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CHAPTER 7.16. - SMOKING IN PUBLIC PLACES AND PLACES OF EMPLOYMENT[3]

Footnotes:

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***Editor's note—** Ord. No. 11-03, § 1, adopted Mar. 16, 2011, repealed the former Ch. 7.16, §§ 7.16.010—7.16.150, and enacted a new Ch. 7.16 as set out herein. The former Ch. 7.16 pertained to smoking in public places and places of employment and derived from Ord. No. 04-06, §§ 2—16, 8-12-2004; Ord. No. 06-06, § 2, 11-8-2006.*

Sec. 7.16.010. - Purpose.

The purpose of this chapter is to protect the public health and welfare by regulating smoking in places available to and used by members of the public and in places of employment.

(Ord. No. 11-03, § 2, 3-16-2011)

Sec. 7.16.020. - Definitions.

The following words and phrases, whenever used in this chapter, shall be construed as defined in this section:

(05) *Bar* means an establishment that is devoted to the serving of alcoholic beverages for consumption by guests on the premises and in which the serving of food is only incidental to the consumption of those beverages, including but not limited to, taverns, nightclubs, cocktail lounges, and cabarets.

(10) *Business* means a sole proprietorship, partnership, joint venture, corporation, association, or other entity formed either for-profit or not-for-profit making purposes, that is open to members of the public and/or has an employee as defined in this section.

(15) *Employee* means a person who is employed by an employer in consideration for direct or indirect monetary wages or profit, and/or a person who volunteers his or her services for an employer, association, nonprofit or volunteer entity.

(20) *Employer* means a person, business, partnership, association, corporation, including a municipal corporation, trust, or non-profit entity that employs the services of one or more individual persons.

(25) *Enclosed* means closed in by a roof and contiguous walls or windows, connected floor to ceiling with appropriate opening for ingress and egress.

(30) *Health care facility* means an office or institution providing care or treatment of diseases, whether physical, mental, or emotional, or other medical, physiological, or psychological conditions, including but not limited to, hospitals, rehabilitation hospitals or other clinics, including weight

control clinics, nursing homes, homes for the aging or chronically ill, laboratories, and offices of surgeons, chiropractors, physical therapists, physicians, dentists, and all specialists within these professions.

(35) *Multi-unit residential facility* means a building or portion thereof that contains more than one dwelling space consisting of essentially complete independent living facilities for one or more persons and includes apartments, condominiums, cooperatives and group homes. A single family residence shared by roommates is not considered a multi-use residence for the purpose of this chapter.

(40) *Place of employment* means an area under the control of a public or private employer that employees normally frequent during the course of employment, including, but not limited to, work areas, employee lounges, restrooms, conference rooms, meeting rooms, classrooms, employee cafeterias, hallways, and vehicles. A private residence is not a "place of employment" unless it is used as a child care, adult day care, or health care facility.

(45) *Public place* means any enclosed area, public or private, to which the public is permitted, regardless of any fee or age requirement. A private residence is not a "public place" unless it is used as a child care, adult day care, or health care facility.

(50) *Restaurant* means an eating establishment, including but not limited to, coffee shops, cafeterias, sandwich stands, and private and public school cafeterias, which gives or offers for sale food to the public, guests, or employees, as well as kitchens and catering facilities in which food is prepared on the premises for serving elsewhere. The term "restaurant" shall include an attached bar.

(55) *Retail tobacco store* means a retail store utilized primarily for the sale of tobacco products and accessories and in which the sale of other products is merely incidental.

(60) *Service area* means any area designated to be or regularly used by one or more persons to receive or wait to receive a service, enter a public place, or make a transaction whether or not the service involves the exchange of money.

(65) *Shopping mall* means an enclosed public walkway or hall area that serves to connect retail or professional establishments.

(70) *Smoking* means inhaling, exhaling, burning, or carrying any lighted cigar, cigarette, pipe, weed, plant, or other combustible substance in any manner or in any form.

(Ord. No. 11-03, § 2, 3-16-2011)

Sec. 7.16.030. - Prohibition of smoking in public places.

Except as otherwise hereinafter provided by this chapter, smoking shall be prohibited in all:

(1) Enclosed areas of all public places, including lobbies, elevators, reception, waiting and service areas, hallways, and other areas used by members of the public, located within the City, including but not limited to the following:

a. Any portion of a museum, aquariums, gallery, library, or museums which is open to and used by members of the general public;

b. Any portion of a grocery store, supermarket or other retail food marketing establishment which is open to and used by the general public;

c. Any restroom open to and used by the general public;

d. Any portion of a theater, auditorium, clubhouse or hall which is open to the general public and used for exhibiting a motion picture, live theatrical performance, religious or spiritual service, banquet, lecture, musical recital or similar performance;

e. Hallways, examination rooms, rooms used for treatment, wards and semi-private rooms of health care facilities;

f. Any licensed child care or adult day care facility;

g. Lobbies, hallways, game rooms, meeting rooms, laundry rooms, and other common areas in multi-unit residential facilities;

h. Public transportation facilities, including buses and taxicabs, under the authority of the City of Laguna Woods, and ticket, boarding, and waiting areas of public transit depots;

i. Any restaurant or bar, including those in private clubs;

j. Any portion of a building owned, leased and/or operated by a public agency or entity which is open to and used by the public and is subject to the jurisdiction of the city;

k. Polling places;

l. Any recreation or sports facility, including but not limited to gymnasiums, enclosed swimming pools, roller skating and ice skating rinks, bowling alleys, pool halls, health spas, clubhouses and other similar places where members of the public assemble whether to engage in physical exercise, participate in athletic events or participate in sports events;

m. Any other business or establishment or portion of a business or establishment which is open to and used by the general public, including but not limited to banks, professional offices, retail stores, enclosed shopping malls, laundromats, beauty and barber shops, nails salons, professional offices, hotels and motels.

(2) Unenclosed areas of the following public places, subject to the reasonable distance requirement in Section 7.16.050:

a. Any service area where one or more persons are waiting for or receiving service of any kind, whether or not such service involves the exchange of money;

b. Outdoor dining areas of restaurants;

c. Unenclosed swimming pools in a multifamily residence;

d. Unenclosed hallways, entryways, breezeways, stairways and other common areas accessible and useable by more than one residence in a multifamily residential facility;

e.

Balconies and patios in residential facilities. For the purpose of this chapter, balconies and patios shall include unenclosed and screened patios and balconies as well as enclosed patios and balconies unless windows and doors are closed to prevent the escape of smoke;

f. Covered and semi-covered carports shared by more than one residential unit;

g. Ticket, boarding and waiting areas for public transportation services;

h. Entrances and exits to enclosed public areas;

i. City parks and preserves;

j. Sites of public events sponsored or co-sponsored by the City, including sports events, entertainment, ceremonies, speaking performances, pageants and fairs.

(Ord. No. 11-03, § 2, 3-16-2011)

Sec. 7.16.040. - Prohibition of smoking in places of employment.

(a) Smoking shall be prohibited in all enclosed facilities within places of employment without exception. This includes common work areas, auditoriums, classrooms, conference and meeting rooms, private offices, elevators, hallways, medical facilities, cafeterias, employee lounges, stairs, restrooms, vehicles, and all other enclosed facilities.

(b) This prohibition on smoking shall be communicated to all existing employees by the effective date of the ordinance from which this chapter is derived and to all prospective employees upon their application for employment.

(Ord. No. 11-03, § 2, 3-16-2011)

Sec. 7.16.050. - Reasonable distance.

Smoking in unenclosed areas shall be prohibited within a reasonable distance of 20 feet from any entrance, opening, crack or vent into an enclosed area where smoking is prohibited, except while actively passing on the way to another destination and so long as smoke does not enter any enclosed area in which smoking is prohibited.

(Ord. No. 11-03, § 2, 3-16-2011)

Sec. 7.16.060. - Where smoking not regulated.

Notwithstanding any other provision of this chapter to the contrary, the following areas shall be exempt from the provisions of Section 7.16.030 of this chapter:

(1) With the exception of locations specifically identified in Section 7.16.030, private residences, except when used as a licensed child care, adult day care, or health care facility.

(2)

Hotel and motel rooms that are rented to guests and are designated as smoking rooms; provided, however, that not more than 20 percent of rooms rented to guests in a hotel or motel may be so designated. The status of rooms as smoking or nonsmoking may not be changed, except to add additional nonsmoking rooms.

(3) Retail tobacco stores; provided that smoke from these places does not infiltrate into areas where smoking is prohibited under the provisions of this chapter.

(4) Private and semiprivate rooms in nursing homes and long-term care facilities that are occupied by one or more persons, all of whom are smokers and have requested in writing to be placed in a room where smoking is permitted; provided that smoke from these places does not infiltrate into areas where smoking is prohibited under the provisions of this chapter.

(5) Outdoor areas except those covered by the provisions of Sections 7.16.030 and 7.16.040.

(Ord. No. 11-03, § 2, 3-16-2011)

Sec. 7.16.070. - Declaration of establishment as nonsmoking.

Notwithstanding any other provision of this chapter, an owner, operator, manager, or other person in control of an establishment, facility, or outdoor area may declare that entire establishment, facility, or outdoor area as a nonsmoking place. Smoking shall be prohibited in any place in which a sign conforming to the requirements of Section 7.16.080 of this chapter is posted.

(Ord. No. 11-03, § 2, 3-16-2011)

Sec. 7.16.080. - Posting of signs.

(a) "No Smoking" signs or the international "No Smoking" symbol (consisting of a pictorial representation of a burning cigarette enclosed in a red circle with a red bar across it) shall be clearly and conspicuously posted in every public place and place of employment where smoking is prohibited by this chapter, by the owner, operator, manager, or other person in control of that place.

(b) Every public place and place of employment where smoking is prohibited by this chapter shall have posted at every entrance a conspicuous sign clearly stating that smoking is prohibited.

(c) All ashtrays shall be removed from any area where smoking is prohibited by this chapter by the owner, operator, manager, or other person having control of the area.

(Ord. No. 11-03, § 2, 3-16-2011)

Sec. 7.16.090. - Nonretaliation.

No person or employer shall discharge, refuse to hire, or in any manner retaliate against an employee, applicant for employment, or customer because that employee, applicant, or customer exercises any rights afforded by this chapter or reports or attempts to prosecute a violation of this chapter.

(Ord. No. 11-03, § 2, 3-16-2011)

Sec. 7.16.100. - Enforcement.

(a) The provisions of this chapter shall be enforced by the City Manager and/or his or her authorized designee.

(b) Notice of the provisions of this chapter shall be given to all applicants for a business license/permit in the City of Laguna Woods.

(c) Any citizen who desires may register a complaint under this chapter with the City Manager and/or his or her authorized designee who will determine if enforcement is warranted based on the facts of the complaint.

(d) The Health Department, Fire Department, or their designees shall, while an establishment is undergoing otherwise mandated inspections, inspect for compliance with this chapter.

(e) An owner, manager, operator, or employee of an establishment regulated by this chapter shall inform persons violating this chapter of the appropriate provisions thereof.

(f) Notwithstanding any other provision of this chapter, an employee or private citizen may bring legal action to enforce this chapter.

(g) In addition to the remedies provided by the provisions of this section, the City Manager or any person aggrieved by the failure of the owner, operator, manager, or other person in control of a public place or a place of employment to comply with the provisions of this chapter may apply for injunctive relief to enforce those provisions in any court of competent jurisdiction.

(Ord. No. 11-03, § 2, 3-16-2011)

Sec. 7.16.110. - Violations and penalties.

(a) A person who smokes in an area where smoking is prohibited by the provisions of this chapter shall be guilty of an infraction, punishable by a fine not exceeding $50.00.

(b) A person who owns, manages, operates, or otherwise controls a public place or place of employment and who fails to comply with the provisions of this chapter shall be guilty of an infraction, punishable by:

(1) A fine not exceeding $100.00 for a first violation.

(2) A fine not exceeding $200.00 for a second violation within one year.

(3) A fine not exceeding $500.00 for each additional violation within one year.

(c) In addition to the fines established by this section, violation of this chapter by a person who owns, manages, operates, or otherwise controls a public place or place of employment may result in the suspension or revocation of any permit or license issued to the person for the premises on which the violation occurred.

(d)

Each day on which a violation of this chapter occurs shall be considered a separate and distinct violation.

(Ord. No. 11-03, § 2, 3-16-2011)

Sec. 7.16.120. - Public education.

The City shall engage in a continuing program to explain and clarify the purposes and requirements of this chapter to citizens affected by it, and to guide owners, operators, and managers in their compliance with it. The program may include publication of a brochure for affected businesses and individuals explaining the provisions of this chapter.

(Ord. No. 11-03, § 2, 3-16-2011)

Sec. 7.16.130. - Governmental agency cooperation.

The City Manager shall annually request other governmental and educational agencies having facilities within the City to establish local operating procedures in cooperation and compliance with this chapter. This includes urging all Federal, State, County and School District agencies to update their existing smoking control regulations to be consistent with the current health findings regarding secondhand smoke.

(Ord. No. 11-03, § 2, 3-16-2011)

Sec. 7.16.140. - Other applicable laws.

This chapter shall not be interpreted or construed to permit smoking where it is otherwise restricted by other applicable laws.

(Ord. No. 11-03, § 2, 3-16-2011)

Sec. 7.16.150. - Liberal construction.

This chapter shall be liberally construed so as to further its purposes.

(Ord. No. 11-03, § 2, 3-16-2011)

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The Health Consequences of Smoking—50 Years of Progress

A Report of the Surgeon General

Executive Summary

U.S. Department of Health and Human Services

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2014

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Office of the Surgeon General
Rockville, MD

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For more information

For more information about the Surgeon General's report, visit www.surgeongeneral.gov.

To download copies of this document, go to www.cdc.gov/tobacco.

To order copies of this document, go to www.cdc.gov/tobacco and click on Publications Catalog or call 1-800-CDC-INFO (1-800-232-4636); TTY: 1-888-232-6348.

Message from Kathleen Sebelius

Secretary of Health and Human Services

Fifty years after the release of the first Surgeon General's report warning of the health hazards of smoking, we have learned how to end the tobacco epidemic. Over the past five decades, scientists, researchers and policy makers have determined what works, and what steps must be taken if we truly want to bring to a close one of our nation's most tragic battles—one that has killed ten times the number of Americans who died in all of our nation's wars combined.

In the United States, successes in tobacco control have more than halved smoking rates since the 1964 landmark Surgeon General's report came out. Americans' collective view of smoking has been transformed from an accepted national pastime to a discouraged threat to individual and public health. Strong policies have largely driven cigarette smoking out of public view and public air space. Thanks to smokefree laws, no longer is smoking allowed on airplanes or in a growing number of restaurants, bars, college campuses and government buildings.

