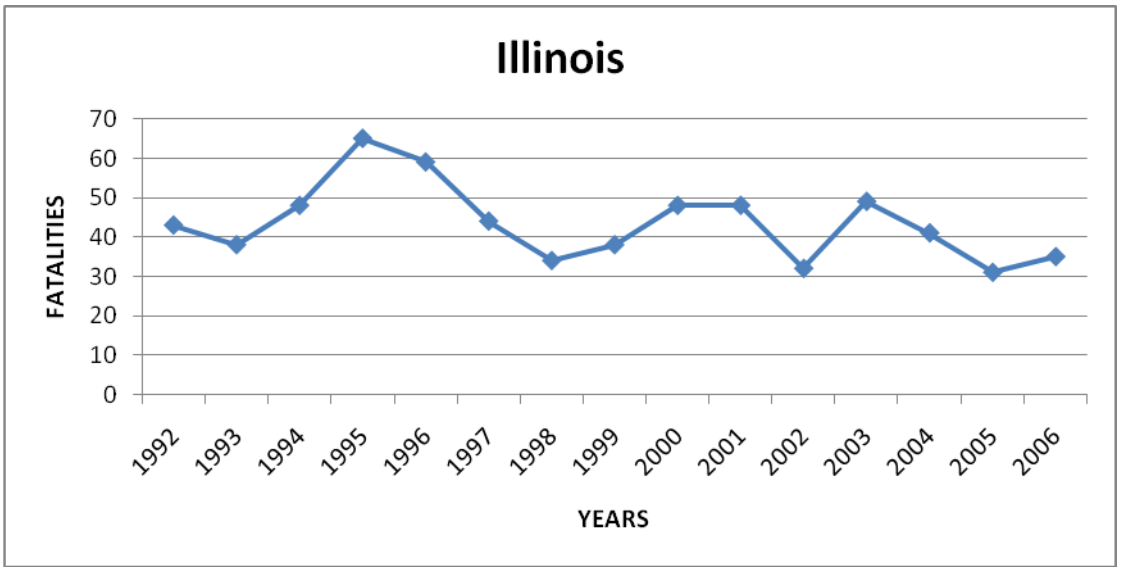
Occupational Fatality Change in years (1992-2006) in New York State & City.



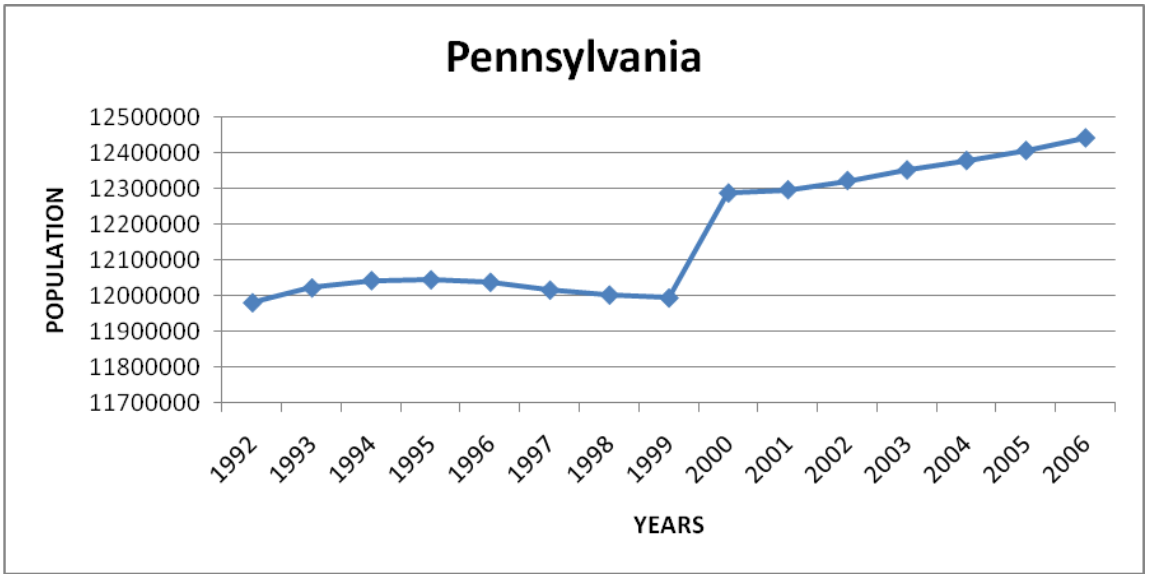
Population Change in years (1992-2006) in Illinois.



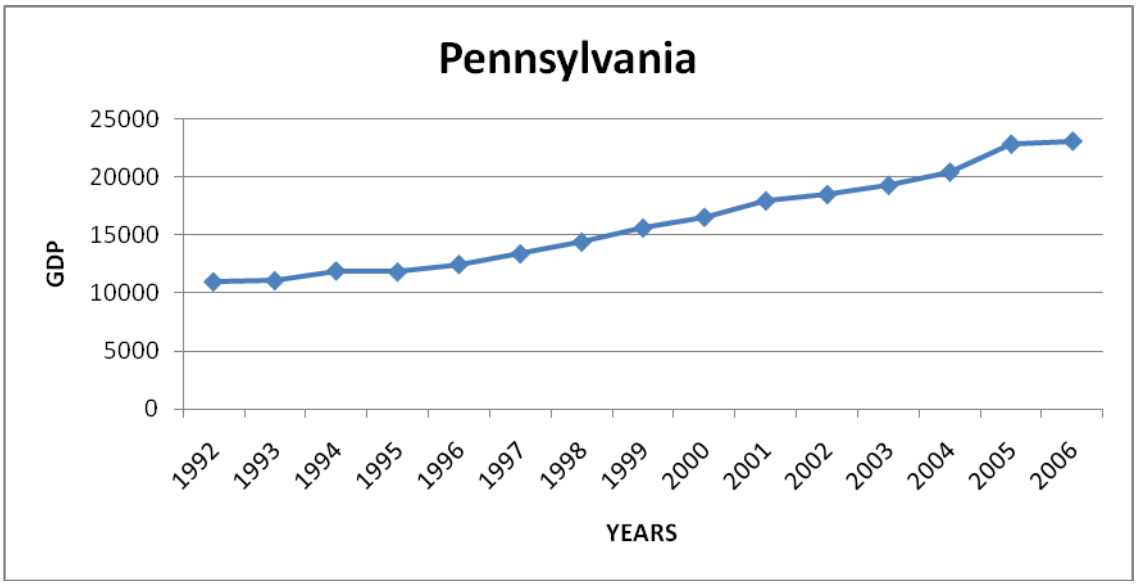
Construction GDP(million $) change in years (1992-2006) in Illinois.



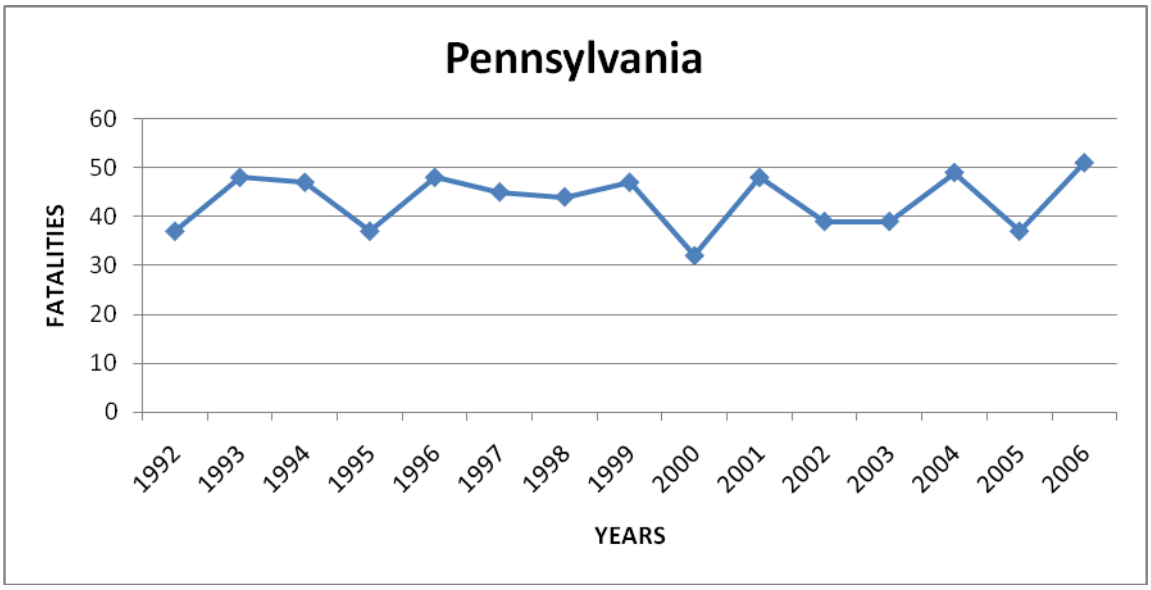
Occupational Fatality Change in years (1992-2006) in Illinois.



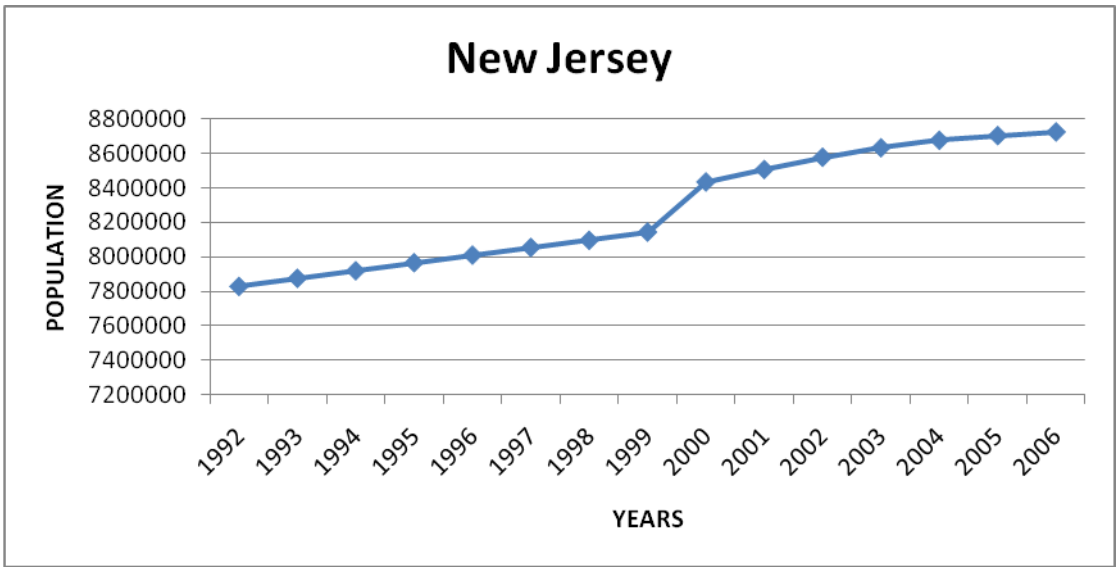
Population Change in years (1992-2006) in Pennsylvania.



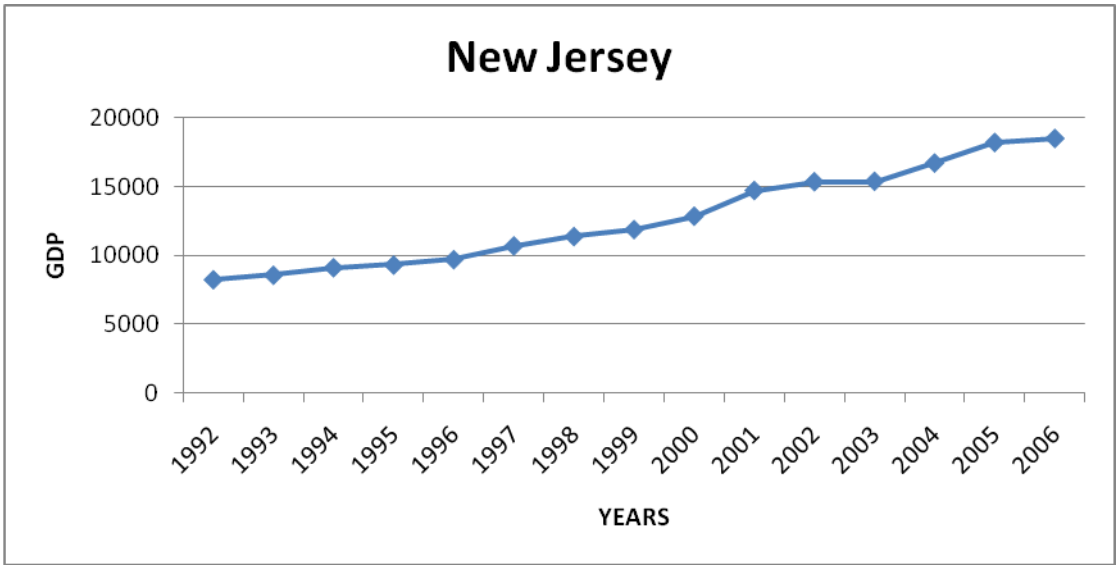
Construction GDP(million $) change in years (1992-2006) in Pennsylvania.



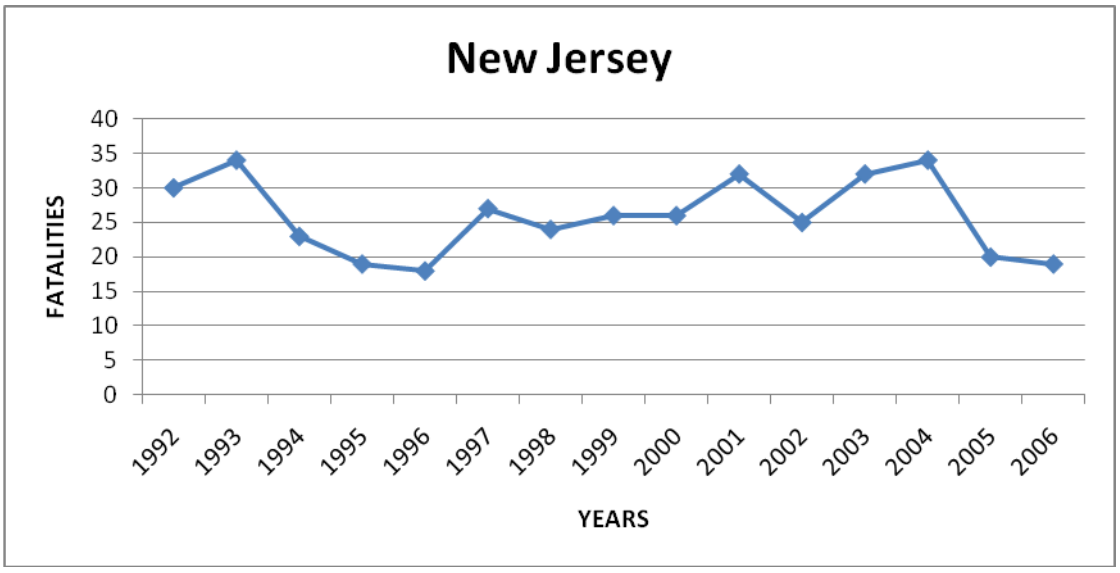
Occupational Fatality Change in years (1992-2006) in Pennsylvania.



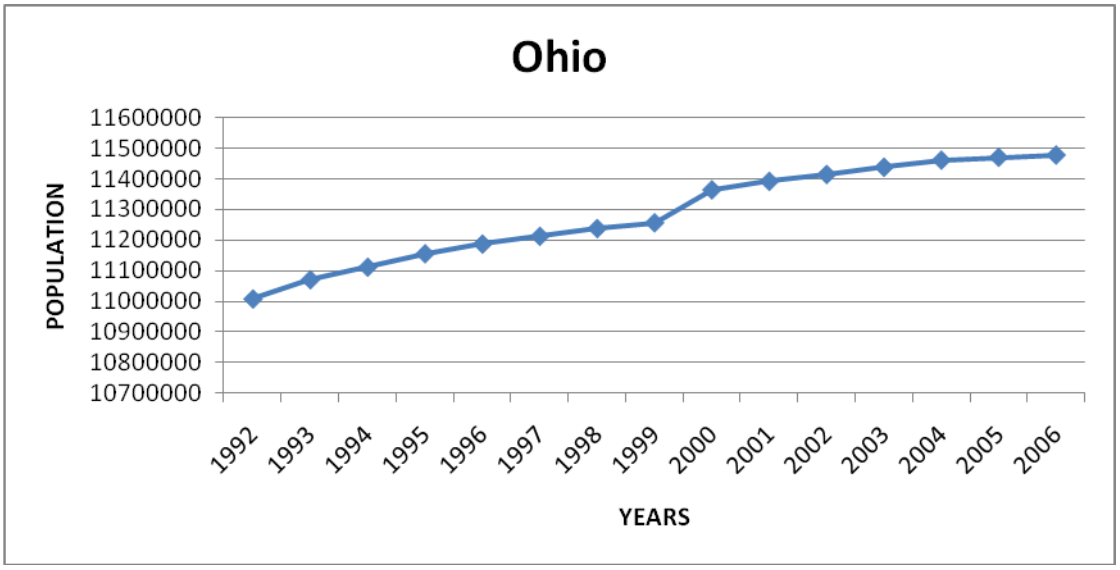
Population Change in years (1992-2006) in New Jersey.



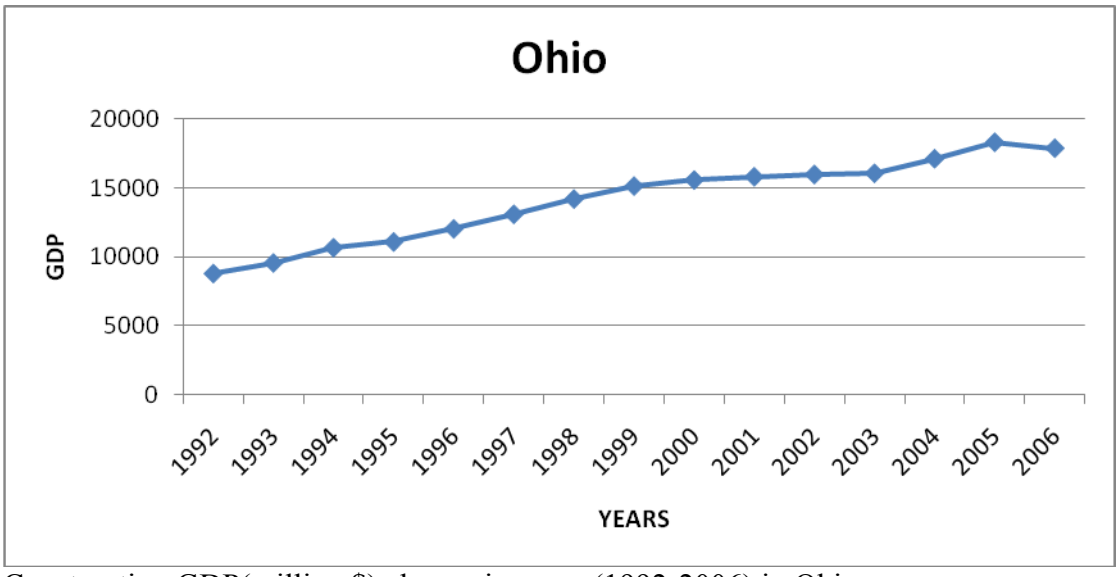
Construction GDP(million $) change in years (1992-2006) in New Jersey.



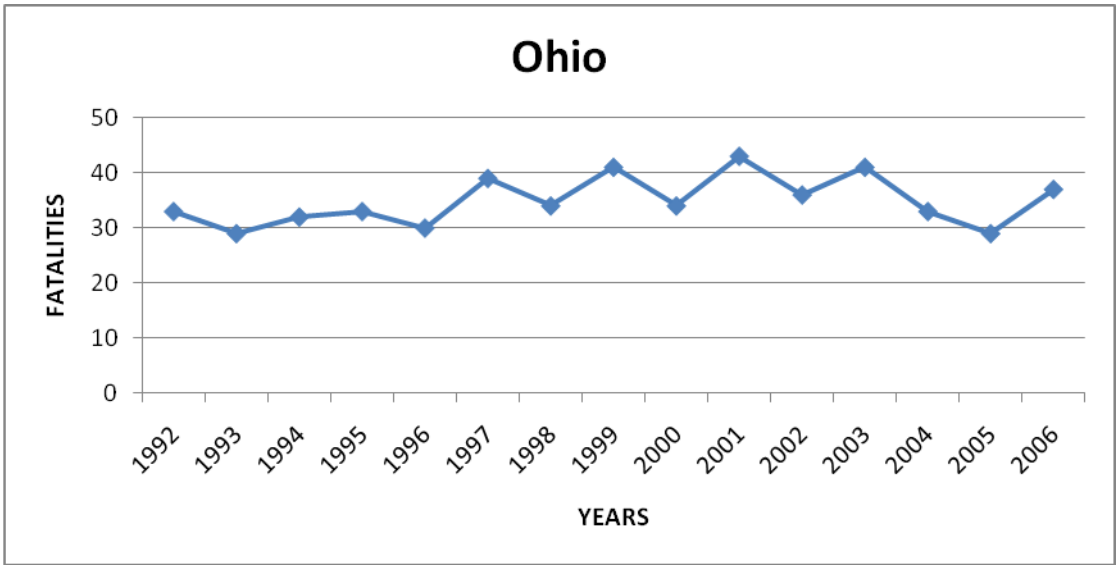
Occupational Fatality Change in years (1992-2006) in New Jersey.



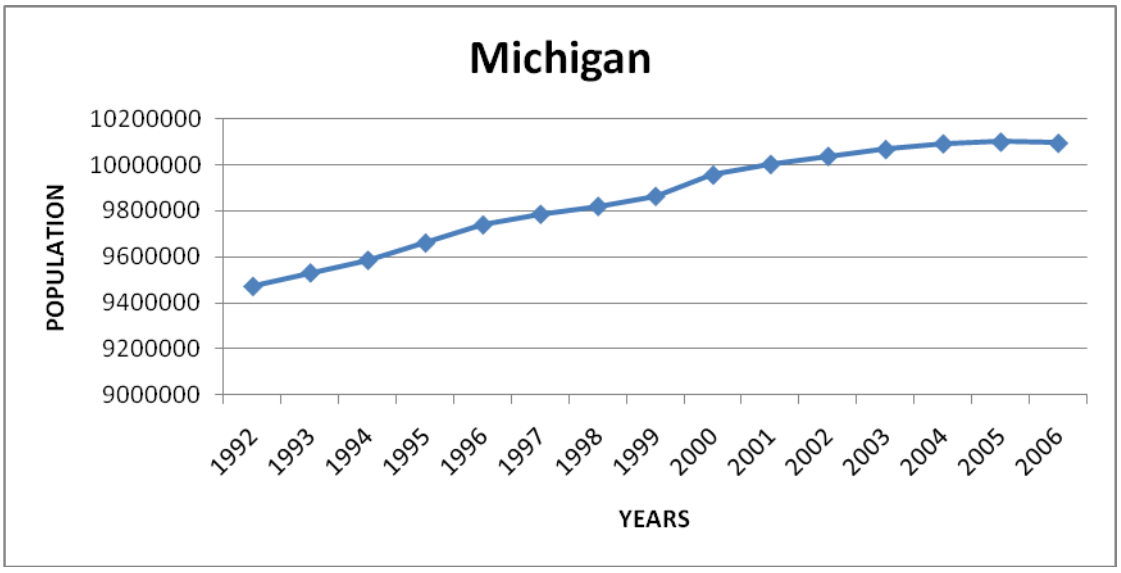
Population Change in years (1992-2006) in Ohio.



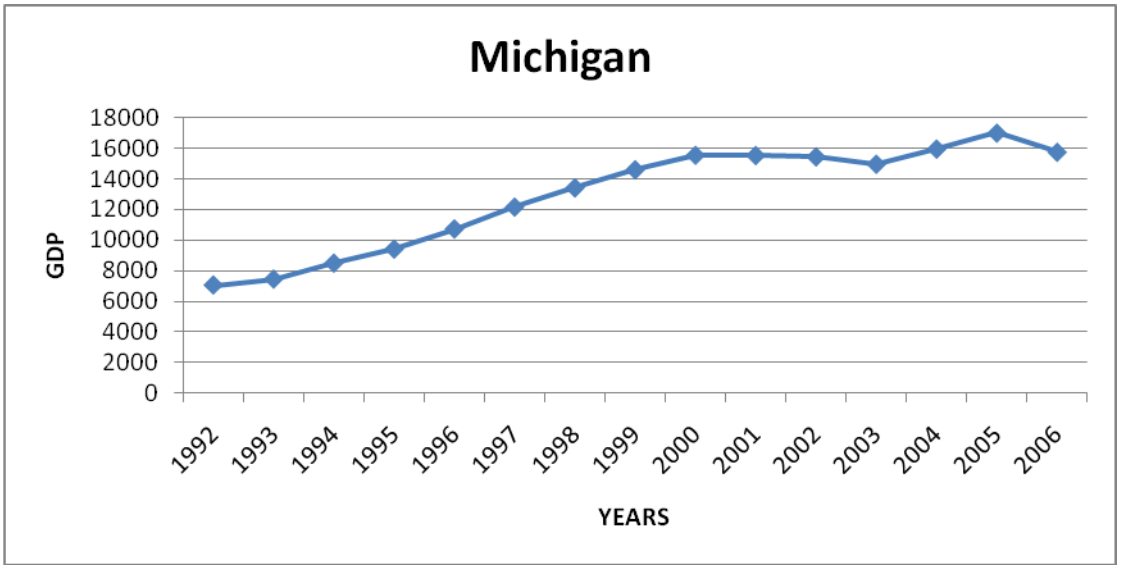
Construction GDP(million $) change in years (1992-2006) in Ohio.



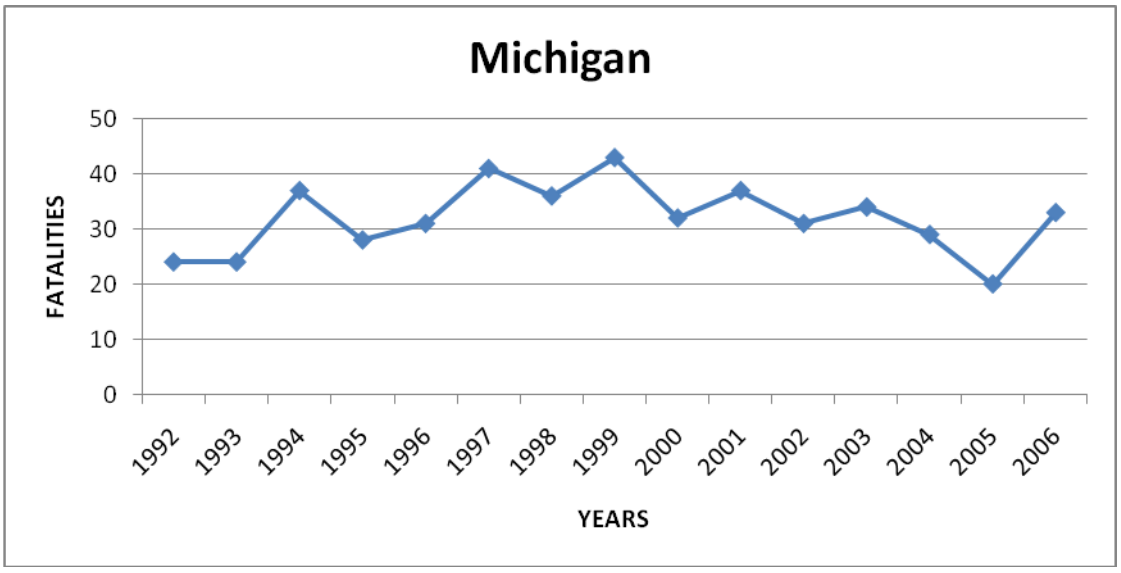
Occupational Fatality Change in years (1992-2006) in Ohio.



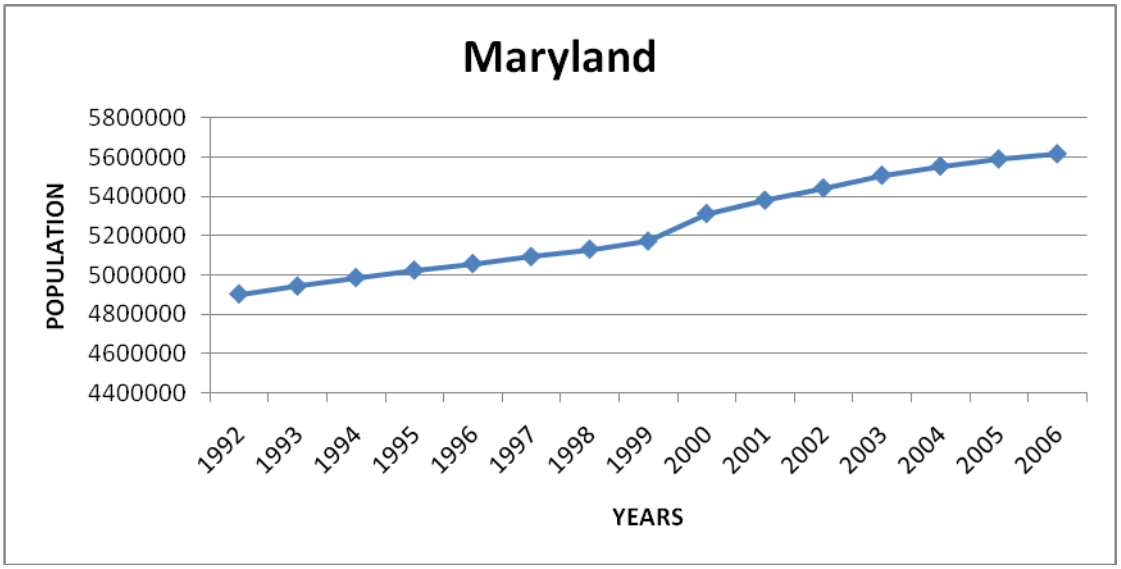
Population Change in years (1992-2006) in Michigan.