Evidence in this new report shows tobacco's continued, immense burden to our nation—and how essential ending the tobacco epidemic is to our work to increase the life expectancy and quality of life of all Americans. This year alone, nearly one-half million adults will still die prematurely because of smoking. Annually, the total economic costs due to tobacco are now over $289 billion. And if we continue on our current trajectory, 5.6 million children alive today who are younger than 18 years of age will die prematurely as a result of smoking.

I believe that we can make the next generation tobacco-free. And I am extremely proud of the Obama Administration's tobacco-control record. For example, the 2009 *Children's Health Insurance Program Reauthorization Act* included an unprecedented $0.62 tax increase that raised the federal excise tax to $1.01 per pack of cigarettes; we know that increasing the cost of cigarettes is one of the most powerful interventions we can make to prevent smoking and reduce prevalence. Building on this knowledge, the President's Fiscal Year 2014 Budget includes a $0.94 per pack Federal tobacco tax increase. For the first time in history, the 2009 *Family Smoking Prevention and Tobacco Control Act* (*Tobacco Control Act) g*ave the U.S. Food and Drug Administration comprehensive authority to regulate tobacco products, which will play a critical role in reducing the harm caused by these products. The *Tobacco Control Act* also provided for user fees to be paid by tobacco manufacturers that can support sustained public education media campaigns targeting youth prevention and cessation. The 2010 *Affordable Care Act (ACA)* expands access to smoking cessation services and now requires most insurance companies to cover cessation treatments. The *Affordable Care Act's* Public Health and Prevention Fund is supporting innovative and effective community-based programs as well as public education campaigns promoting prevention and helping people to quit.

All of these tobacco control interventions are known to reduce tobacco use and, as a result, tobacco's extraordinary toll of death and disease. But in order to free the next generation from these burdens, we must redouble our tobacco control efforts and enlist nongovernmental partners—and society as a whole—to share in this responsibility. Ending the devastation of tobacco-related illness and death is not in the jurisdiction of any one entity. We must all share in this most worthwhile effort to end the tobacco epidemic.

Message from Howard Koh

Assistant Secretary for Health

The nation stands poised at the crossroads of tobacco control. On one hand, we can celebrate tremendous progress 50 years after the landmark 1964 Surgeon General's report: *Smoking and Health*. Adult smoking rates have fallen from about 43% (1965) to about 18% today. Mortality rates from lung cancer, the leading cause of cancer death in this country, are declining. Most smokers visiting health care settings are now routinely asked and advised about tobacco use. On the other hand, cigarette smoking remains the chief preventable killer in America, with more than 40 million Americans caught in a web of tobacco dependence. Each day, more than 3,200 youth (younger than 18 years of age) smoke their first cigarette and another 2,100 youth and young adults who are occasional smokers progress to become daily smokers. Furthermore, the range of emerging tobacco products complicates the current public health landscape.

In this context, the 50th Anniversary of the Surgeon General's report prompts us to pause and ask why this addiction persists when proven interventions can eliminate it. Of great concern, too many in our nation assume that past success in tobacco control guarantees future progress; nothing can be further from the truth. To rejuvenate and reinvigorate national efforts, in 2010, the U.S. Department of Health and Human Services unveiled its first ever strategic plan for tobacco control. *Ending the Tobacco Epidemic: A Tobacco Control Strategic Action Plan* provides a critical framework to guide efforts to rapidly drop prevalence rates of smoking among youth and adults. A major foundation and pillar of the plan is to encourage and promote leadership throughout all sectors of society. Now, this current 2014 Surgeon General's report can accelerate that leadership to fully implement the life-saving prevention that can make the next generation free of tobacco-related death and disease.

We have many tools that we know work. A comprehensive public policy approach emphasizing mass media campaigns to encourage prevention and quit attempts, smokefree policies, restrictions on youth access to tobacco products, and price increases can collectively drive further meaningful reductions in tobacco use. Furthermore, we can accelerate progress through full commitment to clinical and public health advances; including the widespread use of telephone quit lines and science-based counseling and medications for tobacco users. Promoting progress today also requires recognizing that tobacco use has evolved from being an equal-opportunity killer to one threatening the most vulnerable members of our society. We must confront, and reverse, the tragically higher tobacco use rates that threaten persons of low socioeconomic status, sexual minorities, high school dropouts, some racial/ethnic minority groups, and those living with mental illness and substance use disorders.

Of all the accomplishments of the 20th century, historians rank the 1964 Surgeon General's report as one of the seminal public health achievements of our time. Armed with both science and resolve, we can continue to honor the legacy of the report by completing the work it began in the last century. The current 2014 Surgeon General's report represents a national vision for getting the job done. With strategy, commitment, and action, our nation can leave the crossroads and move forward to end the tobacco epidemic once and for all.

Foreword

Fifty years have passed since publication of the landmark report of the Surgeon General's Advisory Committee on smoking and health. This report highlights both the dramatic progress our nation has made reducing tobacco use and the continuing burden of disease and death caused by smoking.

As a physician, when I think about smoking, I recall the patients I have cared for. The man who had a leg amputated. The woman who had to gasp for every single breath that she took. The man with heart disease who hoped to see his son graduate, but didn't live long enough to do so. That's the reality of smoking that health care providers see every day.

The prevalence of current cigarette smoking among adults has declined from 42% in 1965 to 18% in 2012. However, more than 42 million Americans still smoke. Tobacco has killed more than 20 million people prematurely since the first Surgeon General's report in 1964. The findings in this report show that the decline in the prevalence of smoking has slowed in recent years and that burden of smoking-attributable mortality is expected to remain at high and unacceptable levels for decades to come unless urgent action is taken.

Recent surveys monitoring trends in tobacco use indicate that more people are using multiple tobacco products, particularly youth and young adults. The percentage of U.S. middle and high school students who use electronic, or e-cigarettes, more than doubled between 2011 and 2012. We need to monitor patterns of use of an increasingly wide array of tobacco products across all of the diverse segments of our society, particularly because the tobacco industry continues to introduce and market new products that establish and maintain nicotine addiction.

Tobacco control efforts need to not only address the general population, but also to focus on populations with a higher prevalence of tobacco use and lower rates of quitting. These populations include people from some racial/ethnic minority groups, people with mental illness, lower educational levels and socioeconomic status, and certain regions of the country. We now have proven interventions and policies to reduce tobacco initiation and use among youth and adults.

With intense use of proven interventions, we can save lives and reduce health care costs. In 2012, the Centers for Disease Control and Prevention (CDC) launched the first-ever paid national tobacco education campaign — *Tips From Former Smokers* (*Tips*) — to raise awareness of the harms to health caused by smoking, encourage smokers to quit, and encourage nonsmokers to protect themselves and their families from exposure to secondhand smoke. It pulled back the curtain in a way that numbers alone cannot, and showed the tobacco-caused tragedies that we as health care professionals see and are saddened by every day. As a result of this campaign, an estimated 1.6 million smokers made an attempt to quit and, based on a conservative estimate, at least 100,000 smokers quit for good. Additionally, millions of nonsmokers talked with friends and family about the dangers of smoking and referred smokers to quit services. In 2013, CDC launched a new round of advertisements that helped even more people quit smoking by highlighting the toll that smoking-related illnesses take on smokers and their loved ones.

CDC has also established reducing tobacco use as one of its "Winnable Battles." These are public health priorities with large-scale impact on health that have proven effective strategies to address them. CDC believes that with additional effort and support for evidence-based, cost-effective policy and program strategies to reduce tobacco use, we can reduce smoking substantially, prevent millions of people from being killed by tobacco, and protect future generations from smoking.

While we have made tremendous progress over the past 50 years, sustained and comprehensive efforts are needed to prevent more people from having to suffer the pain, disability, disfigurement, and death that smoking causes. Most Americans who have ever smoked have already quit, and most smokers who still smoke want to quit. If we continue to implement tobacco prevention and cessation strategies that have proven effective in reducing tobacco use, people throughout our country will live longer, healthier, more productive lives.

Thomas R. Frieden, M.D., M.P.H.
Director
Centers for Disease Control and Prevention

Preface

from the Acting Surgeon General,
U.S. Department of Health and Human Services

On January 11, 1964, Luther L. Terry, M.D., the 9th Surgeon General of the United States, released the first report on the health consequences of smoking: *Smoking and Health: Report of the Advisory Committee of the Surgeon General of the Public Health Service*. That report marked a major step to reduce the adverse impact of tobacco use on health worldwide.

Over the past 50 years, 31 Surgeon General's reports have utilized the best available evidence to expand our understanding of the health consequences of smoking and involuntary exposure to tobacco smoke. The conclusions from these reports have evolved from a few causal associations in 1964 to a robust body of evidence documenting the health consequences from both active smoking and exposure to secondhand smoke across a range of diseases and organ systems.

The 2004 report concluded that smoking affects nearly every organ of the body, and the evidence in this report provides even more support for that finding. A half century after the release of the first report, we continue to add to the long list of diseases caused by tobacco use and exposure to tobacco smoke. This report finds that active smoking is now causally associated with age-related macular degeneration, diabetes, colorectal cancer, liver cancer, adverse health outcomes in cancer patients and survivors, tuberculosis, erectile dysfunction, orofacial clefts in infants, ectopic pregnancy, rheumatoid arthritis, inflammation, and impaired immune function. In addition, exposure to secondhand smoke has now been causally associated with an increased risk for stroke.

Smoking remains the leading preventable cause of premature disease and death in the United States. The science contained in this and prior Surgeon General's reports provide all the information we need to save future generations from the burden of premature disease caused by tobacco use. However, evidence-based interventions that encourage quitting and prevent youth smoking continue to be underutilized. This report strengthens our resolve to work together to accelerate and sustain what works—such as hard-hitting media campaigns, smokefree air policies, optimal tobacco excise taxes, barrier-free cessation treatment, and comprehensive statewide tobacco control programs funded at CDC-recommended levels. At the same time, we will explore "end game" strategies that support the goal of eliminating tobacco smoking, including greater restrictions on sales. It is my sincere hope that 50 years from now we won't need another Surgeon General's report on smoking and health, because tobacco-related disease and death will be a thing of the past. Working together, we can make that vision a reality.

Boris D. Lushniak, M.D., M.P.H.
Rear Admiral, U.S. Public Health Service
Acting Surgeon General
U.S. Department of Health and Human Services

Overview

For the United States, the epidemic of smoking-caused disease in the twentieth century ranks among the greatest public health catastrophes of the century, while the decline of smoking consequent to tobacco control is surely one of public health's greatest successes. However, the current rate of progress in tobacco control is not fast enough, and much more needs to be done to end the tobacco epidemic. Unacceptably high levels of smoking-attributable disease and death, and the associated costs, will persist for decades without changes in our approach to slowing and even ending the epidemic. If smoking persists at the current rate among young adults in this country, 5.6 million of today's Americans younger than 18 years of age are projected to die prematurely from a smoking-related illness (Chapter 12).

More than 20 million Americans have died as a result of smoking since the first Surgeon General's report on smoking and health was released in 1964 (Table 1) (Chapter 12). Most were adults with a history of smoking, but nearly 2.5 million were nonsmokers who died from heart disease or lung cancer caused by exposure to secondhand smoke. Another 100,000 were babies who died of sudden infant death syndrome (often referred to as SIDS) or complications from prematurity, low birth weight, or other conditions caused by parental smoking, particularly smoking by the mother.

Table 1 Premature deaths caused by smoking and exposure to secondhand smoke, 1965–2014

Cause of death	Total
Smoking-related cancers	6,587,000
Cardiovascular and metabolic diseases	7,787,000
Pulmonary diseases	3,804,000
Conditions related to pregnancy and birth	108,000
Residential fires	86,000
Lung cancers caused by exposure to secondhand smoke	263,000
Coronary heart disease caused by exposure to secondhand smoke	2,194,000
Total	20,830,000

Source: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, unpublished data.

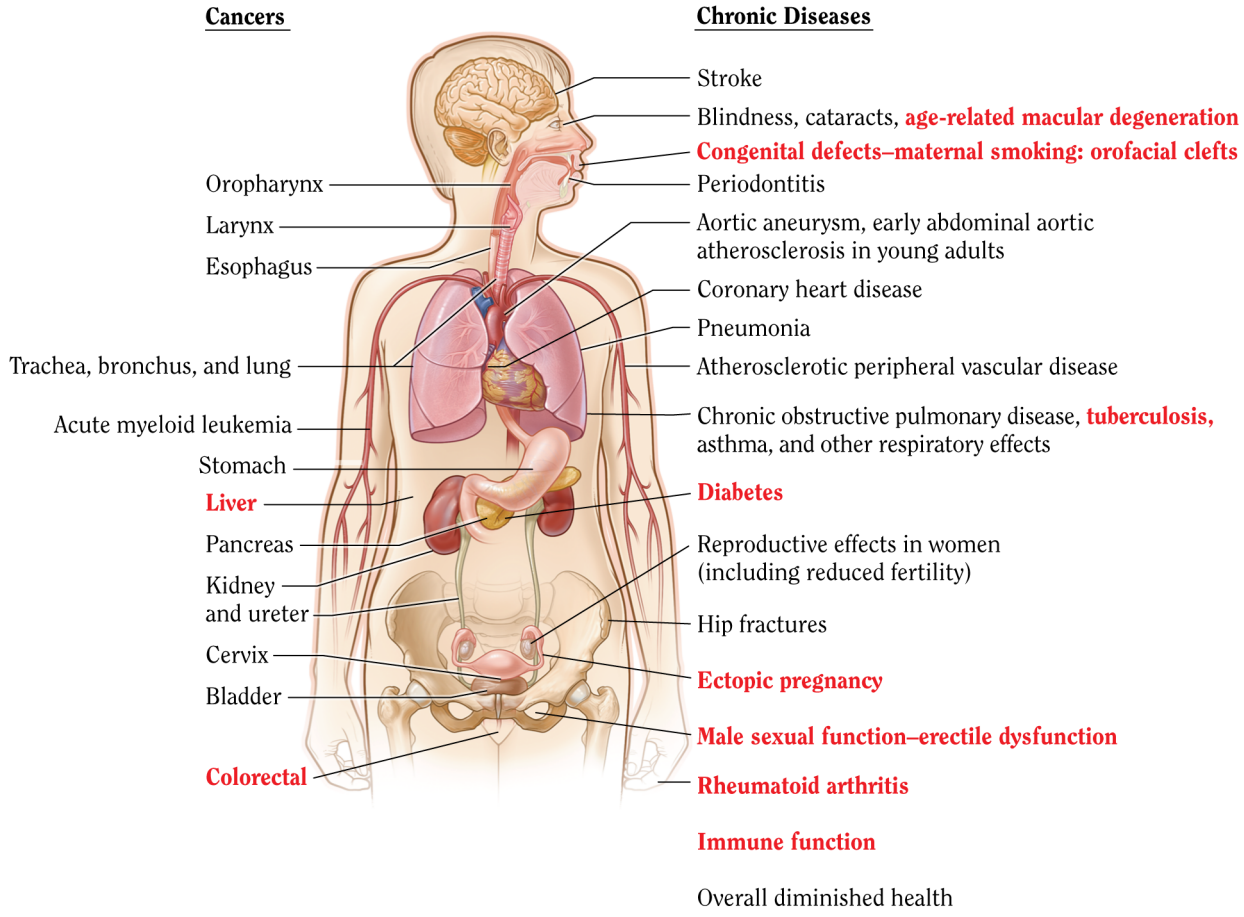
As these figures illustrate, the harms caused by the historic patterns of tobacco use in the United States, and especially by cigarette smoking, are staggering. More than 10 times as many U.S. citizens have died prematurely from cigarette smoking than have died in all the wars fought by the United States during its history. Study after study has confirmed the magnitude of the harm caused to the human body by exposure to toxicants and carcinogens found in tobacco smoke. Since 1964, the 31 previous Surgeon General's reports have chronicled a still growing but already conclusive body of evidence about the adverse impact of tobacco use on human cells and organs and on overall health. Health statistics show that all populations are affected.