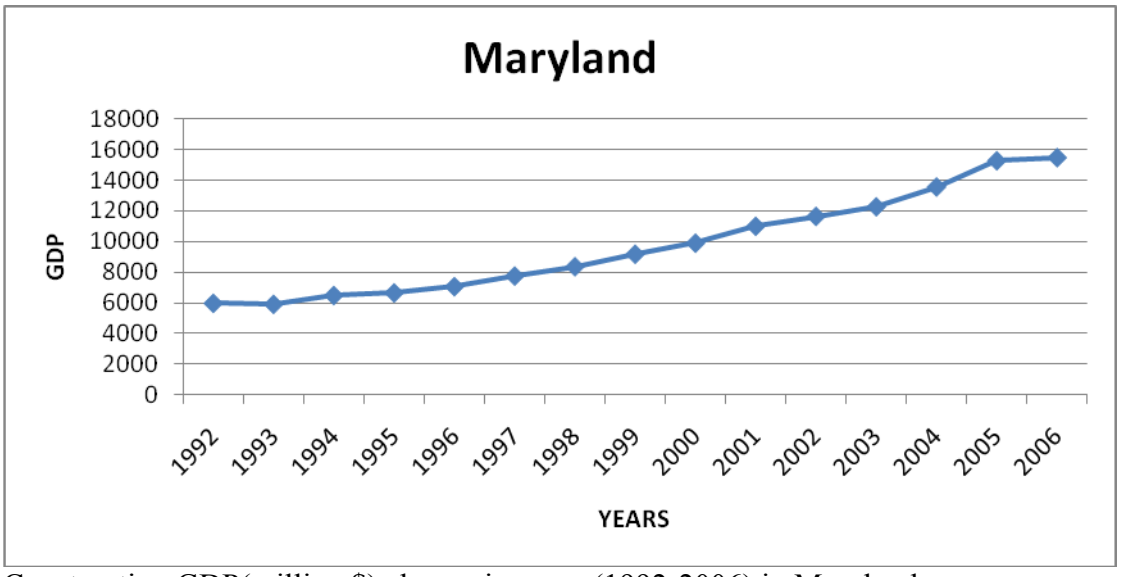
Construction GDP(million $) change in years (1992-2006) in Michigan.



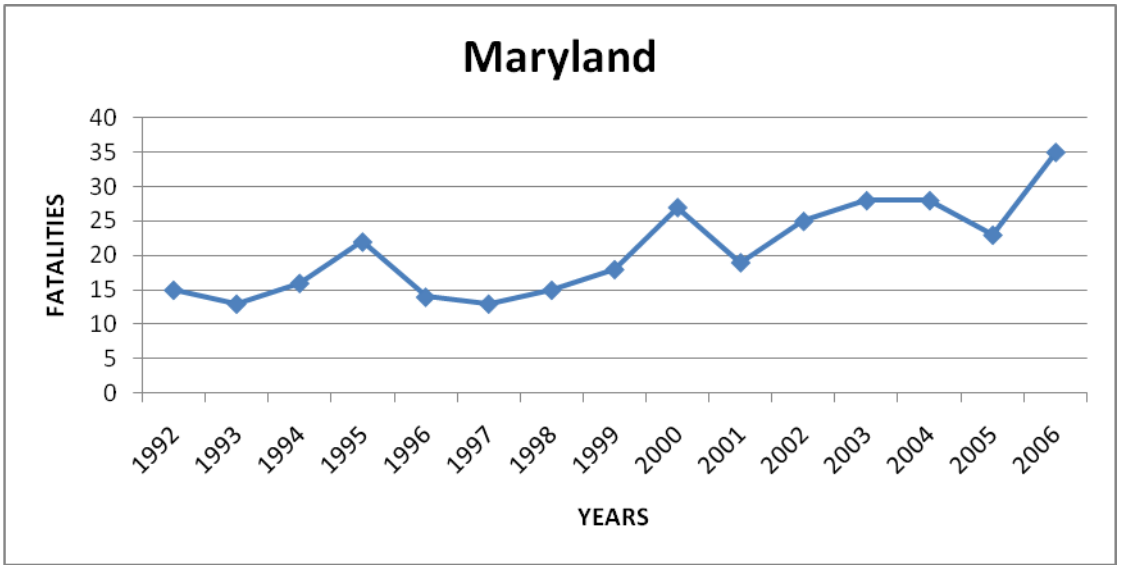
Occupational Fatality Change in years (1992-2006) in Michigan.



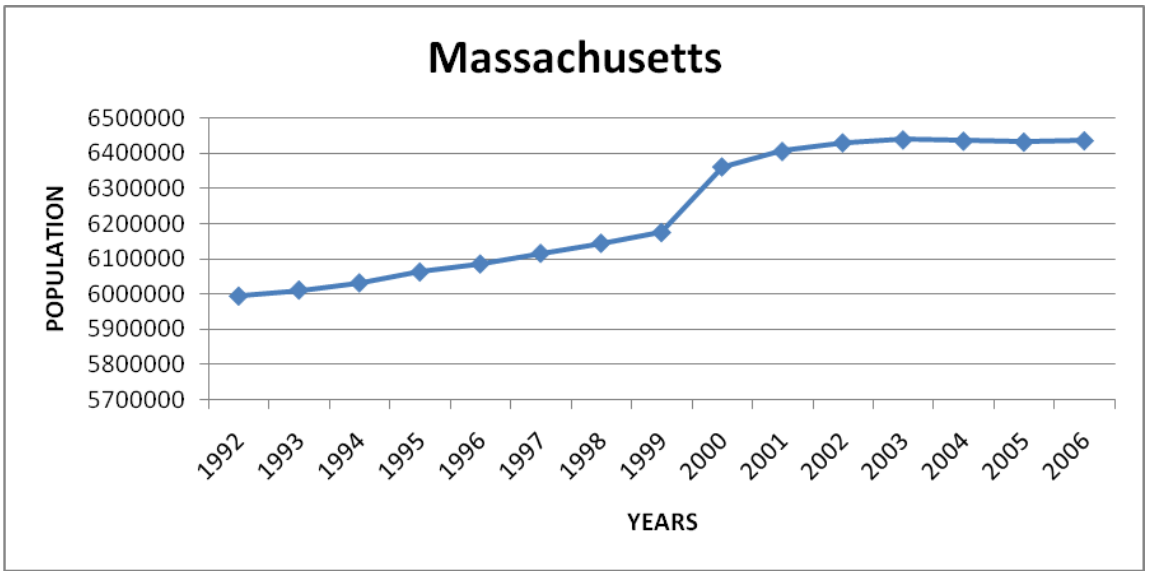
Population Change in years (1992-2006) in Maryland.



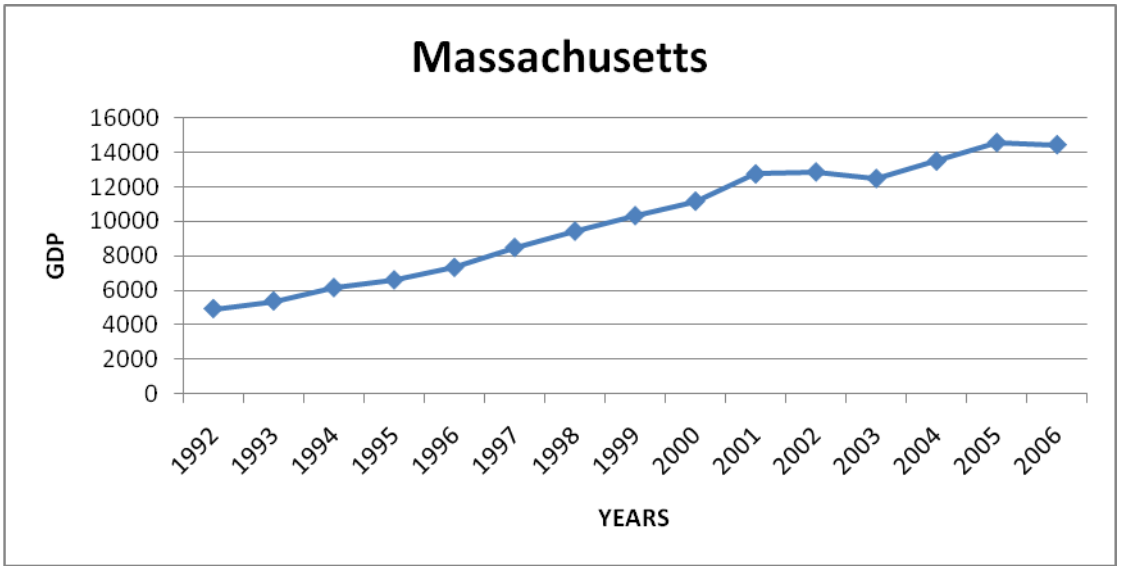
Construction GDP(million $) change in years (1992-2006) in Maryland.



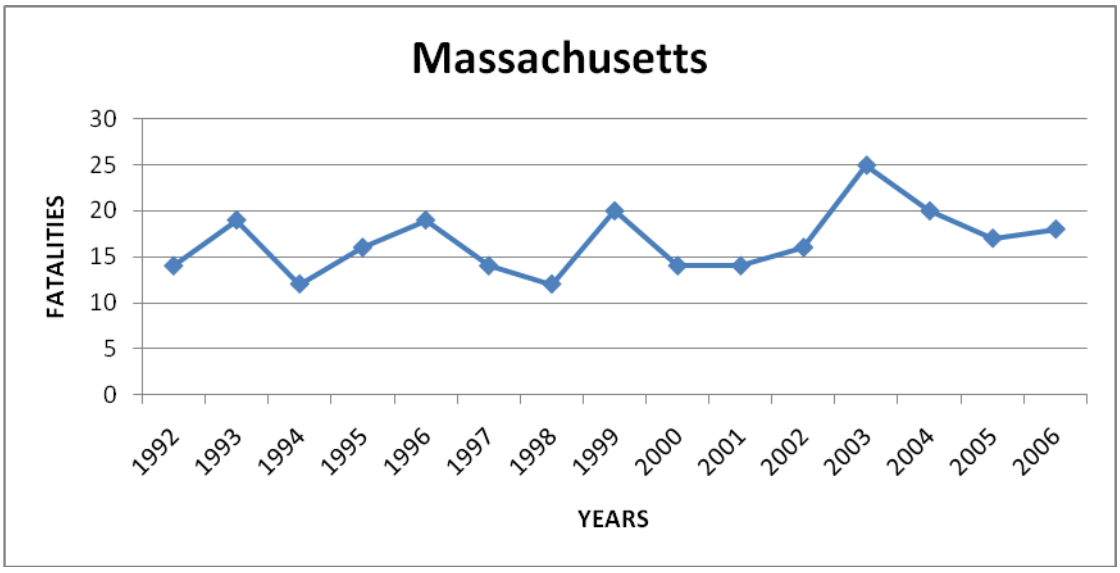
Occupational Fatality Change in years (1992-2006) in Maryland.



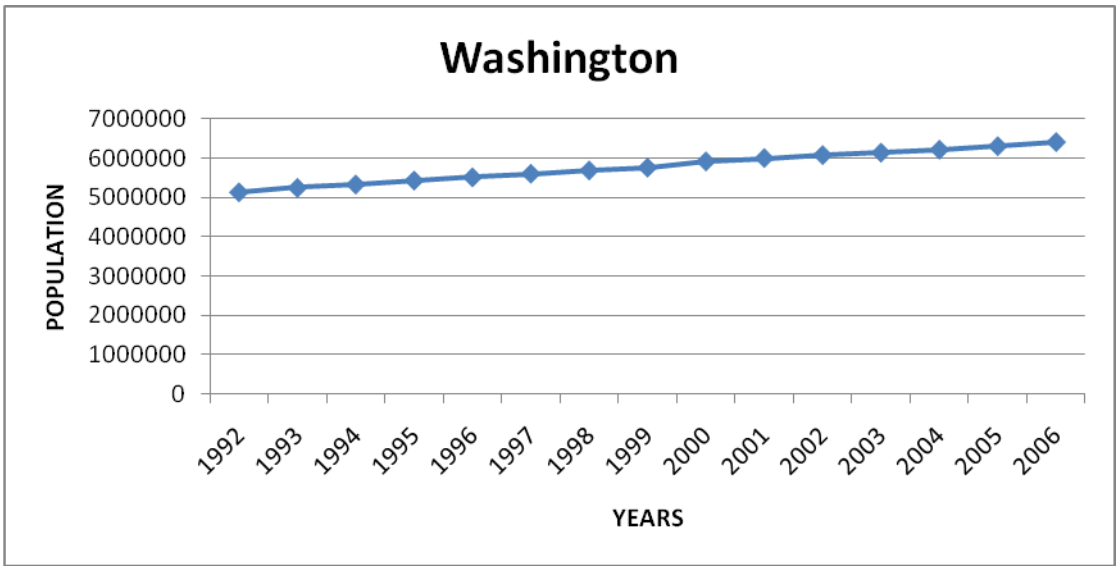
Population Change in years (1992-2006) in Massachusetts.



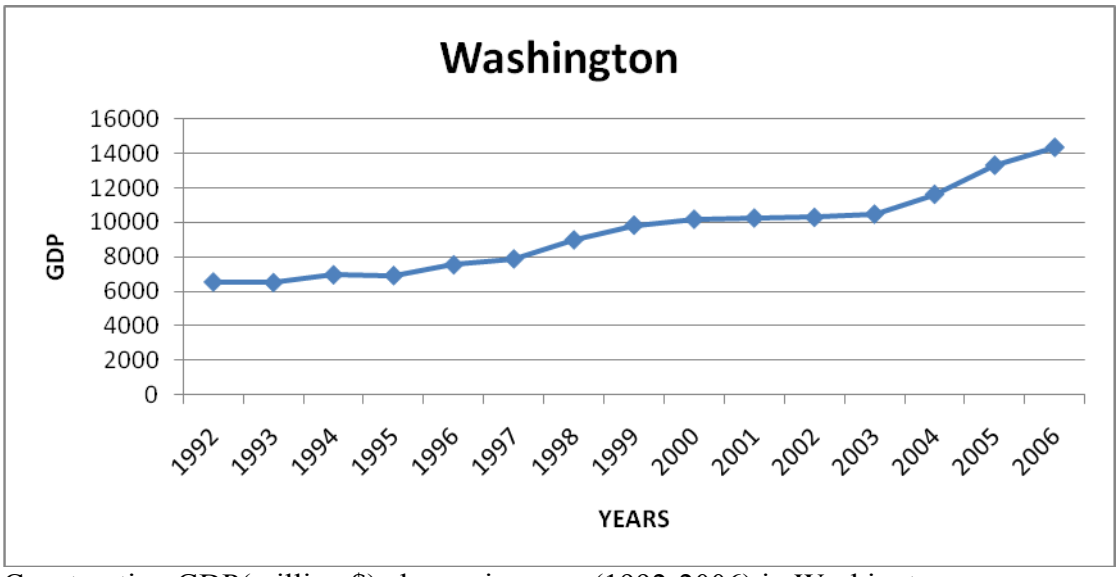
Construction GDP(million $) change in years (1992-2006) in Massachusetts.



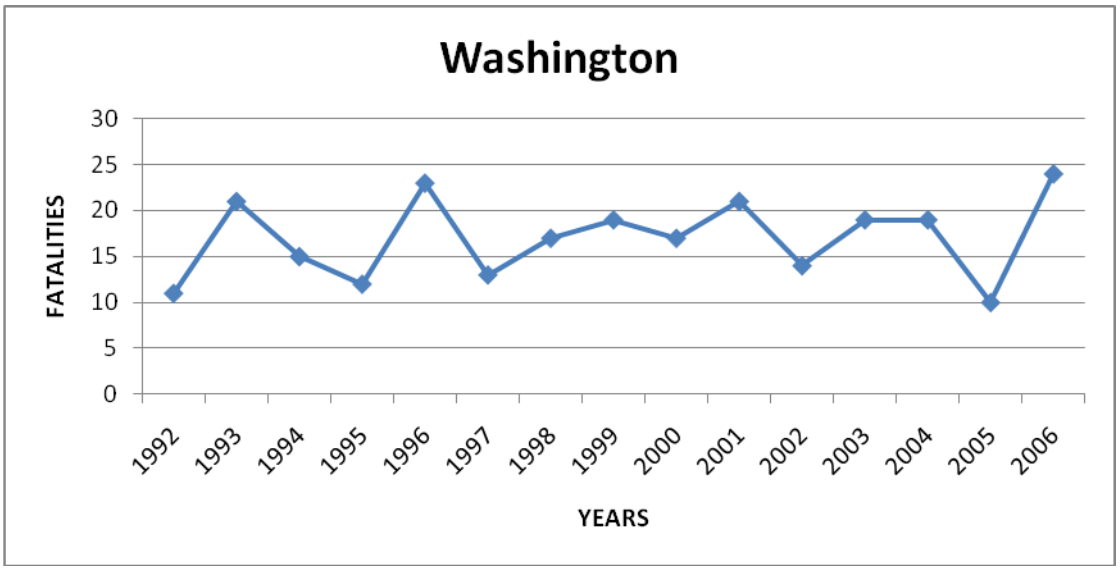
Occupational Fatality Change in years (1992-2006) in Massachusetts.



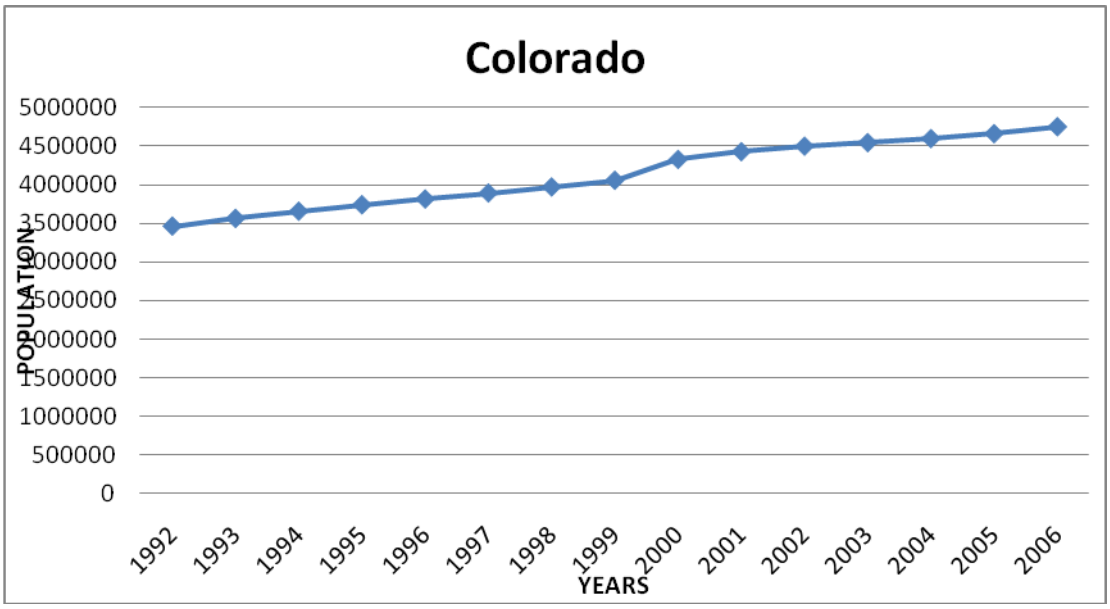
Population Change in years (1992-2006) in Washington.



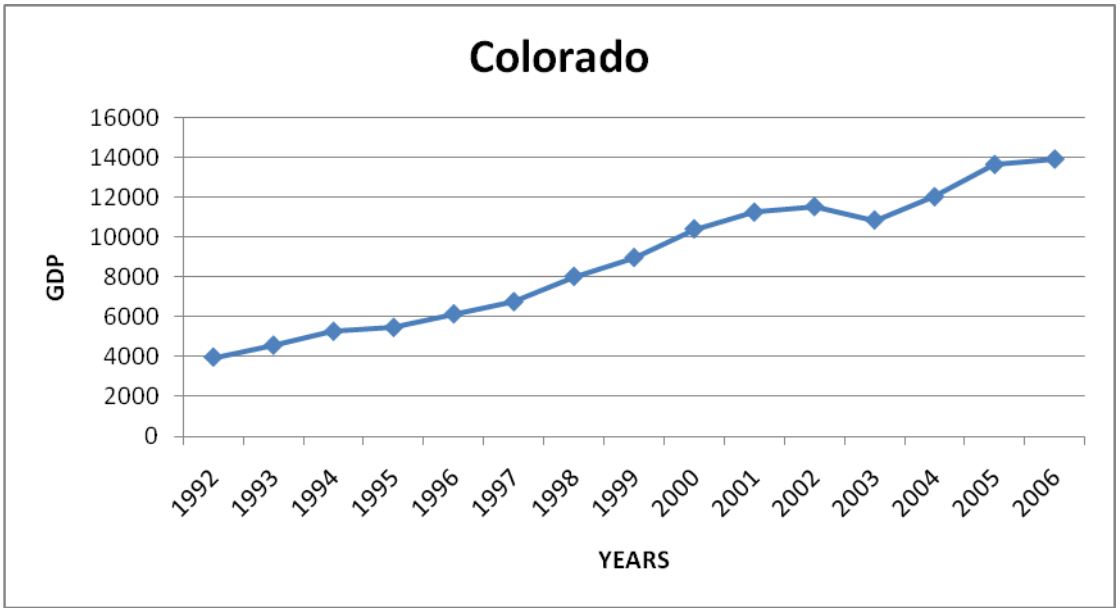
Construction GDP(million $) change in years (1992-2006) in Washington.



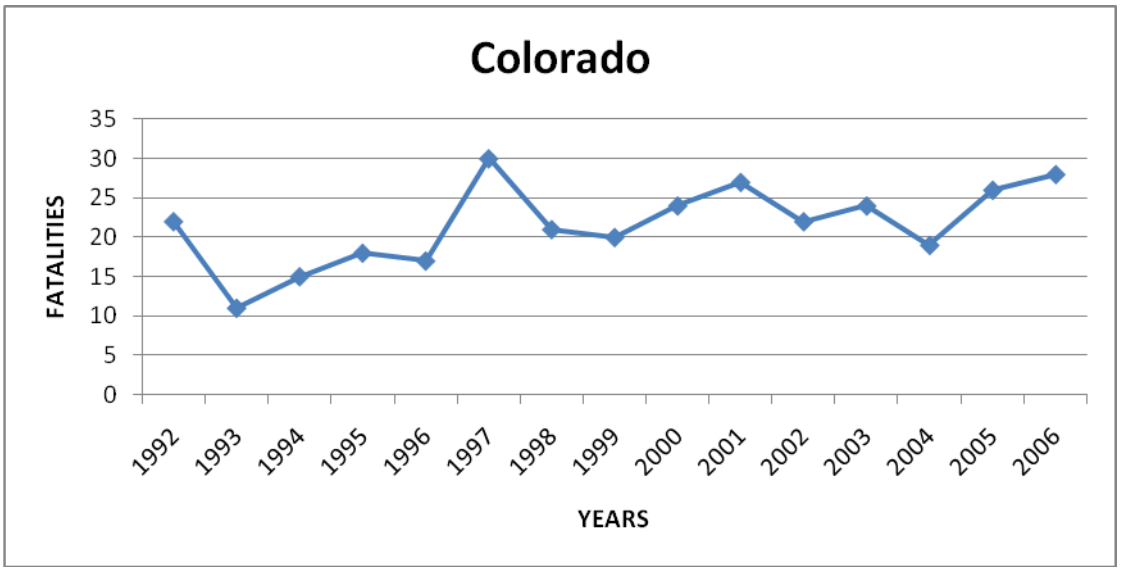
Occupational Fatality Change in years (1992-2006) in Washington.



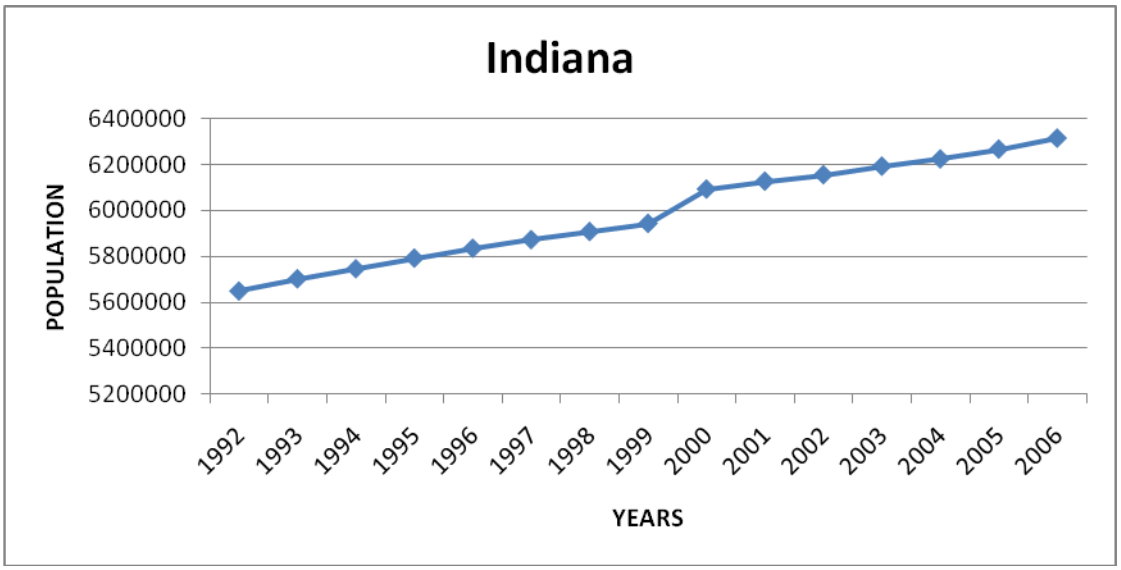
Population Change in years (1992-2006) in Colorado.



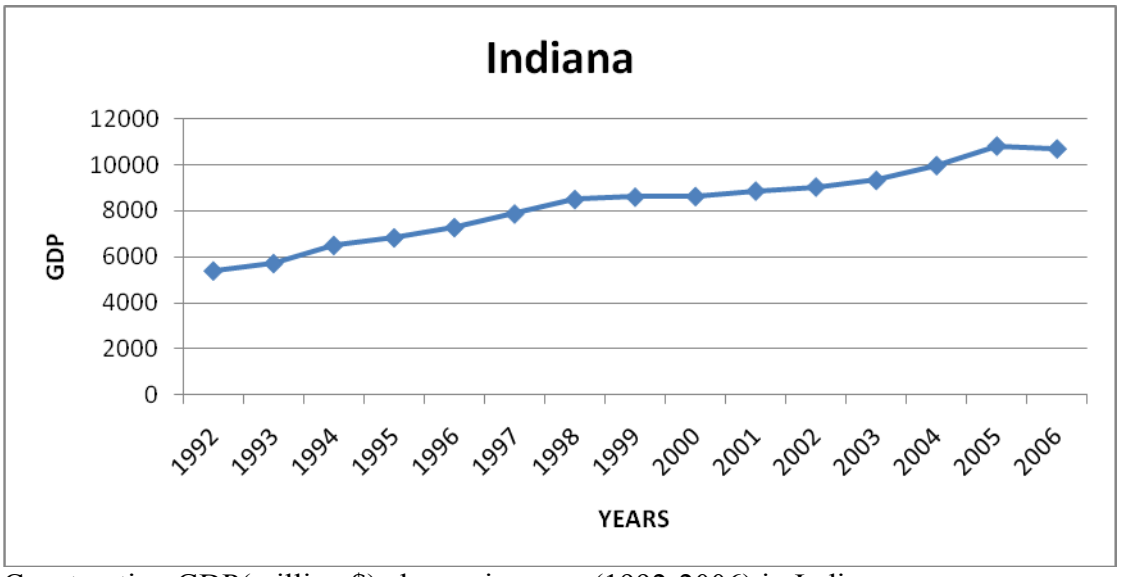
Construction GDP(million $) change in years (1992-2006) in Colorado.



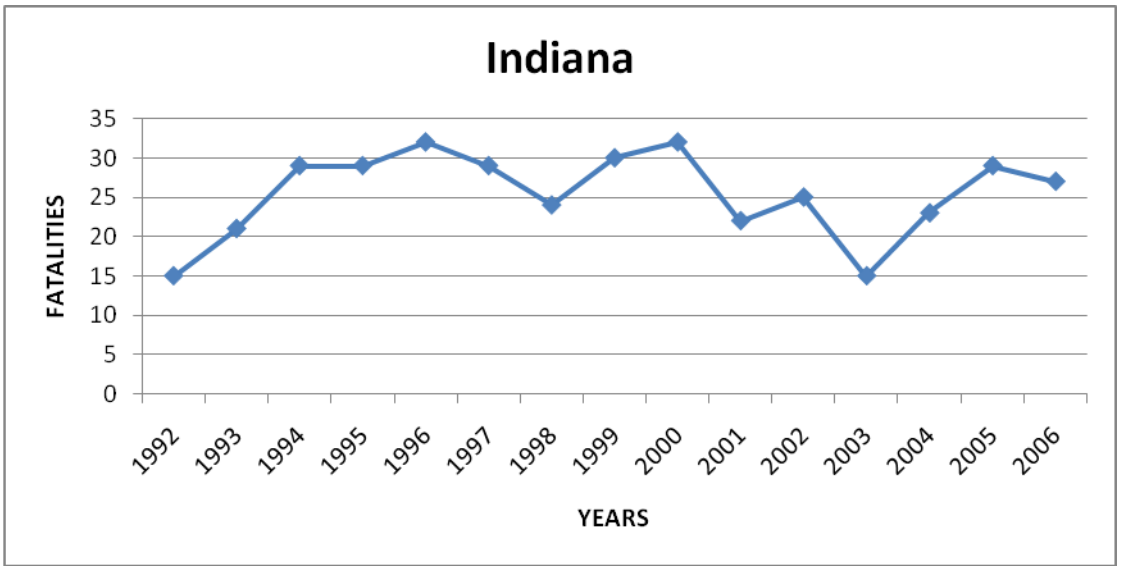
Occupational Fatality Change in years (1992-2006) in Colorado.