Previous Surgeon General's reports have tracked the evolution of cigarettes into the current highly engineered, addictive, and deadly products containing thousands of chemicals that are harmful in themselves, but the burning of tobacco produces the complex chemical mixture of more than 7,000 compounds that cause a wide range of diseases and premature deaths as a result (U.S. Department of Health and Human Services [USDHHS] 2010). Although the prevalence of smoking has declined significantly over the past one-half century, the risks for smoking-related disease and mortality have not. In fact, today's cigarette smokers—both men and women—have a much higher risk for lung cancer and chronic obstructive pulmonary disease (COPD) than smokers in 1964, despite smoking fewer cigarettes (see Chapters 6, 7, and 11, and Figure 12.2 and Figure 13.16).

The 2004 Surgeon General's report showed that smoking impacts nearly every organ of the body (USDHHS 2004). The 2006 report concluded that the scientific evidence indicates that there is no risk-free level of exposure to secondhand smoke (USDHHS 2006). The new evidence in this report provides still more support for these conclusions. Fifty years after the first report in 1964, it is striking that the scientific evidence in this report expands the list of diseases and other adverse health effects caused by smoking and exposure of nonsmokers to tobacco smoke. Figures 1.1A and 1.1B highlight these new findings and show that the disease risks are even greater than presented in previous reports. These new findings include:

- Liver cancer and colorectal cancer are added to the long list of cancers caused by smoking;

Figure 1A The health consequences causally linked to smoking



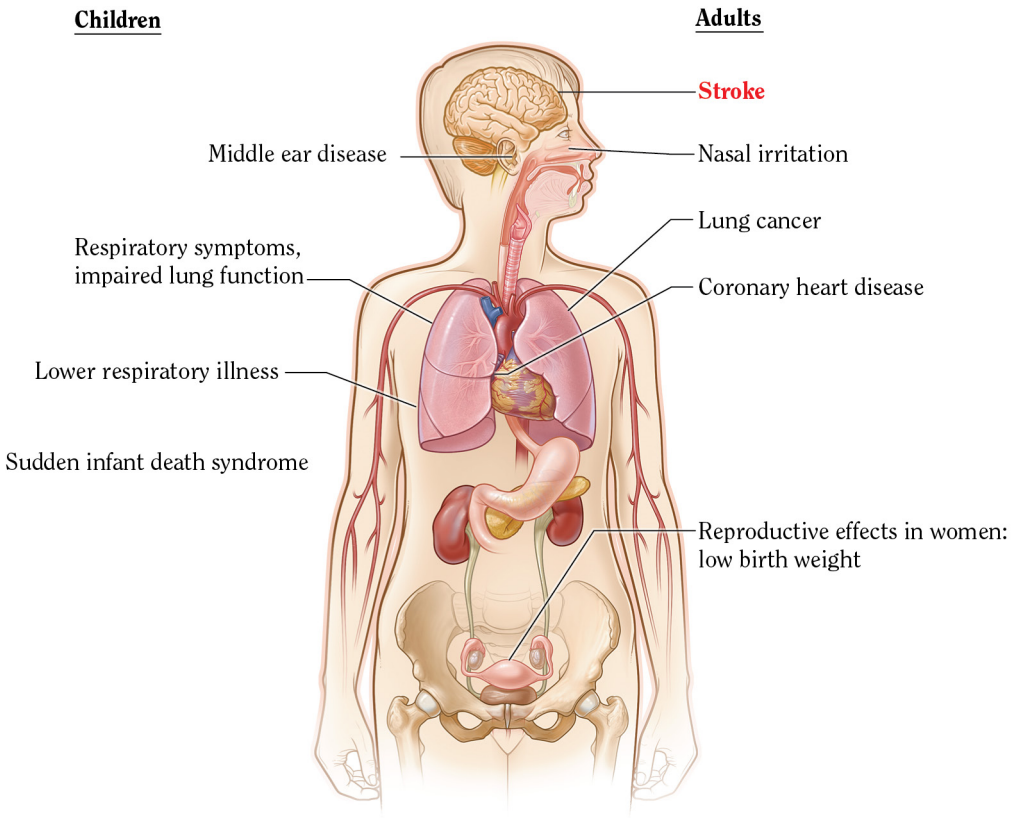
Source: USDHHS 2004, 2006, 2012.
Note: The condition in **red** is a new disease that has been causally linked to smoking in this report.

- Exposure to secondhand smoke is a cause of stroke;
- Smoking increases the risk of dying from cancer and other diseases in cancer patients and survivors;
- Smoking is a cause of diabetes mellitus; and
- Smoking causes general adverse effects on the body including inflammation and it impairs immune function. Smoking is a cause of rheumatoid arthritis.

Progress has been made in tobacco control. During the 50 years since the 1964 report, approaches have moved from single measures, such as small text-only pack warnings, to implementing comprehensive control programs, including indoor smoking bans, support for cessation, restrictions on advertising and promotion, media campaigns, and tax hikes to raise prices (Chapters 2 and 14). Smoking rates have declined, as have mortality rates for some diseases caused by smoking, such as heart disease and lung cancer for which smoking is the major cause.

Nonetheless, between 2005–2009, smoking was responsible for more than 480,000 premature deaths annually among Americans 35 years of age and older (Chapter 12). More than 87% of lung cancer deaths, 61% of all pulmonary disease deaths, and 32% of all deaths from coronary heart disease were attributable to smoking and exposure to secondhand smoke. Additionally, if current trends continue 5.6 million U.S. youth who are currently younger than 18 years of age will die prematurely during adulthood from their smoking (Chapter 12).

Figure 1B The health consequences causally linked to exposure to secondhand smoke



Source: USDHHS 2004, 2006.
Note: The condition in **red** is a new disease that has been causally linked to smoking in this report.

Many of the findings in this report have particular relevance to women who are current smokers. For the first time ever, they are as likely as men to die from many diseases caused by smoking (Chapter 12). The relative risk for dying from coronary heart disease among women 35 years of age and older is now higher than for men. Because the risks for women have increased so much in the last decades, women who smoke now have about the same high risk of death from lung cancer as men.

In addition to the impact that smoking has on health and well-being, the nation pays enormous financial costs because of smoking. Productivity losses from premature death alone now exceed $150 billion per year (Chapter 12). Additionally, the value of lost productivity due to premature deaths caused by exposure to secondhand smoke is now estimated to be $5.6 billion per year. The annual costs of direct medical care of adults attributable to smoking are now estimated to be over $130 billion (Chapter 12).

This comprehensive report chronicles the devastating consequences of 50 years of tobacco use in the United States. It updates data on the numerous health effects resulting from smoking and exposure to secondhand smoke, and details public health trends, both favorable and unfavorable, in tobacco use. This report marks the steady progress achieved in reducing the prevalence of smoking and validates tobacco control strategies that have consistently proven to be effective. It also examines strategies with the potential to eradicate the death and disease caused by the tobacco epidemic at long last, and identifies specific measures that should be taken immediately to move smoking off its decades-old number one spot as the largest single cause of preventable death and disease for the citizens of the United States. Finally, the report documents that effective interventions are available and calls for their full implementation.

Major Conclusions from the Report

1. The century-long epidemic of cigarette smoking has caused an enormous avoidable public health tragedy. Since the first Surgeon General's report in 1964 more than 20 million premature deaths can be attributed to cigarette smoking.

2. The tobacco epidemic was initiated and has been sustained by the aggressive strategies of the tobacco industry, which has deliberately misled the public on the risks of smoking cigarettes.

3. Since the 1964 Surgeon General's report, cigarette smoking has been causally linked to diseases of nearly all organs of the body, to diminished health status, and to harm to the fetus. Even 50 years after the first Surgeon General's report, research continues to newly identify diseases caused by smoking, including such common diseases as diabetes mellitus, rheumatoid arthritis, and colorectal cancer.

4. Exposure to secondhand tobacco smoke has been causally linked to cancer, respiratory, and cardiovascular diseases, and to adverse effects on the health of infants and children.

5. The disease risks from smoking by women have risen sharply over the last 50 years and are now equal to those for men for lung cancer, chronic obstructive pulmonary disease, and cardiovascular diseases.

6. In addition to causing multiple diseases, cigarette smoking has many adverse effects on the body, such as causing inflammation and impairing immune function.

7. Although cigarette smoking has declined significantly since 1964, very large disparities in tobacco use remain across groups defined by race, ethnicity, educational level, and socioeconomic status and across regions of the country.

8. Since the 1964 Surgeon General's report, comprehensive tobacco control programs and policies have been proven effective for controlling tobacco use. Further gains can be made with the full, forceful, and sustained use of these measures.

9. The burden of death and disease from tobacco use in the United States is overwhelmingly caused by cigarettes and other combusted tobacco products; rapid elimination of their use will dramatically reduce this burden.

10. For 50 years the Surgeon General's reports on smoking and health have provided a critical scientific foundation for public health action directed at reducing tobacco use and preventing tobacco-related disease and premature death.

The 2014 Surgeon General's report is presented in three sections:

Section 1: Historical Perspective, Overview, and Conclusions;

Section 2: The Health Consequences of Active and Passive Smoking: The Evidence in 2014; and

Section 3: Tracking and Ending the Epidemic.

The following is a summary of the contents of each section.

Section 1: Historical Perspective, Overview, and Conclusions

When Dr. Luther L. Terry released the first Surgeon General's report on smoking and health in January 1964, few could have anticipated the long-term impact it would have on this nation's health. The report reviewed more than 7,000 research articles related to smoking and disease—the evidence considered dated to the early twentieth century but most came from the wave of research that started at mid-century. The initial report concluded that smoking was associated with higher all-cause mortality rates among men, was a cause of lung cancer and laryngeal cancer in men, was a probable cause of lung cancer in women, and was the most important cause of bronchitis (U.S. Department of Health, Education, and Welfare 1964). News coverage of the report was extensive, and the release of the report was ranked among the top news stories of the twentieth century (*USA Today* 1999).

Nonetheless, public attitudes about smoking and its adverse health effects were slow to change, and smoking declined slowly after the report. In 1964, more than one-half of men and nearly one-third of women were regular smokers; it took approximately 15 years for rates of smoking among men to drop by one-quarter or more (Chapter 2). The scientific evidence helped to launch public health campaigns about the dangers of smoking. The tobacco industry attempted to counter these campaigns through aggressive advertising. It used a variety of tactics to create doubt about the findings on smoking and health and launched marketing strategies that obscured the dangers of smoking by implying that certain cigarettes were safer than others. In fact, rates of smoking among women actually increased in the years following the first Surgeon General's report.

During the decades that followed, however, a number of local, state, and federal laws and policies addressed tobacco product marketing and advertising, labeling and packaging, youth access, and exposure to secondhand smoke. Social norms that had made smoking acceptable everywhere began to change as a grassroots movement aimed at protecting nonsmokers emerged. Surgeon General's reports on the impact of tobacco use on specific populations, the changing cigarette, nicotine addiction, specific smoking-related diseases, and secondhand smoke gave impetus to a steady movement away from smoking as an acceptable social norm. The prevalence of smoking among adults is now less than one-half of what it was in 1964, and the prevalence among youth is less than one-half. A 2011 Gallup poll reported that for the first time, a majority of Americans supported a ban on smoking in all public places (Newport 2011).

The ongoing story of tobacco use covered in this Surgeon General's report illustrates the complexity and dynamic nature of the issue. This report examines smoking from a public health standpoint; as a cultural and social phenomenon; as an extension of the tobacco industry's aggressive and fraudulent campaigns to mislead the public on health hazards; and from legal, policy, and public education perspectives.

Section 2: The Health Consequences of Active and Passive Smoking: The Evidence in 2014

Since 1964, the evidence on smoking and health has expanded greatly; the list of adverse consequences of tobacco smoking has lengthened progressively; and since the 1970s, scientific research has linked the inhalation of secondhand smoke by nonsmokers to specific diseases and other adverse effects. Even in this report, a half-century following the first report, the evidence has been found sufficient to infer further causal associations of active and passive smoking with disease.

Nicotine and Addiction: Nicotine was found to be addicting in the 1988 Surgeon General's report (USDHHS 1988). That conclusion has been repeatedly reaffirmed in subsequent reports, and nicotine addiction figures centrally in initiation and in the difficulty of cessation (USDHHS 2010, 2012). Additionally, nicotine is a pharmacologically active agent that has acute toxicity and that readily enters the body and is distributed throughout. Beyond causing addiction, it activates multiple biologic pathways that are relevant to fetal growth and development, immune function, the cardiovascular system, the central nervous system, and carcinogenesis. Nicotine exposure during fetal development, a critical window

for the brain, has lasting adverse consequences for brain development. Nicotine exposure during pregnancy also contributes to adverse reproductive outcomes, such as preterm birth and stillbirth.