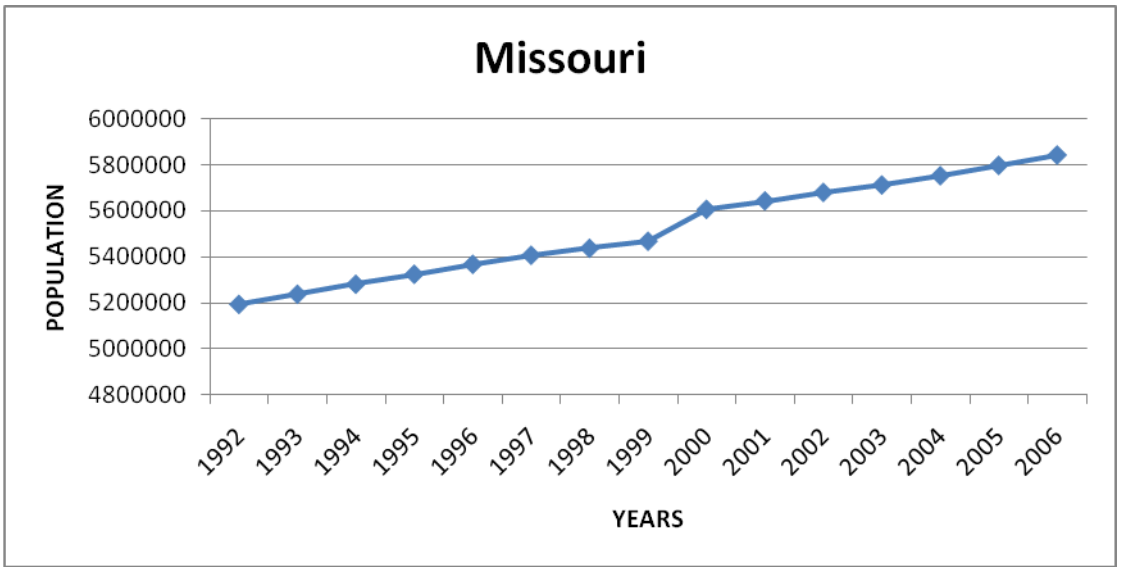
Population Change in years (1992-2006) in Indiana.



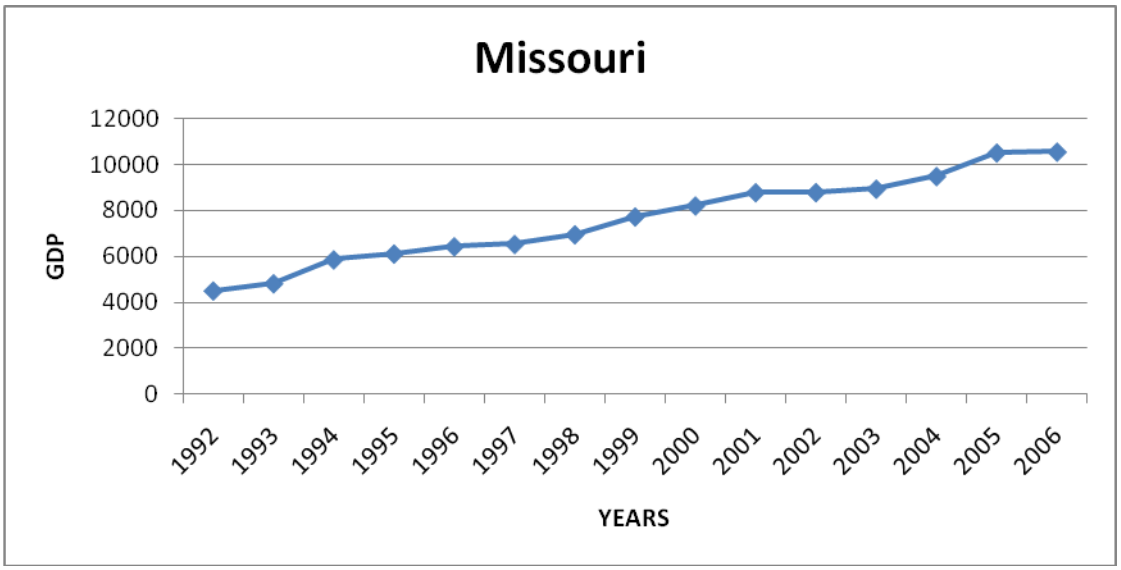
Construction GDP(million $) change in years (1992-2006) in Indiana.



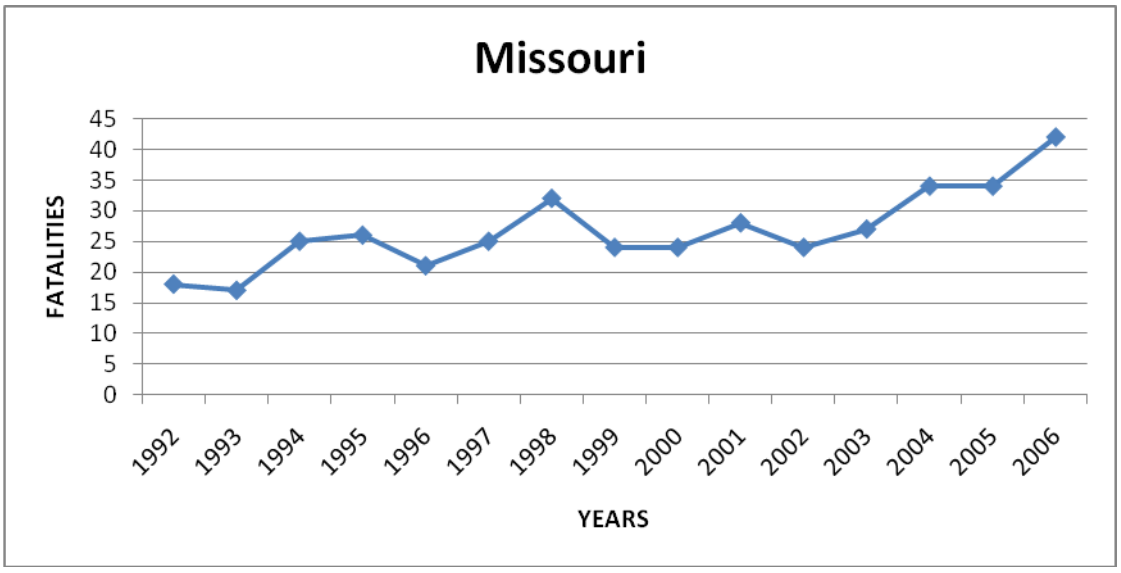
Occupational Fatality Change in years (1992-2006) in Indiana.



Population Change in years (1992-2006) in Missouri.



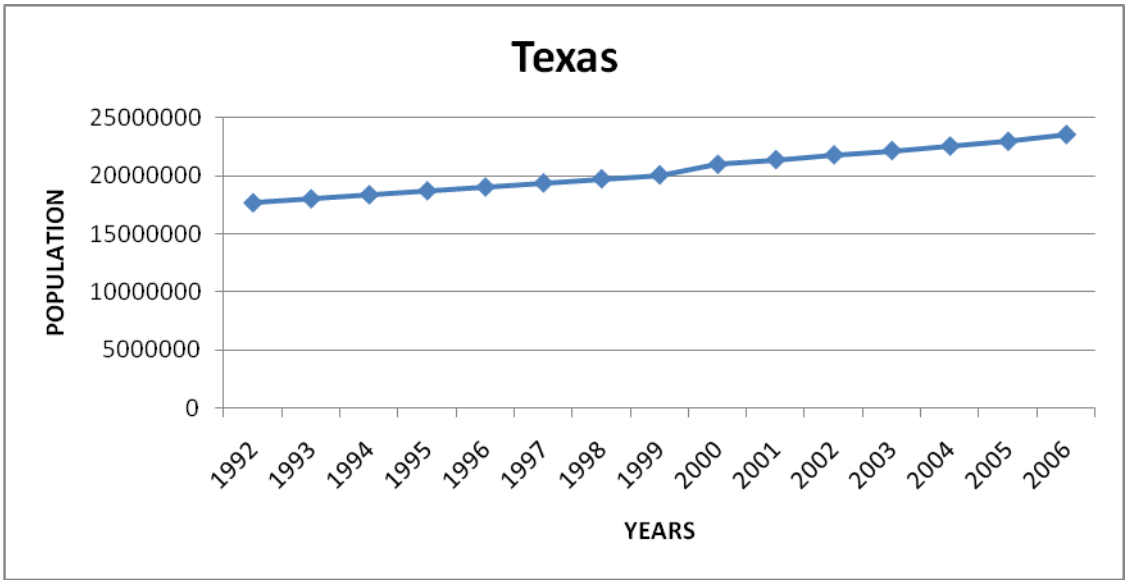
Construction GDP(million $) change in years (1992-2006) in Missouri.



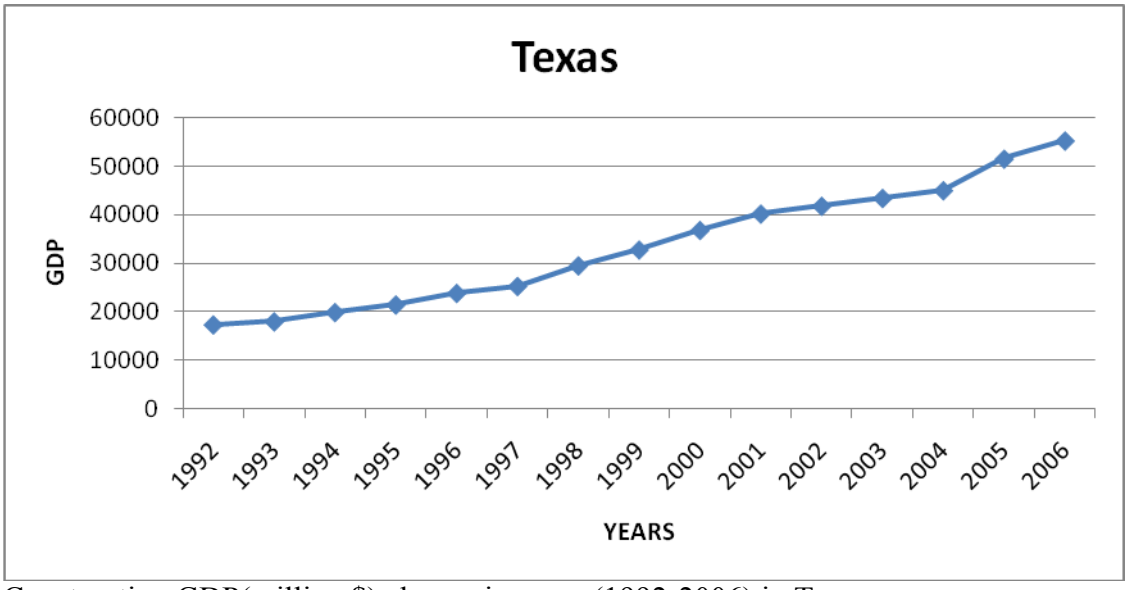
Occupational Fatality Change in years (1992-2006) in Missouri.

APPENDIX B

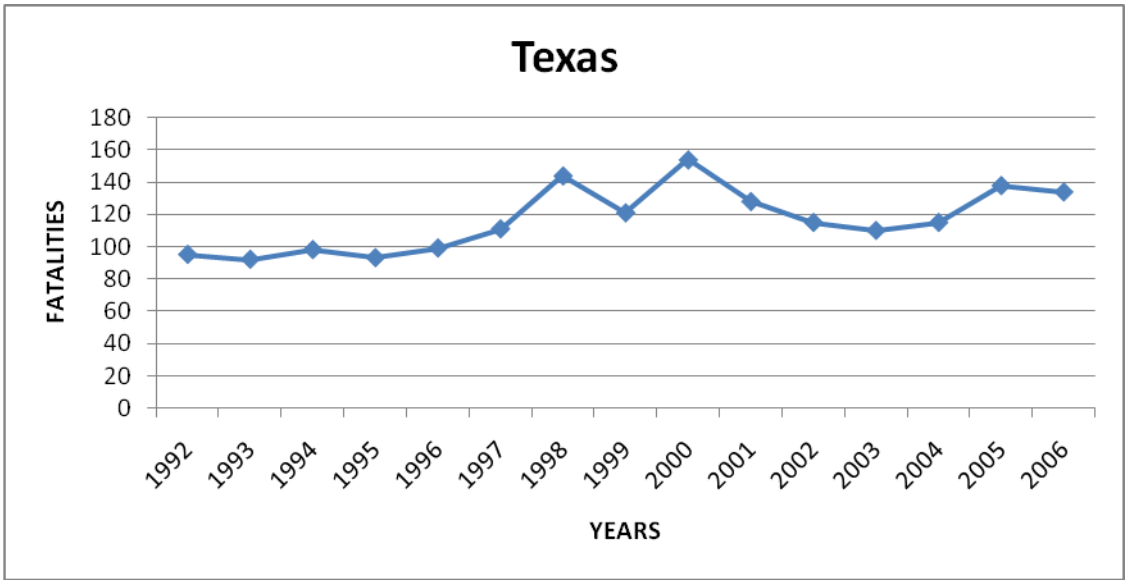
GRAPHS FOR POPULATION, CONSTRUCTION GDP, AND OCCUPATIONAL FATALITIES IN RIGHT TO WORK STATES



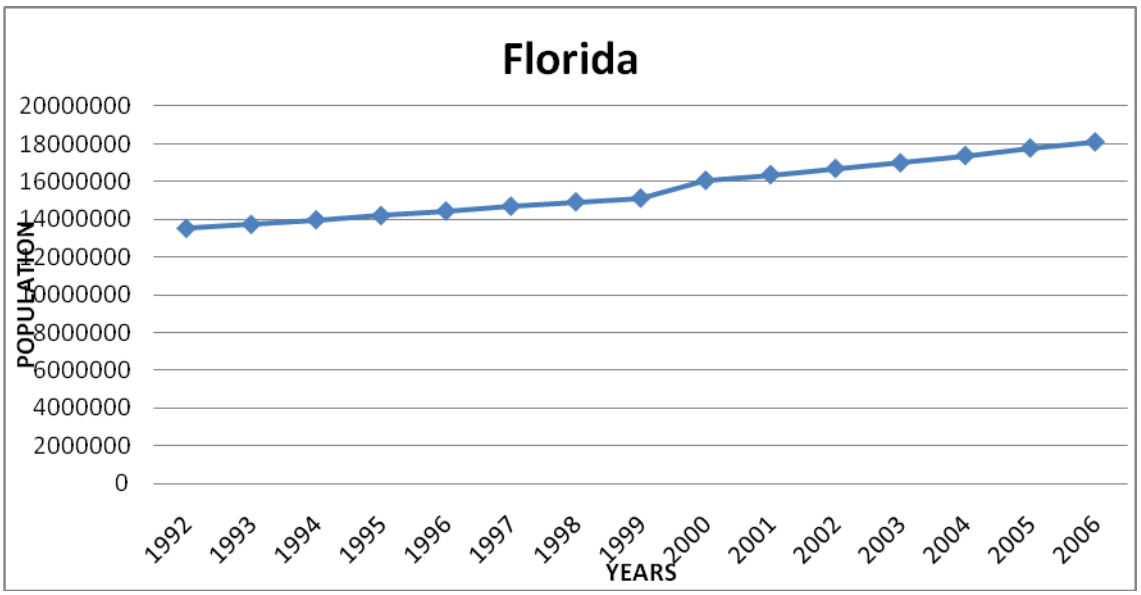
Population Change in years (1992-2006) in Texas.



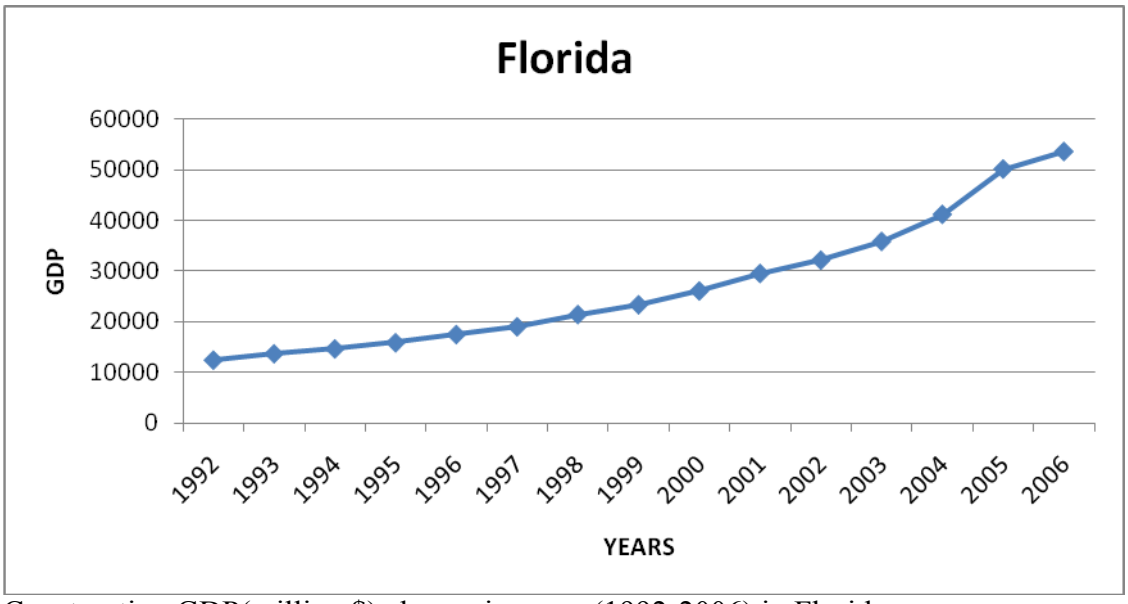
Construction GDP(million $) change in years (1992-2006) in Texas.



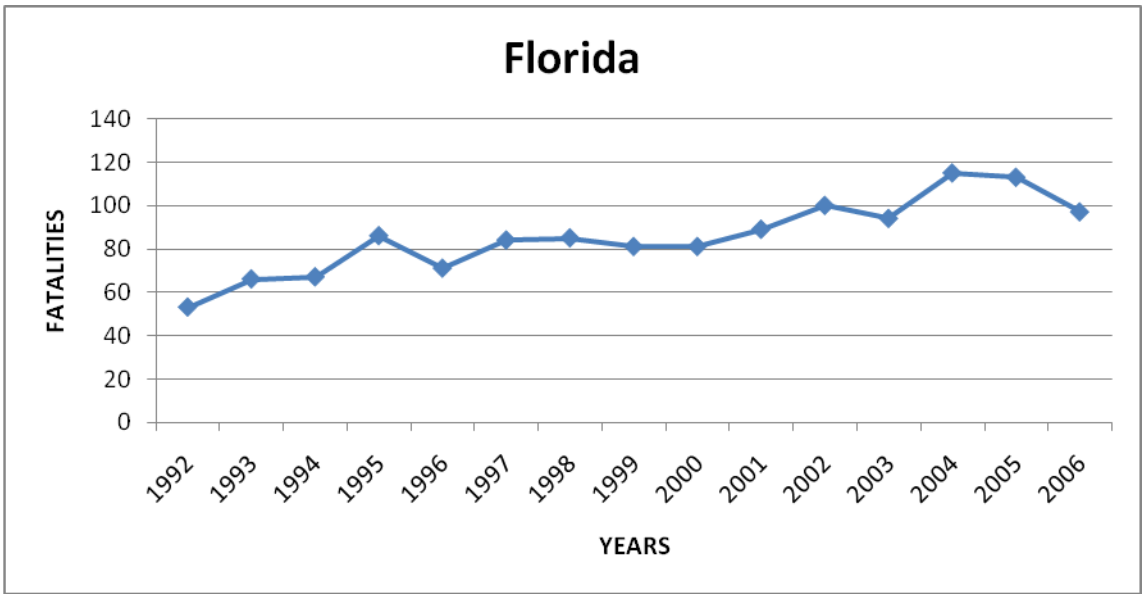
Occupational Fatality Change in years (1992-2006) in Texas.



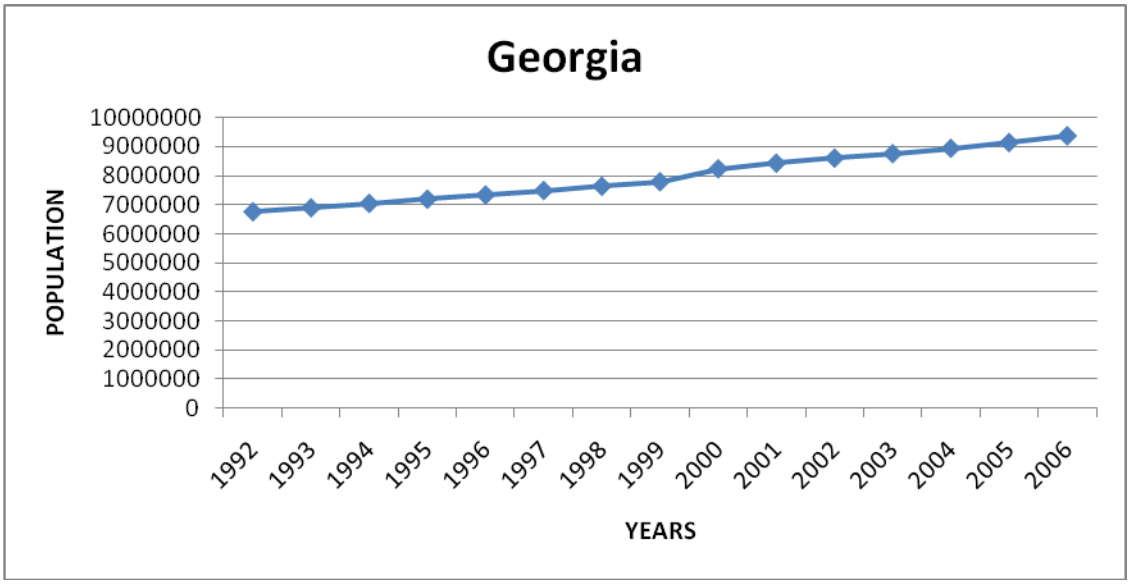
:Population Change in years (1992-2006) in Florida.



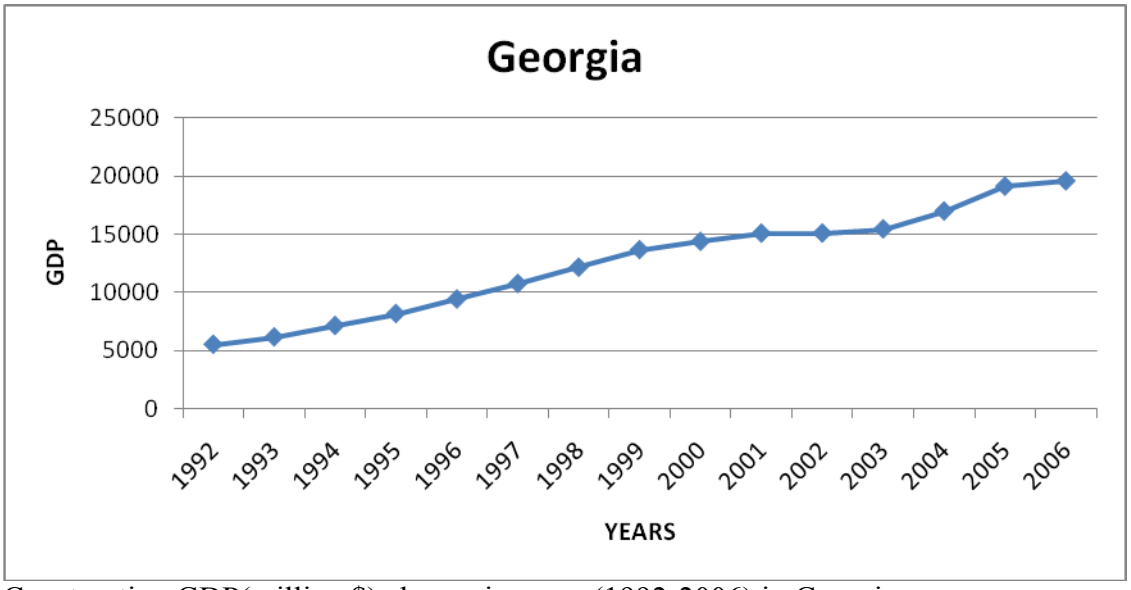
Construction GDP(million $) change in years (1992-2006) in Florida.



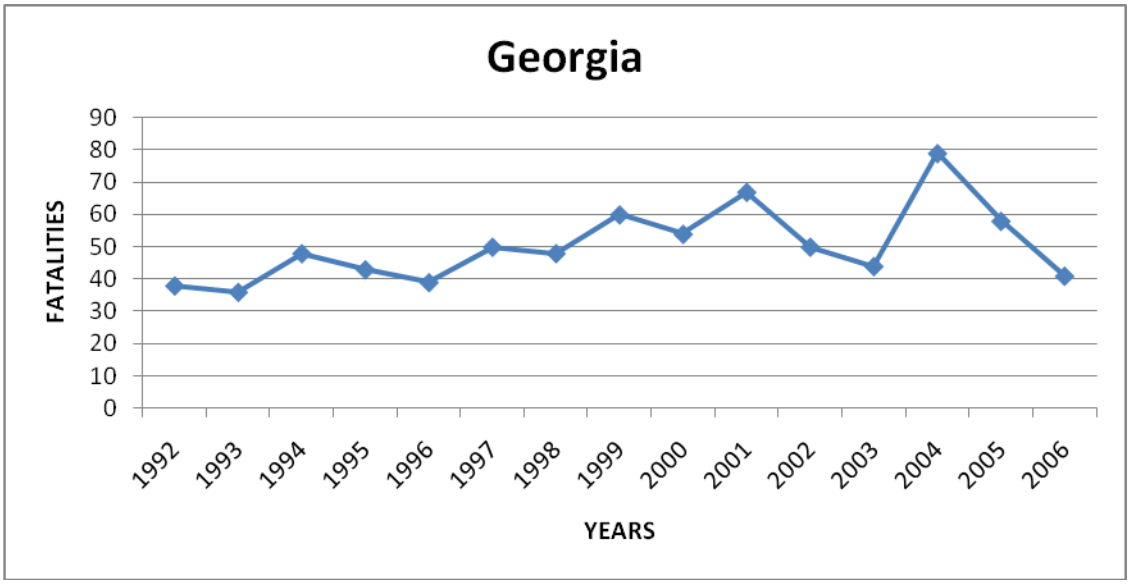
Occupational Fatality Change in years (1992-2006) in Florida.



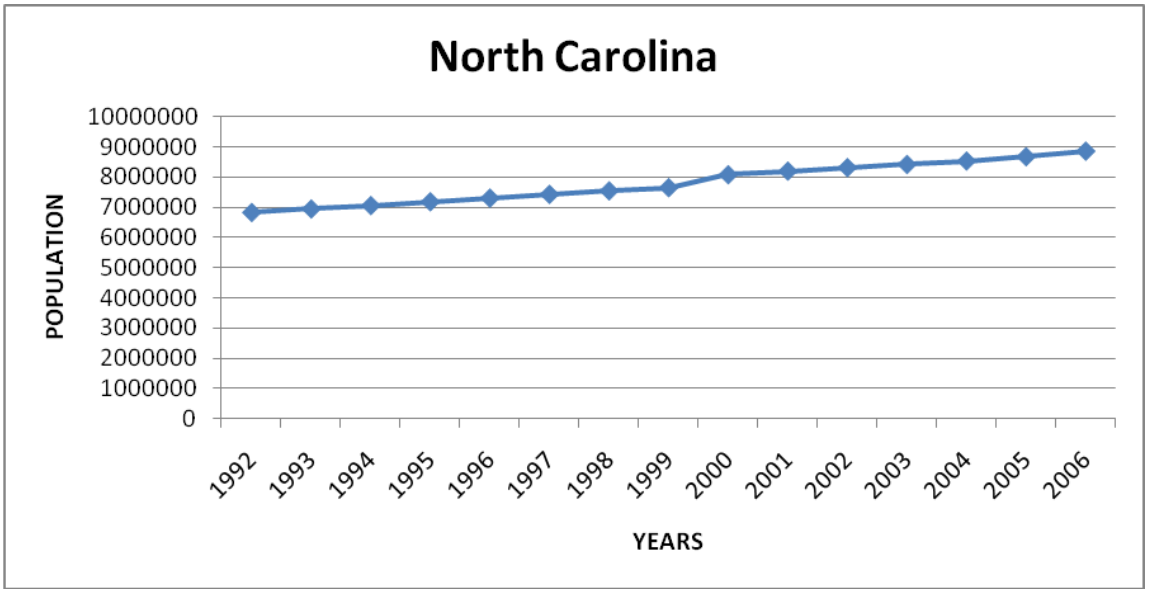
Population Change in years (1992-2006) in Georgia.



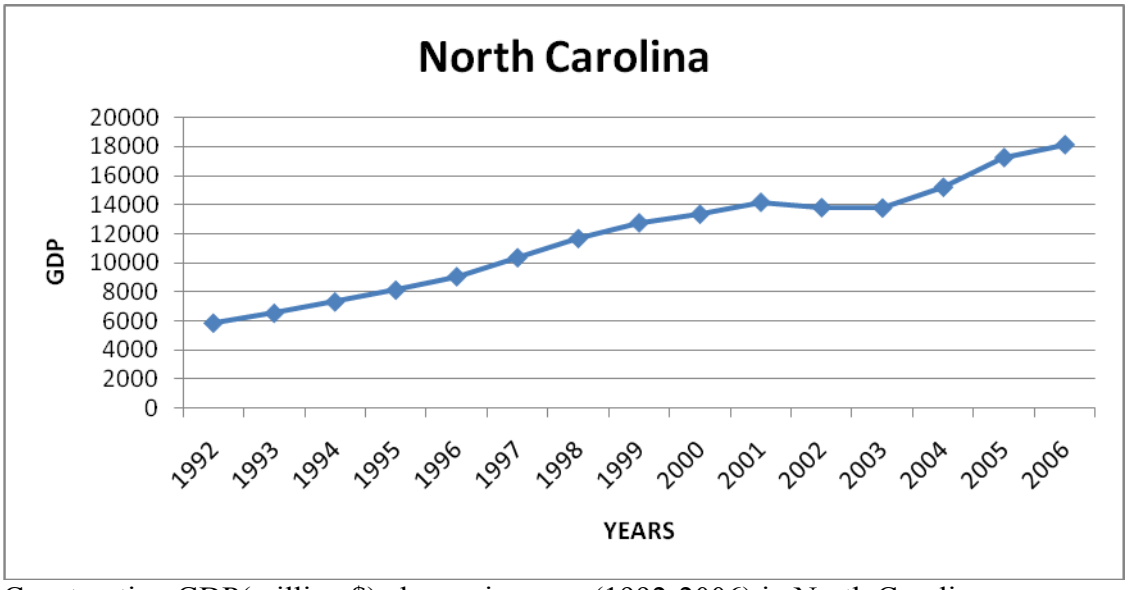
Construction GDP(million $) change in years (1992-2006) in Georgia.