Cancer: Lung cancer, the first of many deadly diseases to be identified in a Surgeon General's report as being caused by smoking (Chapter 6), is now the nation's most common cancer killer among men and women. Two studies carried out by the American Cancer Society have been key sources of information on the risks of lung cancer in smokers. These two studies each followed more than 1 million U.S. men and women, starting in 1959 for the first study and then again in 1982 for the second. Results from these studies have now been compared with data combined from several large populations followed from 2000–2010 (Thun et al. 1997a,b, 2013). Although the risk of lung cancer for never smokers in all three studies stayed about the same, the risk to smokers increased steadily. Among women, risk of lung cancer went up dramatically. In the 1959 study, women smokers were 2.7 times more likely than women never smokers to develop lung cancer; by 2000–2010 that additional risk for women smokers had jumped nearly tenfold, to 25.7. For men who smoked, the risk more than doubled, from 12.2 to 25.0 between the first and last studies. These relative risks increased over the same period as the prevalence of smoking and the average number of cigarettes consumed per smoker decreased. Although the incidence of squamous cell carcinoma of the lung—the type of lung cancer most often diagnosed among smokers at the start of the lung cancer epidemic—declined as smoking rates dropped, the incidence of adenocarcinoma of the lung increased dramatically. Evidence suggests that changes in the composition and design of the cigarette itself may have had some impact on the relative risk of lung cancer, as well as on the shift in the types of lung cancer occurring in the contemporary cohorts of smokers (Thun et al. 2013).

This latest Surgeon General's report also evaluated the evidence on other cancers, and concluded that smoking is a cause of liver cancer and of colorectal cancer, the fourth most diagnosed cancer in the United States and the cancer responsible for the second largest number of cancer deaths annually (Chapter 6). The report found that the evidence is suggestive but insufficient to conclude that smoking and exposure to secondhand smoke cause breast cancer, and that smoking is not a cause for prostate cancer. The report also found that smoking increases the risk of dying from cancer and other diseases in cancer patients and survivors, including breast and prostate cancer patients.

Respiratory diseases: In the 1964 Surgeon General's report, smoking was found to be a cause of "chronic bronchitis," a term used then for the disease now generally referred to as chronic obstructive pulmonary disease (COPD) (Fletcher et al. 1959). Because smoke is inhaled into the lung and its components are deposited and absorbed in the lungs, it has long been linked to adverse effects on the respiratory system, causing malignant and nonmalignant diseases, exacerbating chronic lung diseases, and increasing the risk for respiratory infections. The scientific literature showing associations with multiple diseases of the respiratory tract is extensive as is the evidence supporting the biologic plausibility of smoking as a cause of these associations (Chapter 7). This report has reviewed the updated evidence on COPD. Mortality from COPD continues to rise, and smoking remains responsible for the vast majority of cases (Chapter 7). As for lung cancer, comparison of the findings of the two American Cancer Society studies with the more recent studies spanning 2000–2010 showed rising risks for COPD, particularly in women. Recent studies show that the relative risk for COPD in women has risen greatly, reaching 22.4 compared to never smokers, and similar to the risk in men (Thun et al. 2013).

For asthma, another obstructive lung disease, the evidence was found to be sufficient to infer that smoking worsens asthma in adults who smoke (Chapter 7). The benefits of implementing smokefree policies have been shown for workers with asthma (Eisner et al. 1998; Menzies et al. 2006; Ayres et al. 2009; Wilson et al. 2012). Evidence considered in this report points to a reduction in admissions for respiratory diseases following the implementation of a smokefree policy (Tan and Glantz 2012). Tuberculosis was once a leading cause of death in the United States. Now far less frequent in the United States, it remains prominent worldwide. Evidence reported over the last decade is sufficient to lead to a conclusion that smoking increases the risk for tuberculosis and for dying from tuberculosis (Chapter 7).

Cardiovascular diseases: Although lung cancer is often assumed to be the largest smoking-attributable cause of death in the United States, cardiovascular disease actually claims more lives of smokers 35 years of age and older every year compared with lung cancer (Chapter 8). Exposure to secondhand smoke causes significantly more deaths due to cardiovascular disease than due to lung cancer, and this new report finds that exposure to secondhand smoke is also a cause of stroke. Exposure to secondhand smoke increases the risk for stroke by an estimated 20–30%. Even so, the evidence is clear that reductions in smoking and exposure to secondhand smoke have contributed to the decline in death rates from cardiovascular diseases since the late 1960s. Smokefree laws and policies have been proven to reduce the incidence of heart attacks

and other coronary events among people younger than 65 years of age, and evidence suggests that there could be a relationship between such laws and policies and a reduction in cerebrovascular events.

Diabetes: Previous Surgeon General's reports have found that smoking complicates the treatment of diabetes and that smokers who have been diagnosed with diabetes are at a higher risk for kidney disease, blindness, and circulatory complications leading to amputations. This report concludes that smoking is a cause of type 2 diabetes mellitus, and that the risk of developing diabetes is 30–40% higher for active smokers than nonsmokers (Chapter 10). Furthermore, the risk of developing diabetes increases as the number of cigarettes smoked grows.

Immune and autoimmune disorders: This report finds that smoking is a cause of general adverse effects on the body, including systemic inflammation and impaired immune function (Chapter 10). One result of this altered immunity is increased risk for pulmonary infections among smokers. For example, risks for *Mycobacterium tuberculosis* and for death from tuberculosis disease are higher for smokers than nonsmokers (Chapter 7). Additionally, smoking is known to compromise the equilibrium of the immune system, increasing the risk for several immune and autoimmune disorders. This report finds that smoking is a cause of rheumatoid arthritis, and that smoking interferes with the effectiveness of certain treatments for rheumatoid arthritis (Chapter 10).

Reproductive effects: Several additional adverse reproductive effects are now found to be attributable to smoking (Chapter 9). One is ectopic pregnancy, in which the embryo implants in the Fallopian tube or elsewhere outside the uterus. Ectopic pregnancy is very rarely a survivable condition for the fetus and is a potentially fatal condition for the mother. This report finds that maternal smoking during early pregnancy is causal for orofacial clefts in infants, and evidence suggests that smoking could be associated with certain other birth defects. This report also finds that the evidence is now sufficient to conclude that there is a causal relationship between smoking and erectile dysfunction in men.

Eye disease: The retina is a delicate, light-sensitive tissue that lines the inside of the eye. The macula is the most sensitive part of the retina and is the part of the eye that supplies sharp vision. Age-related macular degeneration (AMD) gradually destroys the macula and can ultimately lead to loss of vision in the center of the eye. This report finds that smoking is a cause of AMD (Chapter 10). Evidence in the report also suggests that quitting smoking may reduce the risk for AMD, but the reduced risk may not appear for 20 or more years after smoking cessation.

General health: Smokers have long been known to suffer from poorer general health than nonsmokers, beginning at an early age and extending throughout adult life (Chapter 11). Although emphasis has been given to smoking as a cause of specific and avoidable diseases, it is a powerful cause of ill-health generally. These health deficits not only reduce the quality of life of smokers but also affect their participation in the workplace and increase their costs to the health care system.

All-cause mortality: The evidence in this report reaffirms that smoking is a major cause of premature death (Chapter 11). During the past 50 years, as generations of men and women who began smoking in adolescence and continued to smoke into middle and older ages have been stricken with the health consequences of lifetime smoking, the relative risk for all-cause mortality associated with current cigarette smoking has increased. The age-standardized relative risk, comparing the all-cause death rate in current smokers to that of never smokers, has more than doubled in men and more than tripled in women during the years since the release of the first Surgeon General's report on smoking and health. The lives of smokers are cut short by the development of the many diseases caused by smoking and by their greater risk of dying from common health events, such as complications of routine surgeries and pneumonia. Smoking shortens life far more than most other risk factors for early mortality; smokers are estimated to lose more than a decade of life. Smoking cessation by 40 years of age reduces that loss approximately 90%. Even stopping by about 60 years of age reduces that loss approximately 40%. However, reducing the number of cigarettes smoked per day is much less effective than quitting entirely for avoiding the risks of premature death from all smoking-related causes of death.

Much of this 50th anniversary Surgeon General's report is devoted to examining evidence on the myriad health effects, avoidable diseases, and all-cause mortality from smoking. Chapters highlight findings on specific health topics from previous Surgeon General's reports in addition to presenting current information. The following are chapter-specific conclusions related to the health effects of smoking from Section 2 of the report.

Chapter 5: Nicotine

1. The evidence is sufficient to infer that at high-enough doses nicotine has acute toxicity.

2. The evidence is sufficient to infer that nicotine activates multiple biological pathways through which smoking increases risk for disease.

3. The evidence is sufficient to infer that nicotine exposure during fetal development, a critical window for brain development, has lasting adverse consequences for brain development.

4. The evidence is sufficient to infer that nicotine adversely affects maternal and fetal health during pregnancy, contributing to multiple adverse outcomes such as preterm delivery and stillbirth.

5. The evidence is suggestive that nicotine exposure during adolescence, a critical window for brain development, may have lasting adverse consequences for brain development.

6. The evidence is inadequate to infer the presence or absence of a causal relationship between exposure to nicotine and risk for cancer.

Chapter 6: Cancer

Lung Cancer

1. The evidence is sufficient to conclude that the risk of developing adenocarcinoma of the lung from cigarette smoking has increased since the 1960s.

2. The evidence is sufficient to conclude that the increased risk of adenocarcinoma of the lung in smokers results from changes in the design and composition of cigarettes since the 1950s.

3. The evidence is not sufficient to specify which design changes are responsible for the increased risk of adenocarcinoma, but there is suggestive evidence that ventilated filters and increased levels of tobacco-specific nitrosamines have played a role.

4. The evidence shows that the decline of squamous cell carcinoma follows the trend of declining smoking prevalence.

Liver Cancer

1. The evidence is sufficient to infer a causal relationship between smoking and hepatocellular carcinoma.

Colorectal Cancer

1. The evidence is sufficient to infer a causal relationship between smoking and colorectal adenomatous polyps and colorectal cancer.

Prostate Cancer

1. The evidence is suggestive of no causal relationship between smoking and the risk of incident prostate cancer.

2. The evidence is suggestive of a higher risk of death from prostate cancer in smokers than in nonsmokers.

3. In men who have prostate cancer, the evidence is suggestive of a higher risk of advanced-stage disease and less-well-differentiated cancer in smokers than in nonsmokers, and—independent of stage and histologic grade—a higher risk of disease progression.

Breast Cancer

1. The evidence is sufficient to identify mechanisms by which cigarette smoking may cause breast cancer.

2. The evidence is suggestive but not sufficient to infer a causal relationship between tobacco smoke and breast cancer.

3. The evidence is suggestive but not sufficient to infer a causal relationship between active smoking and breast cancer.

4. The evidence is suggestive but not sufficient to infer a causal relationship between exposure to secondhand tobacco smoke and breast cancer.

Adverse Health Outcomes in Cancer Patients and Survivors

1. In cancer patients and survivors, the evidence is sufficient to infer a causal relationship between cigarette smoking and adverse health outcomes. Quitting smoking improves the prognosis of cancer patients.

2. In cancer patients and survivors, the evidence is sufficient to infer a causal relationship between cigarette smoking and increased all-cause mortality and cancer-specific mortality.

3. In cancer patients and survivors, the evidence is sufficient to infer a causal relationship between cigarette smoking and increased risk for second primary cancers known to be caused by cigarette smoking, such as lung cancer.

4. In cancer patients and survivors, the evidence is suggestive but not sufficient to infer a causal relationship between cigarette smoking and (1) the risk of recurrence, (2) poorer response to treatment, and (3) increased treatment-related toxicity.

Chapter 7: Respiratory Diseases

Chronic Obstructive Pulmonary Disease

1. The evidence is sufficient to infer that smoking is the dominant cause of chronic obstructive pulmonary disease (COPD) in men and women in the United States. Smoking causes all elements of the COPD phenotype, including emphysema and damage to the airways of the lung.

2. Chronic obstructive pulmonary disease (COPD) mortality has increased dramatically in men and women since the 1964 Surgeon General's report. The number of women dying from COPD now surpasses the number of men.

3. The evidence is suggestive but not sufficient to infer that women are more susceptible to develop severe chronic obstructive pulmonary disease at younger ages.

4. The evidence is sufficient to infer that severe α1-antitrypsin deficiency and cutis laxa are genetic causes of chronic obstructive pulmonary disease.

Asthma

1. The evidence is suggestive but not sufficient to infer a causal relationship between active smoking and the incidence of asthma in adolescents.

2. The evidence is suggestive but not sufficient to infer a causal relationship between active smoking and exacerbation of asthma among children and adolescents.

3. The evidence is suggestive but not sufficient to infer a causal relationship between active smoking and the incidence of asthma in adults.

4. The evidence is sufficient to infer a causal relationship between active smoking and exacerbation of asthma in adults.

Tuberculosis

1. The evidence is sufficient to infer a causal relationship between smoking and an increased risk of *Mycobacterium tuberculosis* disease.

2. The evidence is sufficient to infer a causal relationship between smoking and mortality due to tuberculosis.

3. The evidence is suggestive of a causal relationship between smoking and the risk of recurrent tuberculosis disease.

4. The evidence is inadequate to infer the presence or absence of a causal relationship between active smoking and the risk of tuberculosis infection.

5. The evidence is inadequate to infer the presence or absence of a causal relationship between exposure to secondhand smoke and the risk of tuberculosis infection.

6. The evidence is inadequate to infer the presence or absence of a causal relationship between exposure to secondhand smoke and the risk of tuberculosis disease.

Idiopathic Pulmonary Fibrosis

1. The evidence is suggestive but not sufficient to infer a causal relationship between cigarette smoking and idiopathic pulmonary fibrosis.

Chapter 8: Cardiovascular Disease

1. The evidence is sufficient to infer a causal relationship between exposure to secondhand smoke and increased risk of stroke.

2. The estimated increase in risk for stroke from exposure to secondhand smoke is about 20–30%.

3. The evidence is sufficient to infer a causal relationship between the implementation of a smokefree law or policy and a reduction in coronary events among people younger than 65 years of age.

4. The evidence is suggestive but not sufficient to infer a causal relationship between the implementation of a smokefree law or policy and a reduction in cerebrovascular events.

5. The evidence is suggestive but not sufficient to infer a causal relationship between the implementation of a smokefree law or policy and a reduction in other heart disease outcomes, including angina and out-of-hospital sudden coronary death.

Chapter 9: Reproductive Outcomes

Congenital Malformations

1. The evidence is sufficient to infer a causal relationship between maternal smoking in early pregnancy and orofacial clefts.

2. The evidence is suggestive but not sufficient to infer a causal relationship between maternal smoking in early pregnancy and clubfoot, gastroschisis, and atrial septal heart defects.

Neurobehavioral Disorders of Childhood

1. The evidence is suggestive but not sufficient to infer a causal relationship between maternal prenatal smoking and disruptive behavioral disorders, and attention deficit hyperactivity disorder in particular, among children.

2. The evidence is insufficient to infer the presence or absence of a causal relationship between maternal prenatal smoking and anxiety and depression in children.

3. The evidence is insufficient to infer the presence or absence of a causal relationship between maternal prenatal smoking and Tourette syndrome.

4. The evidence is insufficient to infer the presence or absence of a causal relationship between maternal prenatal smoking and schizophrenia in her offspring.

5. The evidence is insufficient to infer the presence or absence of a causal relationship between maternal prenatal smoking and intellectual disability.

Ectopic Pregnancy

1. The evidence is sufficient to infer a causal relationship between maternal active smoking and ectopic pregnancy.

Spontaneous Abortion

1. The evidence is suggestive but not sufficient to infer a causal relationship between maternal active smoking and spontaneous abortion.

Male Sexual Function

1. The evidence is sufficient to infer a causal relationship between smoking and erectile dysfunction.

Chapter 10: Other Specific Outcomes

Eye Disease: Age-Related Macular Degeneration

1. The evidence is sufficient to infer a causal relationship between cigarette smoking and neovascular and atrophic forms of age-related macular degeneration.

2. The evidence is suggestive but not sufficient to infer that smoking cessation reduces the risk of advanced age-related macular degeneration.

Dental Disease

1. The evidence is suggestive but not sufficient to infer a causal relationship between active cigarette smoking and dental caries.

2. The evidence is suggestive but not sufficient to infer a causal relationship between exposure to tobacco smoke and dental caries in children.

3. The evidence is suggestive but not sufficient to infer a causal relationship between cigarette smoking and failure of dental implants.

Diabetes

1. The evidence is sufficient to infer that cigarette smoking is a cause of diabetes.

2. The risk of developing diabetes is 30–40% higher for active smokers than nonsmokers.

3. There is a positive dose-response relationship between the number of cigarettes smoked and the risk of developing diabetes.

Immune Function and Autoimmune Disease

1. The evidence is sufficient to infer that components of cigarette smoke impact components of the immune system. Some of these effects are immune activating and others are immune-suppressive.

2. The evidence is sufficient to infer that cigarette smoking compromises the immune system and that altered immunity is associated with increased risk for pulmonary infections.

3. The evidence is sufficient to infer that cigarette smoke compromises immune homeostasis and that altered immunity is associated with an increased risk for several disorders with an underlying immune diathesis.

Rheumatoid Arthritis

1. The evidence is sufficient to infer a causal relationship between cigarette smoking and rheumatoid arthritis.

2. The evidence is sufficient to infer that cigarette smoking reduces the effectiveness of the tumor necrosis factor-alpha (TNF-α) inhibitors.

Systemic Lupus Erythematosus

1. The evidence is inadequate to infer the presence or absence of a causal relationship between cigarette smoking and systemic lupus erythematosus (SLE), the severity of SLE, or the response to therapy for SLE.

Inflammatory Bowel Disease

1. The evidence is suggestive but not sufficient to infer a causal relationship between cigarette smoking and Crohn's disease.

2. The evidence is suggestive but not sufficient to infer a causal relationship between cigarette smoking and a protective effect for ulcerative colitis.

Chapter 11: General Morbidity and All-Cause Mortality

1. The evidence is sufficient to infer a causal relationship between smoking and diminished overall health. Manifestations of diminished overall health among smokers include self-reported poor health, increased absenteeism from work, and increased health care utilization and cost.

2. The evidence is sufficient to infer that cigarette smoking increases risk for all-cause mortality in men and women.

3. The evidence is sufficient to infer that the relative risk of dying from cigarette smoking has increased over the last 50 years in men and women in the United States.

Section 3: Tracking and Ending the Epidemic

The final section of the 50th anniversary Surgeon General's report on smoking and health covers the human and economic costs of the smoking epidemic in the United States, current trends in tobacco use and tobacco control, the status of interventions and programs that address the smoking epidemic, and a vision for a future that is free of death and disease caused by tobacco use.

Throughout this report, the overwhelming harm done to this nation's health by cigarette smoking is made clear repeatedly. Accumulated data from the past 50 years graphically illustrate the devastating loss of life and the economic waste that have flowed from the manufacture, marketing, sale, and consumption of combustible tobacco products. In this half-century, nearly 25 trillion cigarettes have been consumed, despite a significant drop in consumption per smoker (Figure 2). The annual costs attributed to smoking in the United States are between $289 billion and $333 billion, including at least $130 billion for direct medical care of adults over $150 billion for lost productivity due to premature death, and more than $5 billion for lost productivity from premature death due to exposure to secondhand smoke (Chapter 12).

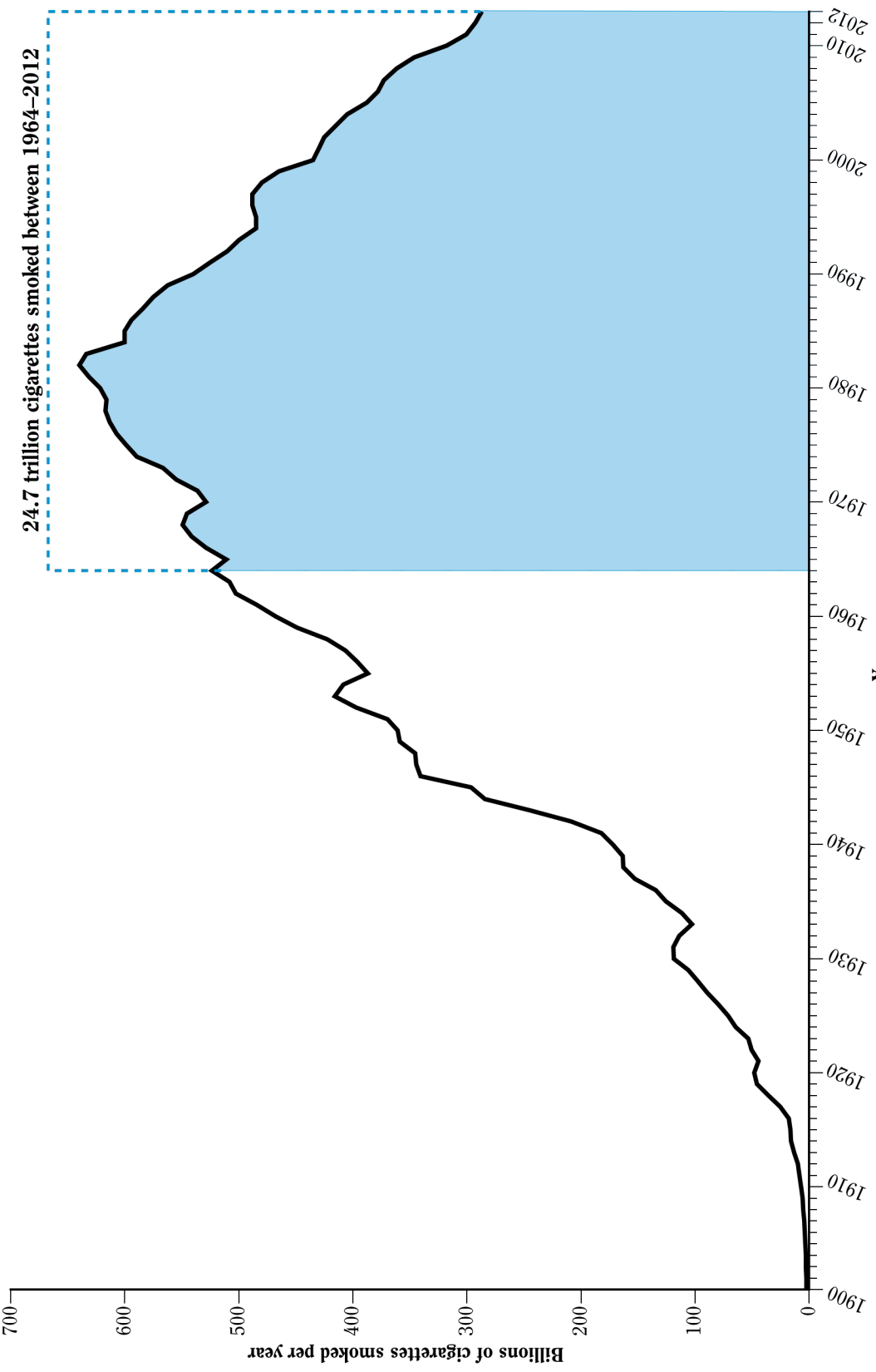


Figure 2 Total cigarette consumption, United States, 1900–2012

Source: Miller 1981; U.S. Department of Agriculture 1987, 1996, 2005, 2007a,b; Centers for Disease Control and Prevention 2012.
Note: Data shown are annual total consumption of cigarettes. This differs from Figure 2.1, which reports the annual adult (18 years of age and older) per capita consumption.

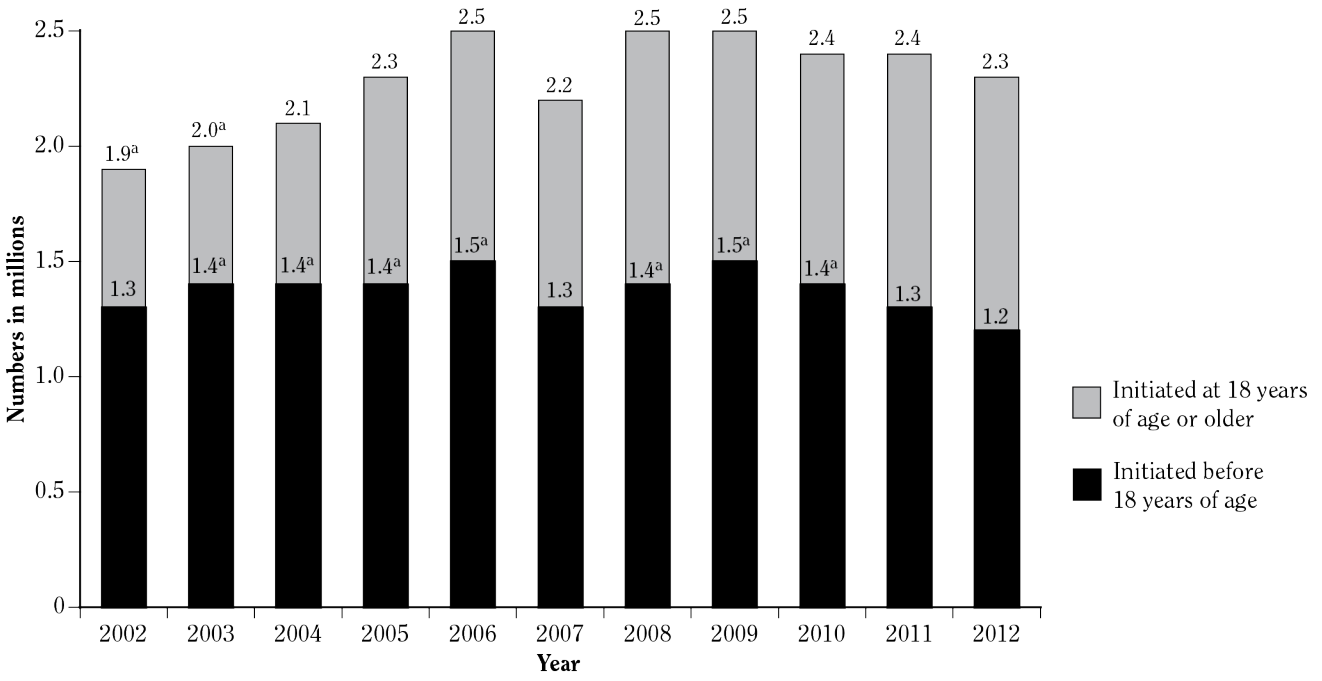
Despite decades of warnings on the dangers of smoking, nearly 42 million adults (Chapter 13) and more than 3.5 million middle and high school students continue to smoke cigarettes (USDHHS 2012). Significant disparities in tobacco use persist among certain racial/ethnic populations, and among groups defined by educational level, socioeconomic status, geographic region, sexual minorities (including individuals who are gay, lesbian, bisexual, and transgender, and individuals with same-sex relationships or attraction), and severe mental illness. The majority (88%) started smoking before 18 years of age, and nearly all first use of cigarettes occurs before 26 years of age (USDHHS 2012). The fraction of smoking initiation occurring after 18 years of age has been increasing over the past decade (Figure 3).

Tobacco industry advertising and promotional activities cause youth and young adults to start smoking, and nicotine addiction keeps people smoking past those ages (Chapter 14) (USDHHS 2012). Each year, for every adult who dies prematurely from a smoking-related cause, more than two youth or young adults become replacement smokers (Chapter 13) (USDHHS 2012). Although the prevalence of current smoking among high school-aged youth has declined, the total number of youth and young adults who started smoking increased from 1.9 million in 2002 to 2.3 million in 2012 (Figure 3). However, progress has been made in reducing initiation among youth younger than 18 years of age, with the total number of youth who initiated smoking before age 18 declining from 1.5 million in 2009 down to 1.2 million in 2012.

While attention has focused primarily on cigarette smoking, this and recent Surgeon General's reports review health risks and emphasize the need to monitor patterns of use of all combusted tobacco products, particularly the use of cigarette-like cigars and roll-your-own cigarettes using pipe tobacco. Most commonly, these products are used along with cigarettes. According to recent trends, the percentage of adults, 18 years of age and older—who smoke either cigarettes, cigars, or roll-your-own cigarettes made with pipe tobacco—has remained relatively steady (25–26%) since 2009 and has declined only a small amount since 2002 (Table 2).

Although recent trends emphasize the need for continued and vigorous tobacco control efforts, significant

Figure 3 Cigarette initiation during the past year among persons 12 years of age and older, by age at first use, 2002–2012



Source: Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2002–2012.
[a]Difference between this estimate and the 2012 estimate is statistically significant at the 0.05 level.