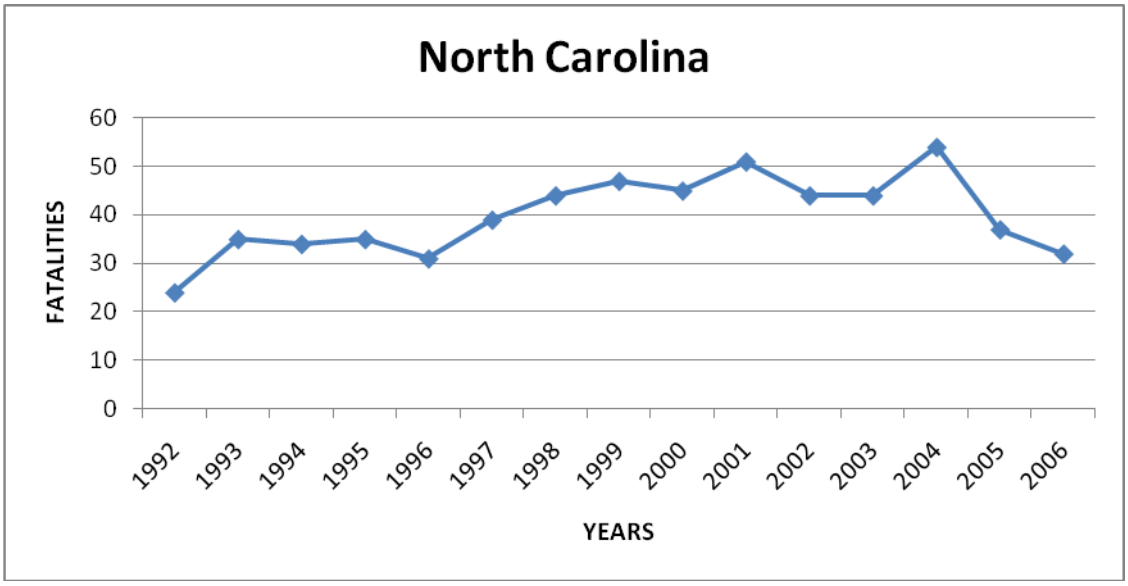
Occupational Fatality Change in years (1992-2006) in Georgia.



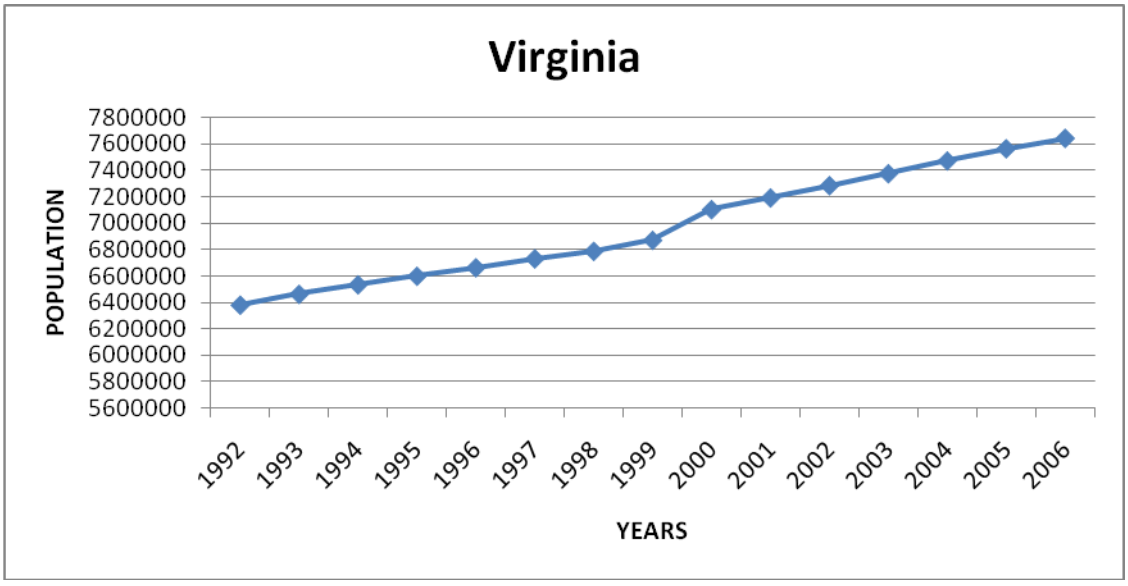
Population Change in years (1992-2006) in North Carolina.



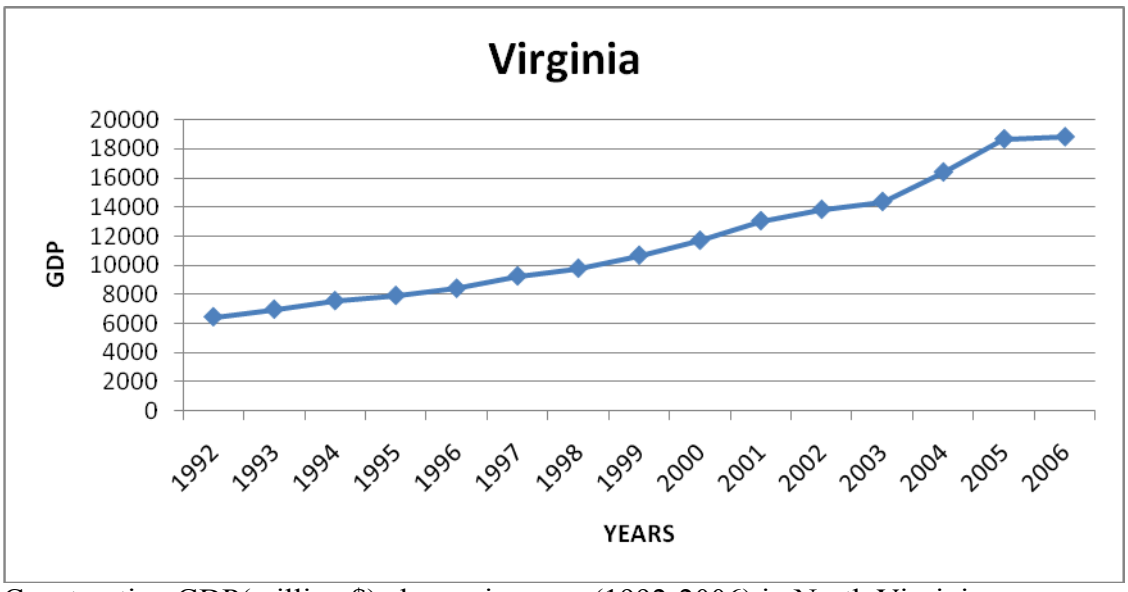
Construction GDP(million $) change in years (1992-2006) in North Carolina.



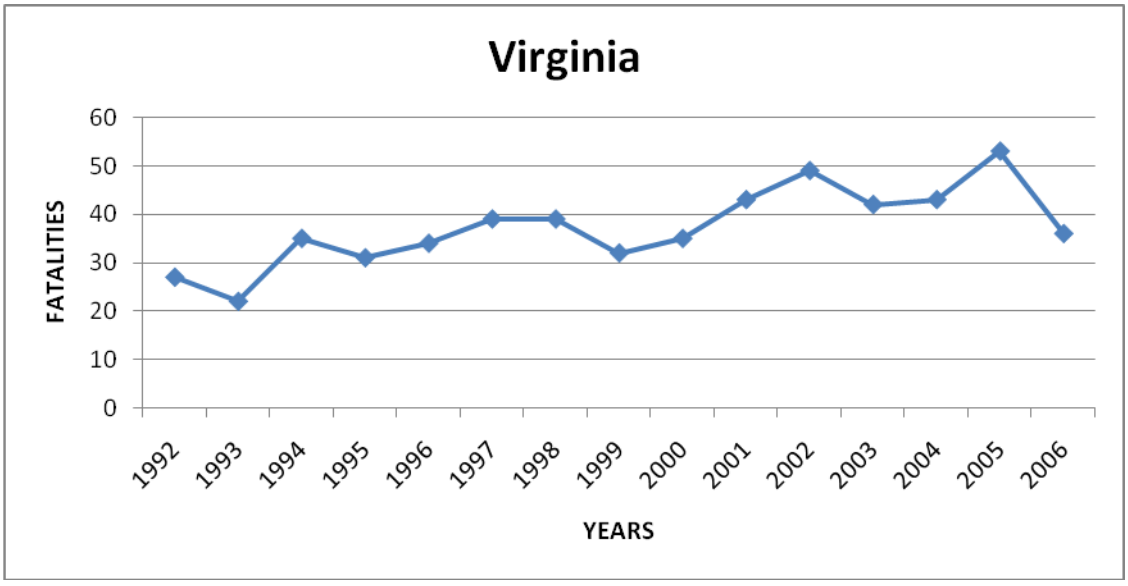
Occupational Fatality Change in years (1992-2006) in North Carolina.



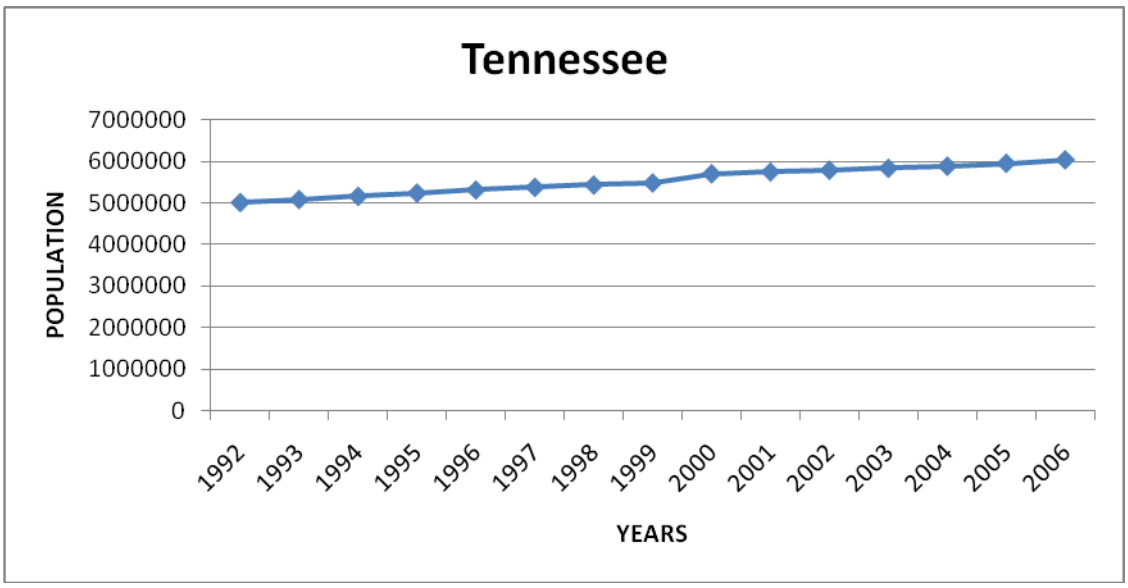
Population Change in years (1992-2006) in North Virginia.



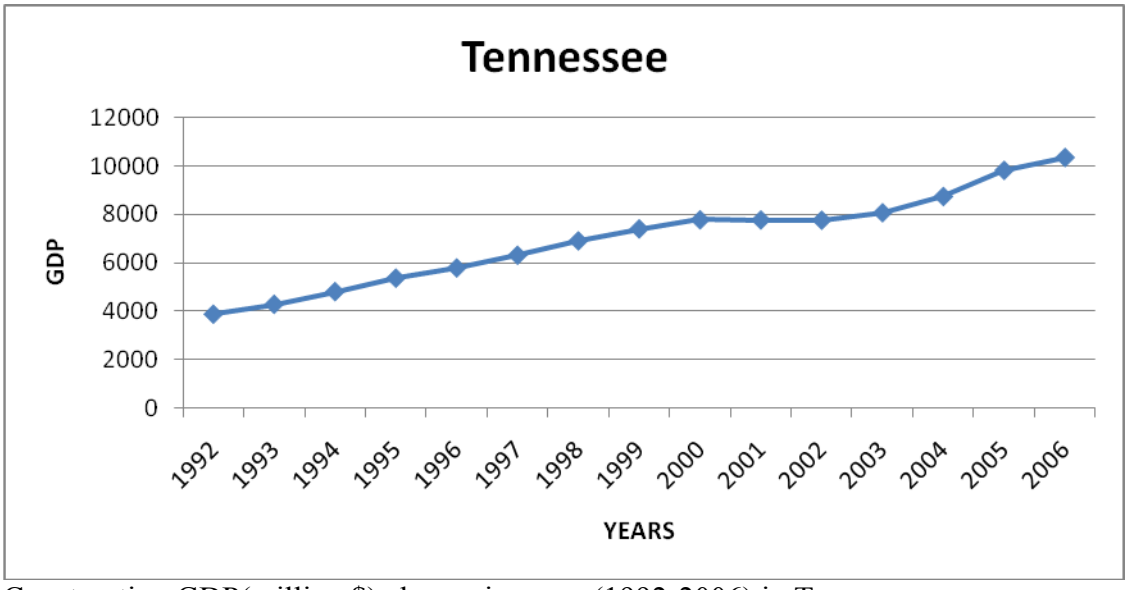
Construction GDP(million $) change in years (1992-2006) in North Virginia.