Table 2 Percentage of tobacco product use in the past month among persons 18 years of age and older, 2002–2012

Substance	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total tobacco products[a]	30.8[b]	30.2[b]	29.6[b]	29.9[b]	30.1[b]	29.2[b]	28.8[b]	28.1	27.8	26.9	27.3
Cigarettes[c]	25.8[b]	25.2[b]	24.7[b]	24.7[b]	24.8[b]	24.1[b]	23.7[b]	23.0[d]	22.6	21.7	22.0
Smokeless tobacco	3.5	3.4	3.1[b]	3.3	3.5	3.3	3.6	3.5	3.6	3.3	3.6
Cigars	5.5	5.5	5.8	5.8	5.7	5.5	5.5	5.4	5.4	5.2	5.4
Pipe tobacco	0.8	0.7[b]	0.8[d]	0.9	1.0	0.8	0.8[d]	0.8	0.9	0.8	1.0
Cigarettes[c] or cigars	28.5[b]	27.9[b]	27.6[b]	27.7[b]	27.7[b]	27.0[b]	26.4[b]	25.8[d]	25.5	24.6	24.8
Cigarettes,[c] cigars, or pipe tobacco	28.8[b]	28.2[b]	27.9[b]	28.0[b]	28.0[b]	27.3[b]	26.7[b]	26.1	25.8	24.9	25.2

Source: Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2002–2012.

[a]Tobacco products include cigarettes, smokeless tobacco (i.e., chewing tobacco or snuff), cigars, or pipe tobacco.

[b]Difference between estimate and 2012 estimate is statistically significant at the 0.01 level.

[c]Past month cigarette use is defined as smoking during the 30 days preceding the survey and smoking 100 cigarettes or more in a lifetime. Respondents with an unknown lifetime number of cigarettes smoked were excluded from the analysis.

[d]Difference between estimate and 2012 estimate is statistically significant at the 0.05 level.

achievements have been made during the past five decades. In fact, historic success in tobacco control is considered one of the top public health achievements of the twentieth century (Centers for Disease Control and Prevention [CDC] 1999; Ward and Warren 2007). Today, in the United States there are more former smokers than current smokers, and success rates for quitting have been increasing among recent birth cohorts (Chapter 13). Interest in quitting is high across all segments of society. Patterns of tobacco use are also changing, with more people smoking intermittently and smoking fewer cigarettes; however, there is an increase in the use of tobacco products other than cigarettes, often concurrent with cigarettes.

The burden of smoking-attributable disease and premature death and its high costs to the nation will continue for decades unless smoking prevalence is reduced more rapidly than the current trajectory. The evidence in this report shows that the nation may fail to achieve the *Healthy People 2020* objective of reducing the prevalence of smoking among adults to 12%. Model estimates suggest that if the status quo in tobacco control in 2008 were maintained, the projected prevalence of smoking among adults in 2050 could still be as high as 15% (Chapter 15). Trends in smoking rates among youth and adults show progress, but the prevalence of current smoking among youth and adults is only slowly declining and the actual number of youth and young adults starting to smoke has increased since 2002 (Figure 3). Additionally, the use of multiple tobacco products is increasingly common, especially among young smokers. Concerns remain that use of these new products may increase initiation rates among youth and young adults, delay quitting, and prolong the smoking epidemic.

The tobacco industry continues to position itself to sustain its sales by recruiting youth and young adults and by maintaining current smokers as consumers of all their nicotine-containing products including cigarettes (see Chapters 13, 14, and 15). As reviewed in Chapter 14, U.S. District Judge Gladys Kessler entered her final opinion and order on August 17, 2006, and found that the tobacco industry defendants violated the *Racketeer Influenced and Corrupt Organizations* (*RICO*) *Act* by lying, misrepresenting, and deceiving the public "including smokers and the young people they avidly sought as 'replacement smokers,' about the devastating health effects of smoking and environmental tobacco smoke" (*U.S. v. Philip Morris* 2006:852). The *Tobacco Control Act* incorporates as congressional findings of fact Judge Kessler's determinations that "the major United States cigarette companies continue to target and market to youth," that the companies sought to "encourage youth to start smoking subsequent to the signing of the Master Settlement Agreement

in 1998," and that they "have designed their cigarettes to precisely control nicotine delivery levels and provide doses of nicotine sufficient to create and sustain addiction while also concealing much of their nicotine-related research" (*Tobacco Control Act* 2009, §2(47) – (49)).

Therefore, this report addresses the question: what steps are needed to end the tobacco epidemic? There are different ways to achieve this vision. Should the emphasis be on ending cigarette use?; ending the use of the most harmful tobacco products while reducing the harm of remaining products?; or ending the use of all tobacco products?

The scientific findings of the 2012 Surgeon General's report (USDHHS 2012) show that there are evidence-based strategies that can rapidly drop initiation and prevalence rates of smoking among youth to single digits. To reach this target, these strategies need to be fully implemented and sustained with sufficient intensity and duration. Without such increased and sustained action, 5.6 million youth younger than 18 years of age in this country today are projected to die prematurely from a smoking-related illness. But millions of these projected deaths could be averted, making tobacco control a highest priority in our overall public health commitment and strategy.

The scientific evidence is incontrovertible: inhaling the combustion compounds from tobacco smoke, particularly from cigarettes, is deadly. It has been stated that "The cigarette is also a defective product, meaning not just dangerous but *unreasonably* dangerous, killing half its long-term users. And addictive by design" (Proctor 2013, p. i27). As the list of diseases caused by smoking has continued to increase, the updated estimate of the annual number of deaths attributable to smoking and exposure to secondhand smoke is now approaching 500,000 (Chapter 12). This increase has occurred despite decreases in per capita cigarette consumption and prevalence of smoking, emphasizing our enhanced understanding of the increased lethality of cigarettes. The high risks of cigarette smoking and the historic and current patterns of tobacco use in the United States lead to a primary conclusion of this report:

- The burden of death and disease from tobacco use in the United States is overwhelmingly caused by cigarettes and other combusted tobacco products; rapid elimination of their use will dramatically reduce this burden.

Could the use of cigarettes and other combusted tobacco products be rapidly reduced in this country? As noted above, evidence-based strategies that can rapidly drop youth initiation and prevalence rates down to single digits have already been identified and used (USDHHS 2012). Chapter 14 reviews a broad range of well-defined and effective interventions proven to reduce smoking rates if implemented and sustained at funding levels consistent with CDC's recommended levels (Figure 4).

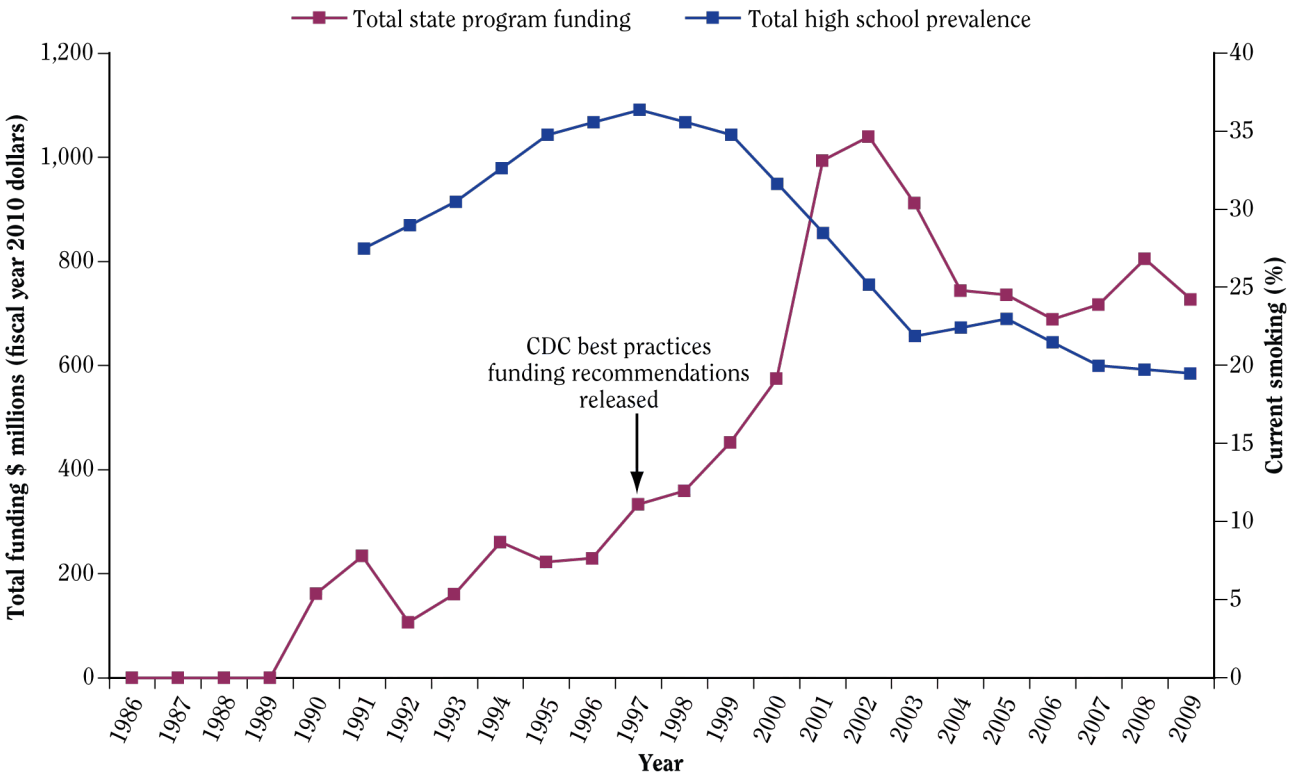
This and previous reports outline effective programs and policies: raising the retail price of cigarettes and other tobacco products, smokefree indoor air policies, high-impact media campaigns, full access to cessation treatments, and funding of comprehensive statewide tobacco control programs at the CDC recommended levels.

However, these five actions are not all that needs to be done. In considering options for reducing the health burden caused by smoking, many additional recommended actions have been defined in evidence reviews and guidance documents discussed in this report. For example, selected state experience suggests that all levels of government can enhance revenue collection and minimize tax avoidance and evasion through several promising policy approaches, such as implementing a high-tech cigarette tax stamp, improving tobacco licensure management, and making the stamps harder to counterfeit. These state practices could also be expanded to the national level with a track and trace system. A track and trace system, in the tobacco control context, is a system that can track goods from manufacture to distribution to sale, identifying points in the supply chain where taxes should be paid and confirm payment. Implementing such systems would also simultaneously retain the positive public health effects of taxation and protect product regulation in the market.

There is no question that these proven interventions need to be fully implemented and sustained at recommended levels. In addition to initiatives of the federal government, other factors in society can significantly affect social norms. Portrayals of tobacco use in U.S. films appear to have rebounded upward in the past 2 years (Chapter 14). In 2012, youth were exposed to an estimated 14.9 billion in-theater tobacco-use impressions[1] in youth-rated films (Polansky et al. 2013). Youth who are exposed to images of smoking in movies are more likely to smoke; those who get the most exposure to onscreen smoking are about twice as likely to begin smoking as those who get the least exposure (USDHHS 2012). Actions that would eliminate the depiction of tobacco use in movies, which are produced and rated as appropriate for children and adolescents, could have a significant effect on preventing youth from becoming tobacco users.

[1]One impression equals one tobacco use incident on screen viewed by one audience member.

Figure 4 Total funding for state tobacco control programs, 1986–2010 (adjusted to fiscal year 2010 dollars)



Source: Project ImpacTEEN; University of Illinois at Chicago; CDC, Youth Risk Behavior Survey, 1991–2009. Current smoking defined as high school students who smoked on ≥1 of the past 30 days—United States.
Note: **CDC** = Centers for Disease Control and Prevention.

Faced with the challenge of achieving a vision of a society free of tobacco-related death and disease, a discussion has begun within the field of tobacco control about what has come to be called the tobacco "end game" in the published literature. This literature considers strategies that could be used in addition to the expanded implementation of the proven tobacco control interventions, to accelerate declines in the use of cigarettes and other combusted tobacco products and end the epidemic of disease and premature death caused by tobacco.

Chapter 15 discusses various end game strategies; the feasibility and applicability are reviewed. It has been suggested that an integrated national tobacco control strategy should be considered—based on a foundation of enhanced implementation of the proven strategies (taxation, smokefree areas, increased barrier-free cessation support, warning labels, public health campaigns, and restrictions on advertising, promotions, and sponsorship) into which the most feasible end game strategies are included (van der Eijk 2013). Examples of end game options which could complement the proven interventions in accomplishing our overall goal of a society free of tobacco-related death and disease include but are not limited to:

1. Reducing the nicotine content to make cigarettes less addictive (Benowitz and Henningfield 2013); and

2. Greater restrictions on sales, particularly at the local level, including bans on entire categoies of tobacco products (Berrick 2013; Malone 2013).

End game strategies might be aided by future approaches and devices for nicotine delivery that better substitute for the cigarette. As discussed in Chapter 14, various new products are increasingly being introduced into the market. In 2012 Lorillard acquired Blu Electronic Cigarettes, in 2013 R.J. Reynolds Tobacco Com-

pany introduced VUSE electronic cigarettes in limited markets, and Altria announced that it will introduce an electronic cigarette in 2014 (Esterl 2013; Lorillard 2013; Reynolds American 2013; Wells Fargo Securities Research 2013). Additionally, other electronic nicotine delivery systems have been developed and marketed by companies with little or no experience in developing and marketing traditional tobacco products (WHO 2009; Henningfield and Zaatari 2010; Cobb and Abrams 2011). As these new products are entering the marketplace rapidly, significant questions remain about (1) how to assess the potential toxicity and health effects of the more than 250 electronic cigarette brands; (2) the magnitude of reduced risk from electronic cigarettes versus continuing use of conventional cigarettes for individual smokers; (3) the need to weigh the potential individual benefits versus population risks; (4) how the advertising and marketing of these new products should be regulated; and (5) even assuming that electronic cigarettes could be sufficiently safe to the users and offer net public health benefits, there are significant questions about the manner in which they should be regulated (Benowitz 2013). Further research and attention to the consequences as well as regulatory measures will be necessary to fully address these questions. However, the promotion of electronic cigarettes and other innovative tobacco products is much more likely to be beneficial in an environment where the appeal, accessibility, promotion, and use of cigarettes are being rapidly reduced.

The following are chapter-specific conclusions from Section 3 of the report.

Chapter 12: Smoking-Attributable Morbidity, Mortality, and Economic Costs

1. Since the first Surgeon General's report on smoking and health in 1964, there have been more than 20 million premature deaths attributable to smoking and exposure to secondhand smoke. Smoking remains the leading preventable cause of premature death in the United States.

2. Despite declines in the prevalence of current smoking, the annual burden of smoking-attributable mortality in the United States has remained above 400,000 for more than a decade and currently is estimated to be about 480,000, with millions more living with smoking-related diseases.

3. Due to the slow decline in the prevalence of current smoking, the annual burden of smoking-attributable mortality can be expected to remain at high levels for decades into the future, with 5.6 million youth currently 0 to 17 years of age projected to die prematurely from a smoking-related illness.

4. Annual smoking-attributable economic costs in the United States estimated for the years 2009–2012 were between $289–332.5 billion, including $132.5–175.9 billion for direct medical care of adults, $151 billion for lost productivity due to premature death estimated from 2005–2009, and $5.6 billion (in 2006) for lost productivity due to exposure to secondhand smoke.

Chapter 13: Patterns of Tobacco Use Among U.S. Youth, Young Adults, and Adults

1. In the United States, the prevalence of current cigarette smoking among adults has declined from 42% in 1965 to 18% in 2012.

2. The prevalence of current cigarette smoking declined first among men (between 1965 and the 1990s), and then among women (since the 1980s). However, declines in the prevalence of smoking among adults (18 years of age and older) have slowed in recent years.

3. Most first use of cigarettes occurs by 18 years of age (87%), with nearly all first use by 26 years of age (98%).

4. Very large disparities in tobacco use remain across racial/ethnic groups and between groups defined by educational level, socioeconomic status, and region.

5. In the United States there are now more former smokers than there are current smokers. More than half of all ever smokers have quit smoking.

6. The rate of quitting smoking among recent birth cohorts has been increasing, and interest in quitting is high across all segments of society.

7. Patterns of tobacco use are changing, with more intermittent use of cigarettes and an increase in use of other products.

Chapter 14: Current Status of Tobacco Control

1. The evidence is sufficient to conclude that there are diverse tobacco control measures of proven efficacy at the population and individual levels.

2. The evidence is sufficient to conclude that advertising and promotional activities by the tobacco companies cause the onset and continuation of smoking among adolescents and young adults.

3. Tobacco product regulation has the potential to contribute to public health through reductions in tobacco product addictiveness and harmfulness, and by preventing false or misleading claims by the tobacco industry of reduced risk.

4. The evidence is sufficient to conclude that litigation against tobacco companies has reduced tobacco use in the United States by leading to increased product prices, restrictions on marketing methods, and making available industry documents for scientific analysis and strategic awareness.

5. The evidence is sufficient to conclude that increases in the prices of tobacco products, including those resulting from excise tax increases, prevent initiation of tobacco use, promote cessation, and reduce the prevalence and intensity of tobacco use among youth and adults.

6. The evidence is sufficient to conclude that smokefree indoor air policies are effective in reducing exposure to secondhand smoke and lead to less smoking among covered individuals.

7. The evidence is sufficient to conclude that mass media campaigns, comprehensive community programs, and comprehensive statewide tobacco control programs prevent initiation of tobacco use and reduce the prevalence of tobacco use among youth and adults.

8. The evidence is sufficient to conclude that tobacco cessation treatments are effective across a wide population of smokers, including those with significant mental and physical comorbidity.

Chapter 15: The Changing Landscape of Tobacco Control—Current Status and Future Directions

1. Together, experience since 1964 and results from models exploring future scenarios of tobacco control indicate that the decline in tobacco use over coming decades will not be sufficiently rapid to meet targets. The goal of ending the tragic burden of avoidable disease and premature death will not be met quickly enough without additional action.

2. Evidence-based tobacco control interventions that are effective continue to be underutilized and implemented at far below funding levels recommended by the Centers for Disease Control and Prevention. Implementing tobacco control policies and programs as recommended by *Ending the Tobacco Epidemic: A Tobacco Control Strategic Plan* by the U.S. Department of Health and Human Services and the *Ending the Tobacco Problem: A Blueprint for the Nation* by the Institute of Medicine on a sustained basis at high intensity would accelerate the decline of tobacco use in youth and adults, and also accelerate progress toward the goal of ending the tobacco epidemic.

3. New "end game" strategies have been proposed with the goal of eliminating tobacco smoking. Some of these strategies may prove useful for the United States, particularly reduction of the nicotine content of tobacco products and greater restrictions on sales (including bans on entire categories of tobacco products).

Accelerating the National Movement to Reduce Tobacco Use

These key conclusions of this report provide evidence that calls for dramatic action:

The current rate of progress in tobacco control is not fast enough. More needs to be done.

- High levels of smoking-attributable disease and death costs will persist for decades into this twenty-first century unless more rapid progress is made in tobacco control. The current burden is unacceptable.

- The almost 500,000 annual premature deaths due to smoking and exposure to tobacco smoke are far too many. Even 100,000 or 200,000 annual attribut¬able deaths are far too many; yet this is a realistic projection of the burden well into the middle of this twenty-first century if more rapid progress is not made in tobacco control.

- The burden of death and disease from tobacco use in the United States is overwhelmingly caused by cigarettes and other combusted tobacco products; rapid elimination of their use will dramatically reduce this burden.

- There are important lessons to be learned from other successes in public health. In confronting worldwide epidemics caused by smallpox and polio, the eradication of the diseases was the clear objective. From this single-minded focus, the best strategies and actions based on public health science and practice were applied, evaluated, refined, and sustained for decades. The results are now evident: smallpox was eradicated decades ago and polio is on the verge of elimination. The nation should firmly commit to this goal of creating a society free of tobacco-related death and disease by engaging all sectors of society to an equally single-minded focus.

In the last 50 years, the smoking rate in the United States has been cut by more than one-half (from 42.7% in 1965 to 18% in 2012). The Strategic Action Plan, *Ending the Tobacco Epidemic: A Tobacco Control Strategic Action Plan for the U.S. Department of Health and Human Services* (USDHHS 2010a), provides a critical framework to guide and coordinate efforts to reduce the smoking rate to less than 10% for both youth and adults in 10 years, averting millions of smoking-related deaths. This national commitment will require increased and sustained action to rapidly eliminate the use of cigarettes and other forms of combustible tobacco products. As end game strategies are being developed, the following actions should be implemented:

- Counteracting industry marketing by sustaining high impact national media campaigns like the CDC's Tips from Former Smokers campaign and FDA's youth prevention campaigns at a high frequency level and exposure for 12 months a year for a decade or more;

- Raising the average excise cigarette taxes to prevent youth from starting smoking and encouraging smokers to quit;

- Fulfilling the opportunity of the Affordable Care Act to provide access to barrier-free proven tobacco use cessation treatment including counseling and medication to all smokers, especially those with significant mental and physical comorbidities;

- Expanding smoking cessation for all smokers in primary and specialty care settings by having health care providers and systems examine how they can establish a strong standard of care for these effective treatments;

- Effective implementation of FDA's authority for tobacco product regulation in order to reduce tobacco product addictiveness and harmfulness;

- Expanding tobacco control and prevention research efforts to increase understanding of the ever changing tobacco control landscape;

- Fully funding comprehensive statewide tobacco control programs at CDC recommended levels; and

- Extending comprehensive smokefree indoor protections to 100% of the U.S. population.

- Former WHO Director General Gro Brundtland was correct in 1999 in stating the need to evaluate current action from the perspective of our grandchildren and their children (Asma et al. 2002). As future generations look back on our current actions and knowledge of the tobacco epidemic, will current efforts show the commitment to public health and social justice set forth in our national plans and objectives?

This nation's decades-long battle against the tobacco epidemic has successfully prevented millions of premature deaths that would otherwise have occurred—an historic achievement by any measure. On the fiftieth anniversary of the landmark 1964 Surgeon General's report, this nation must rededicate itself not only to carrying forward the successful tobacco control efforts that have long been under way, but also to expanding and accelerating those efforts in full recognition of the challenge that remains.

References

Asma S, Yang G, Samet J, Giovino G, Bettcher DW, Lopez A, Yach D. Tobacco. In: Roger D, McEwen J, Beaglehole R, Tanaka H, editors. *Oxford Textbook of Public Health*. 4th ed. New York: Oxford University Press, 2002: 1481–502.

Ayres JG, Semple S, MacCalman L, Dempsey S, Hilton S, Hurley JF, Miller BG, Naji A, Petticrew M. Bar workers' health and environmental tobacco smoke exposure (BHETSE): symptomatic improvement in bar staff following smoke-free legislation in Scotland. *Occupational and Environmental Medicine* 2009;66(5): 339–46.

Benowitz NL, Henningfield JE. Reducing the nicotine content to make cigarettes less addictive. *Tobacco Control* 2013;22(Suppl 1):i14–i7.

Berrick AJ. The tobacco-free generation proposal. *Tobacco Control* 2013;22(Suppl 1):i22–i6.

Centers for Disease Control and Prevention. Consumption of cigarettes and combustible tobacco—United States, 2000–2011. *Morbidity and Mortality Weekly Report* 2012;61(30):565–9.

Centers for Disease Control and Prevention. Ten great public health achievements—United States, 1900–1999. *Morbidity and Mortality Weekly Report* 1999;48(12):241–3.

Chapman S, Wakefield MA. Large-scale unassisted smoking cessation over 50 years: lessons from history for endgame planning in tobacco control. *Tobacco Control* 2013;22(Suppl 1):i33–i5.

Cobb NK, Abrams DB. E-cigarette or drug-delivery device? Regulating novel nicotine products. *New England Journal of Medicine* 2011;365(3):193–5.

Eisner MD, Smith AK, Blanc PD. Bartenders' respiratory health after establishment of smokefree bars and taverns. *JAMA: the Journal of the American Medical Association* 1998;280(22):1909–14.

Esterl M. Philip Morris to tap e-cigarette market next year. *Wall Street Journal* November 20, 2013.

Family Smoking Prevention and Tobacco Control Act, Public Law 111-31, *U.S. Statutes at Large* 123 (2009): 1776.

Fletcher CM, Gilson JG, Hugh-Jones P, Scadding JG. Terminology, definitions, and classification of chronic pulmonary emphysema and related conditions. A report of the conclusions of a Ciba guest symposium. *Thorax* 1959;14:286–99.

Hatsukami DK. Ending tobacco-caused mortality and morbidity: the case for performance standards for tobacco products. *Tobacco Control* 2013;22(Suppl 1): i36–i7.

Henningfield JE, Zaatari GS. Electronic nicotine delivery systems: emerging science foundation for policy. *Tobacco Control* 2010;19(2):89–90.

Lorillard. Presentation at Lorillard Investor Day; June 27, 2013.

Malone RE. Tobacco endgames: what they are and are not, issues for tobacco control strategic planning and a possible U.S. scenario. *Tobacco Control* 2013;22(Suppl 1): i42–i4.

Menzies D, Nair A, Williamson PA, Schembri S, Al-Khairalla MZ, Barnes M, Fardon TC, McFarlane L, Magee GJ, Lipworth BJ. Respiratory symptoms, pulmonary function, and markers of inflammation among bar workers before and after a legislative ban on smoking in public places. *JAMA: the Journal of the American Medical Association* 2006;296(14):1742–8.

Miller R. U.S. cigarette consumption, 1900 to date. In: Harr W, editor. *Tobacco Yearbook*. Bowling Green (KY): Cockrel Corporation, 1981:53.

Newport F. For first time, majority in U.S. supports public smoking ban: little support for making smoking illegal, however, July 15, 2011; <http://www.gallup.com/poll/148514/first-time-majority-supports-public-smoking-ban.aspx>; accessed: December 19, 2012.

Polansky JR, Titus K, Lanning N, Glantz SA. *Smoking in Top-Grossing U.S. Movies, 2012*. San Francisco: San Francisco: University of California San Francisco, Center for Tobacco Control Research and Education, 2013.

Proctor RN. Why ban the sale of cigarettes? The case for abolition. *Tobacco Control* 2013;22(Suppl 1):i27–i30.

Reynolds American Incorporated. Reynolds American: Transformation through innovation. Presentation for webcast at Reynolds American Investor's Day Conference; November 18. 2013.

Tan CE, Glantz SA. Association between smoke-free legislation and hospitalizations for cardiac, cerebrovascular, and respiratory diseases: a meta-analysis. *Circulation* 2012;126(18):2177–83.

Thun MJ, Carter BD, Feskanich D, Freedman ND, Prentice R, Lopez AD, Hartge P, Gapstur SM. 50-year trends in smoking-related mortality in the United States. *New England Journal of Medicine* 2013;368(4):351–64.

Thun MJ, Heath CW Jr. Changes in mortality from smoking in two American Cancer Society prospective studies since 1959. *Preventive Medicine* 1997;26(4):422–6.

Thun MJ, Lally CA, Flannery JT, Calle EE, Flanders WD, Heath CW Jr. Cigarette smoking and changes in the histopathology of lung cancer. *Journal of the National Cancer Institute* 1997;89(21):1580–6.

U.S. Department of Agriculture. *Tobacco Outlook*. TBS-263. Washington: U.S. Department of Agriculture, Economics Research Service, 2007; <http://usda.mannlib.cornell.edu/usda/ers/TBS//2000s/2007/TBS-10-24-2007.pdf>; accessed: July 15, 2013.

U.S. Department of Agriculture. *Tobacco Outlook*. Washington: U.S. Department of Agriculture, Economic Research Service, 1996; <http://usda01.library.cornell.edu/usda/ers/TBS/1990s/1996/TBS-04-08-1996.asc>; accessed: August 15, 2013.

U.S. Department of Agriculture. *Tobacco Outlook*. Washington: U.S. Department of Agriculture, Economic Research Service, 2005; <http://usda01.library.cornell.edu/usda/ers/TBS//2000s/2005/TBS-09-16-2005.pdf>; accessed: August 15, 2013.

U.S. Department of Agriculture. *Tobacco Outlook*. Washington: U.S. Department of Agriculture, Economics Research Service, 2007; <http://usda.mannlib.cornell.edu/usda/ers/TBS//2000s/2007/TBS-04-24-2007.pdf>; accessed: August 15, 2013.

U.S. Department of Agriculture. *Tobacco: Situation and Outlook Report*. TS-199. Washington: U.S. Department of Agriculture, Economic Research Service, 1987.

U.S. Department of Health and Human Services. *The Health Consequences of Smoking: Nicotine Addiction. A Report of the Surgeon General*. Atlanta (GA): U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 1988. DHHS Publication No. (CDC) 88-8406.

U.S. Department of Health and Human Services. *The Health Consequences of Smoking: A Report of the Surgeon General*. Atlanta (GA): U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2004.

U.S. Department of Health and Human Services. *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General–Executive Summary*. Rockville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2006.

U.S. Department of Health and Human Services. *Ending the Tobacco Epidemic: A Tobacco Control Strategic Action Plan for the U.S. Department of Health and Human Services*. Washington: Office of the Assistant Secretary for Health, 2010a.