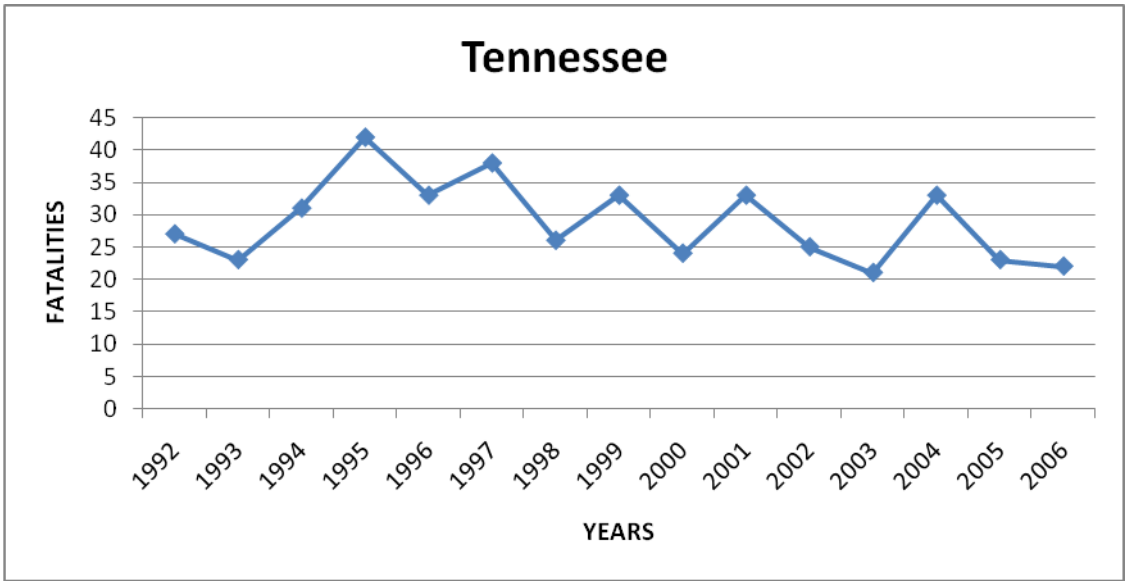
Occupational Fatality Change in years (1992-2006) in Virginia.



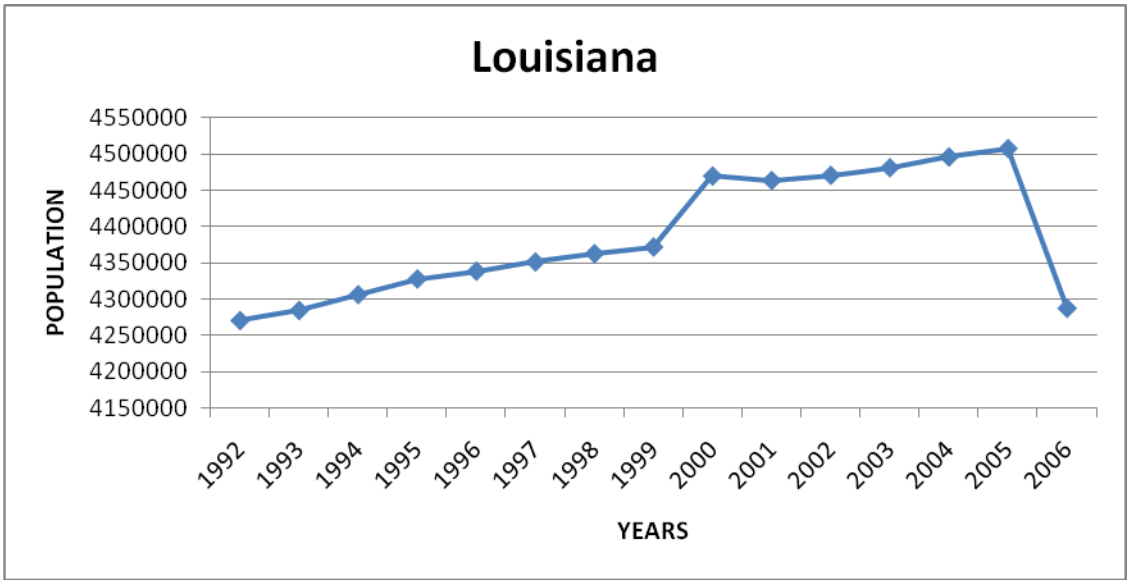
Population Change in years (1992-2006) in Tennessee.



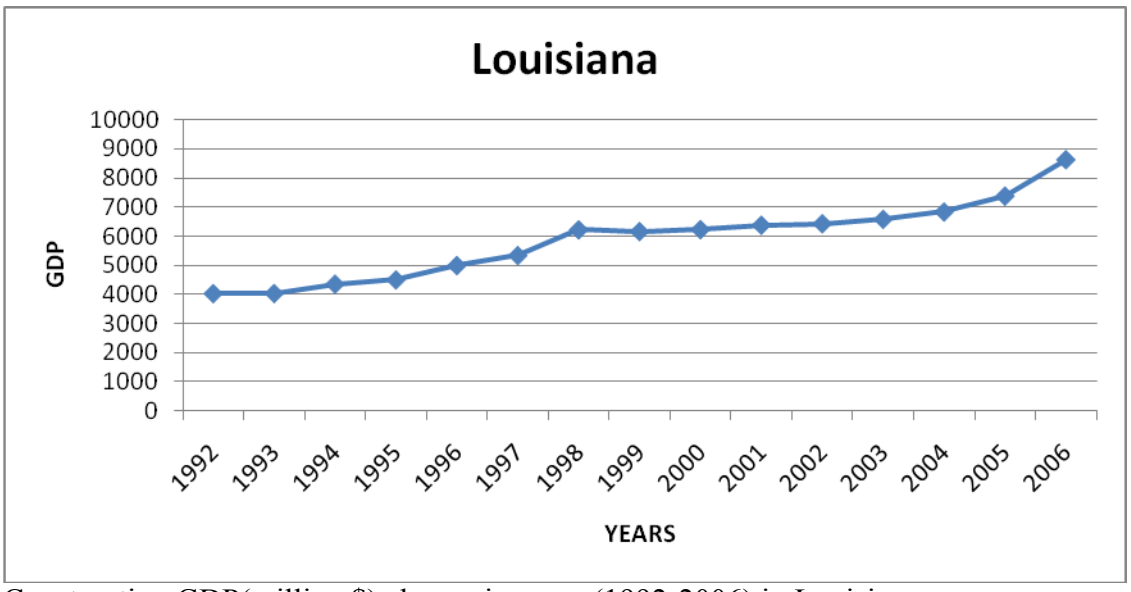
Construction GDP(million $) change in years (1992-2006) in Tennessee.



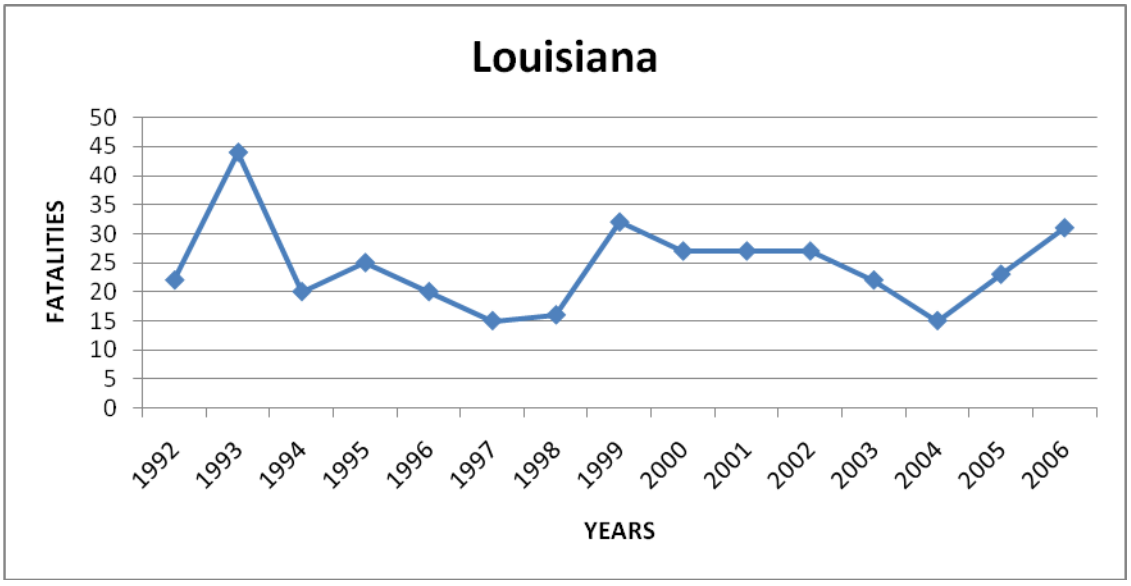
Occupational Fatality Change in years (1992-2006) in Tennessee.



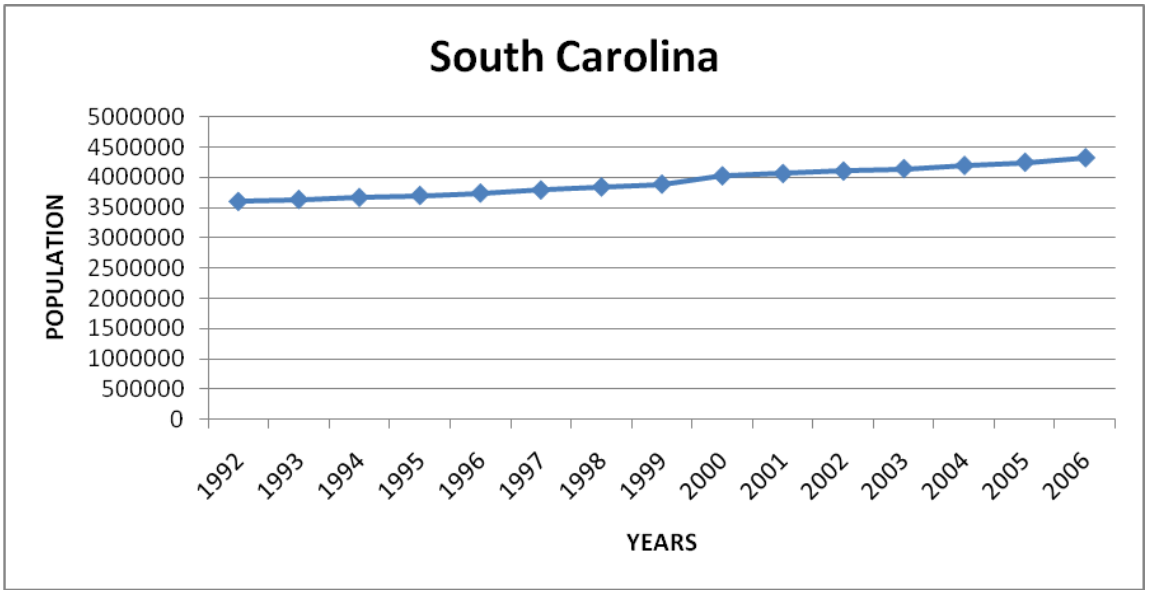
Population Change in years (1992-2006) in Louisiana.



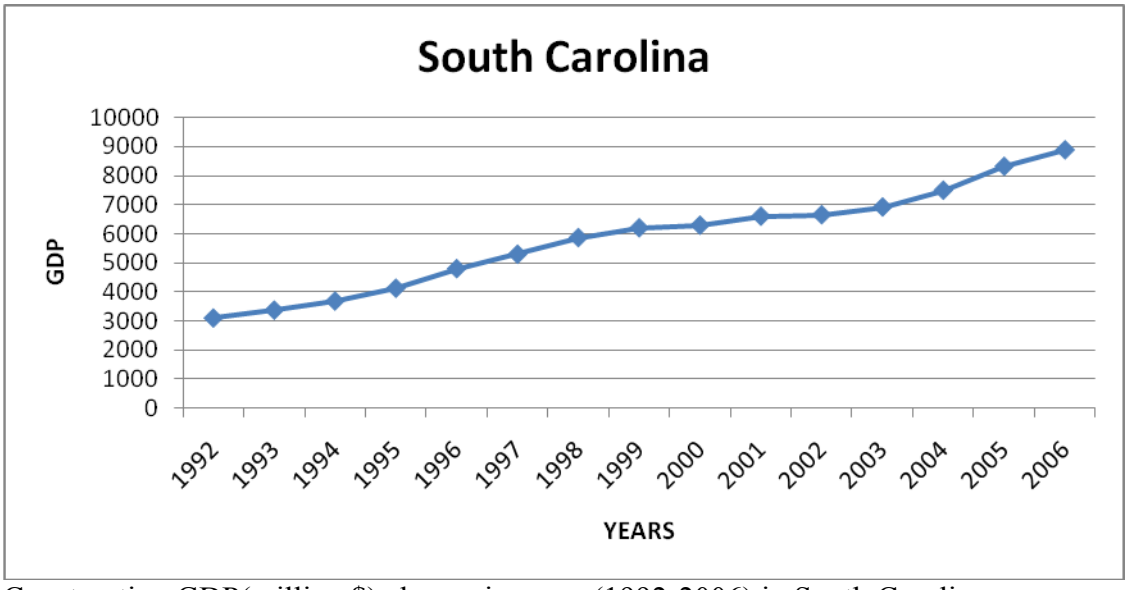
Construction GDP(million $) change in years (1992-2006) in Louisiana.



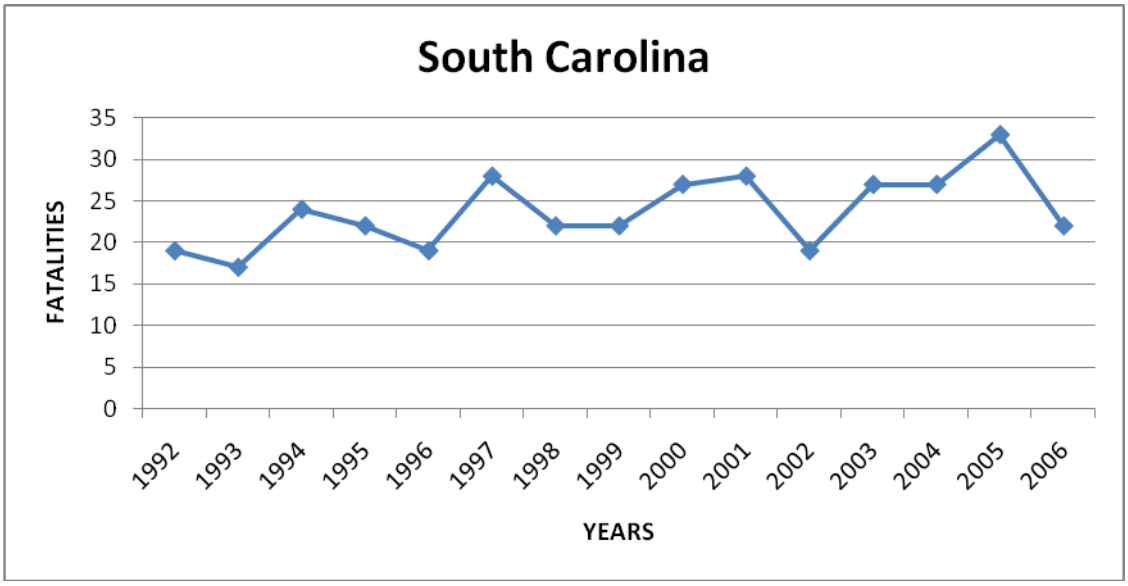
Occupational Fatality Change in years (1992-2006) in Louisiana.



Population Change in years (1992-2006) in South Carolina.



Construction GDP(million $) change in years (1992-2006) in South Carolina.



Occupational Fatality Change in years (1992-2006) in South Carolina.

VITA

Yildirim Dogan received his Bachelor of Science degree in geodesy and photogrametry from The Technical University of Istanbul in Turkey in 1998. He started the Master of Science in construction management program at Texas A&M University in January 2008 and received his Master of Science degree in May 2010.

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