U.S. Department of Health and Human Services. *How Tobacco Smoke Causes Disease—The Biology and Behavioral Basis for Smoking-Attributable Disease: A Report of the Surgeon General*. Atlanta (GA): U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2010b.

U.S. Department of Health and Human Services. *Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General*. Atlanta (GA): U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2012.

U.S. Department of Health, Education, and Welfare. *Smoking and Health: Report of the Advisory Committee to the Surgeon General of the Public Health Service*. Washington: U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, 1964. PHS Publication No. 1103.

United States v. Philip Morris, 449 F. Supp. 2d 1 (D.D.C. 2006).

USA Today. 100 events that shifted history. *USA Today* February 24, 1999.

Ward JW, Warren C, editors. In: *Silent Victories: The History and Practice of Public Health in Twentieth-Century America* New York: Oxford University Press, 2007.

Wells Fargo Securities Research and Economics. E-cigs revolutionizing the tobacco industry. Presentation at 2013 E-Cigarette Forum; November 21, 2013; New York.

Wilson T, Shamo F, Boynton K, Kiley J. The impact of Michigan's Dr. Ron Davis smoke-free air law on levels of cotinine, tobacco-specific lung carcinogen and severity of self-reported respiratory symptoms among non-smoking bar employees. *Tobacco Control* 2012;21(6):593–5.

World Health Organization. *Tobacco Industry Interference with Tobacco Control*. Geneva (Switzerland): World Health Organization, 2009; <http://www.who.int/tobacco/publications/industry/interference/en/>; accessed: April 1, 2013.

U.S. Department of Health and Human Services

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2016

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For more information

For more information about the Surgeon General's report, visit www.surgeongeneral.gov. To download copies of this document, go to www.cdc.gov/tobacco.
To order copies of this document, go to www.cdc.gov/tobacco and click on Publications Catalog or call 1-800-CDC-INFO (1-800-232-4636); TTY: 1-888-232-6348.

Message from Sylvia Burwell

Secretary, U.S. Department of Health and Human Services

The mission of the Department of Health and Human Services is to enhance and protect the health and well-being of all Americans. This report confirms that the use of electronic cigarettes (or e-cigarettes) is growing rapidly among American youth and young adults. While these products are novel, we know they contain harmful ingredients that are dangerous to youth. Important strides have been made over the past several decades in reducing conventional cigarette smoking among youth and young adults. We must make sure this progress is not compromised by the initiation and use of new tobacco products, such as e-cigarettes. That work is already underway.

To protect young people from initiating or continuing the use of e-cigarettes, actions must be taken at the federal, state, and local levels. At the federal level, the U.S. Food and Drug Administration (FDA)—under authority granted to it by Congress under the *Family Smoking Prevention and Tobacco Control Act of 2009*—took a historic step to protect America's youth from the harmful effects of using e-cigarettes by extending its regulatory authority over the manufacturing, distribution, and marketing of e-cigarettes. Through such action, FDA now requires minimum age restrictions to prevent sales to minors and prohibits sales through vending machines (in any facility that admits youth), and will require products to carry a nicotine warning.

We have more to do to help protect Americans from the dangers of tobacco and nicotine, especially our youth. As cigarette smoking among those under 18 has fallen, the use of other nicotine products, including e-cigarettes, has taken a drastic leap. All of this is creating a new generation of Americans who are at risk of nicotine addiction.

The findings from this report reinforce the need to support evidence-based programs to prevent youth and young adults from using tobacco in any form, including e-cigarettes. The health and well-being of our nation's young people depend on it.

Foreword

Tobacco use among youth and young adults in any form, including e-cigarettes, is not safe. In recent years, e-cigarette use by youth and young adults has increased at an alarming rate. E-cigarettes are now the most commonly used tobacco product among youth in the United States. This timely report highlights the rapidly changing patterns of e-cigarette use among youth and young adults, assesses what we know about the health effects of using these products, and describes strategies that tobacco companies use to recruit our nation's youth and young adults to try and continue using e-cigarettes. The report also outlines interventions that can be adopted to minimize the harm these products cause to our nation's youth.

E-cigarettes are tobacco products that deliver nicotine. Nicotine is a highly addictive substance, and many of today's youth who are using e-cigarettes could become tomorrow's cigarette smokers. Nicotine exposure can also harm brain development in ways that may affect the health and mental health of our kids.

E-cigarette use among youth and young adults is associated with the use of other tobacco products, including conventional cigarettes. Because most tobacco use is established during adolescence, actions to prevent our nation's young people from the potential of a lifetime of nicotine addiction are critical.

E-cigarette companies appear to be using many of the advertising tactics the tobacco industry used to persuade a new generation of young people to use their products. Companies are promoting their products through television and radio advertisements that use celebrities, sexual content, and claims of independence to glamorize these addictive products and make them appealing to young people.

Comprehensive tobacco control and prevention strategies for youth and young adults should address all tobacco products, including e-cigarettes. Further reductions in tobacco use and initiation among youth and young adults are achievable by regulating the manufacturing, distribution, marketing, and sales of all tobacco products—including e-cigarettes, and particularly to children—and combining those approaches with other proven strategies. These strategies include funding tobacco control programs at levels recommended by the Centers for Disease Control and Prevention (CDC); increasing prices of tobacco products; implementing and enforcing comprehensive smokefree laws; and sustaining hard-hitting media campaigns, such as CDC's *Tips from Former Smokers* that encourages smokers to quit for good, and FDA's *Real Cost* that is aimed at preventing youth from trying tobacco and reducing the number of youth who move from experimenting to regular use. We can implement these cost-effective, evidence-based, life-saving strategies now. Together with additional effort and support, we can protect the health of our nation's young people.

Thomas R. Frieden, M.D., M.P.H.
Director
Centers for Disease Control and Prevention

Preface

from the Surgeon General

E-cigarette use among U.S. youth and young adults is now a major public health concern. E-cigarette use has increased considerably in recent years, growing an astounding 900% among high school students from 2011 to 2015. These products are now the most commonly used form of tobacco among youth in the United States, surpassing conventional tobacco products, including cigarettes, cigars, chewing tobacco, and hookahs. Most e-cigarettes contain nicotine, which can cause addiction and can harm the developing adolescent brain.

Compared with older adults, the brain of youth and young adults is more vulnerable to the negative consequences of nicotine exposure. The effects include addiction, priming for use of other addictive substances, reduced impulse control, deficits in attention and cognition, and mood disorders. Furthermore, fetal exposure to nicotine during pregnancy can result in multiple adverse consequences, including sudden infant death syndrome, altered corpus callosum, auditory processing deficits, effects on behaviors and obesity, and deficits in attention and cognition. Ingestion of e-cigarette liquids containing nicotine can also cause acute toxicity and possibly death if the contents of refill cartridges or bottles containing nicotine are consumed.

This report highlights what we know and do not know about e-cigarettes. Gaps in scientific evidence do exist, and this report is being issued while these products and their patterns of use continue to change quickly. For example, the health effects and potentially harmful doses of heated and aerosolized constituents of e-cigarette liquids—including solvents, flavorants, and toxicants—are not completely understood. However, although e-cigarettes generally emit fewer toxicants than combustible tobacco products, we know that aerosol from e-cigarettes is not harmless.

Although we continue to learn more about e-cigarettes with each passing day, we currently know enough to take action to protect our nation's young people from being harmed by these products. Previous reports of the Surgeon General have established that nearly all habitual tobacco use begins during youth and young adulthood. To prevent and reduce the use of e-cigarettes by youth and young adults, we must work together as a society. We must implement proven prevention and education strategies. Health care providers, parents, teachers, and other caregivers should advise youth about the dangers of nicotine and discourage tobacco use in any form, including e-cigarettes. They can set a positive example by being tobacco-free and encouraging those who already use these products to quit. Free help is available at 1-800-QUIT-NOW or http://www.smokefree.gov. Preventing tobacco use in any form among youth and young adults is critical to ending the tobacco epidemic in the United States.

Vivek H. Murthy, M.D., M.B.A.
U.S. Surgeon General

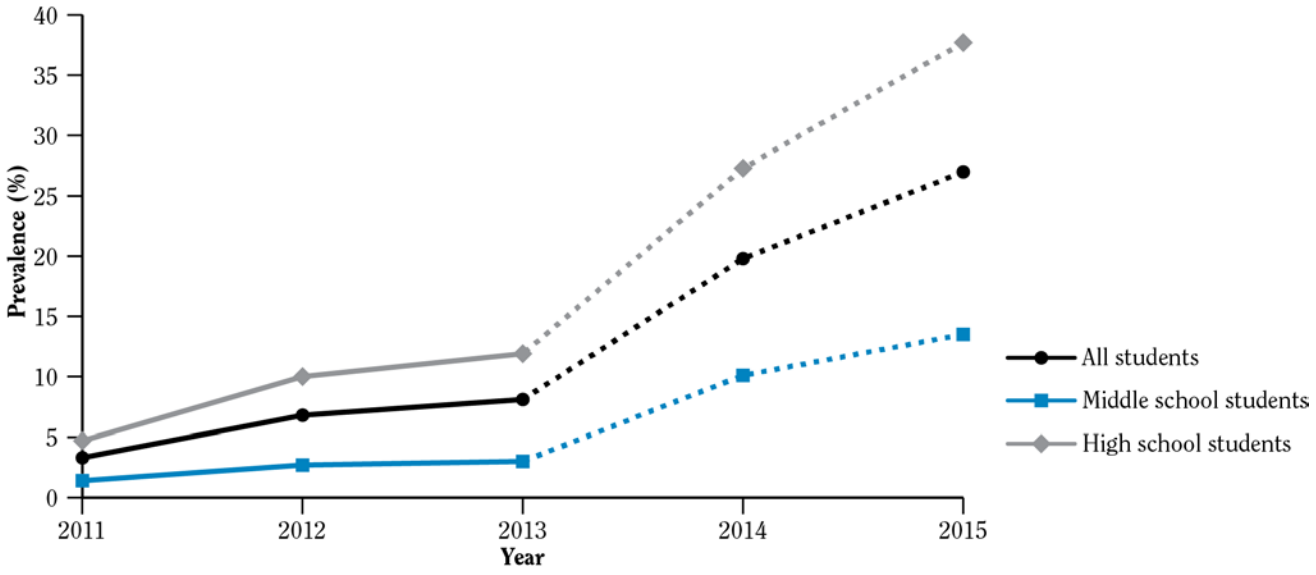
Overview

Although conventional cigarette smoking has declined markedly over the past several decades among youth and young adults in the United States (U.S. Department of Health and Human Services [USDHHS] 2012), there have been substantial increases in the use of emerging tobacco products among these populations in recent years (Centers for Disease Control and Prevention [CDC] 2015, 2016). Among these increases there has been a dramatic rise in electronic cigarette (e-cigarette) use among youth and young adults (Figures 1, 2, and 3). It is crucial that the progress made in reducing conventional cigarette smoking among youth and young adults not be compromised by the initiation and use of e-cigarettes. This Surgeon General's report focuses on the history, epidemiology, and health effects of e-cigarette use among youth and young adults; the companies involved with marketing and promoting these products; and existing and proposed public health policies regarding the use of these products by youth and young adults.

E-cigarettes include a diverse group of devices that allow users to inhale an aerosol, which typically contains nicotine, flavorings, and other additives. E-cigarettes are tobacco products and are regulated as such under the *Federal Food, Drug, and Cosmetic Act,* as amended by the *Family Smoking Prevention and Tobacco Control Act of 2009.* E-cigarettes vary widely in design and appearance, but generally operate in a similar manner and are composed of similar components (Figure 4). A key challenge for surveillance of the products and understanding their patterns of use is the diverse and nonstandard nomenclature for the devices (Alexander et al. 2016). These devices are referred to, by the companies themselves, and by consumers, as "e-cigarettes," "e-cigs," "cigalikes," "e-hookahs," "mods," "vape pens," "vapes," and "tank systems." This report employs the term "e-cigarette" to represent all of the diverse products in this rapidly diversifying product category.

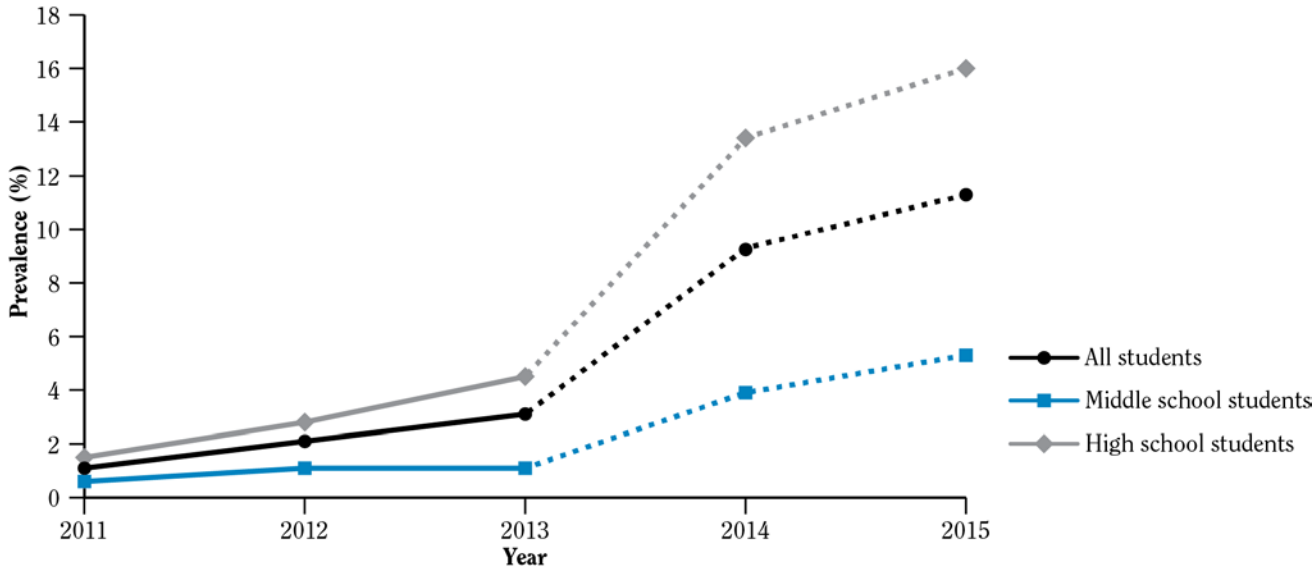
This report focuses on research conducted among youth and young adults because of the implications of e-cigarette use in these populations, particularly the potential for future public health problems. Understanding e-cigarette use among young people is critical because previous research suggests that about 9 in 10 adult smokers first try conventional cigarettes during adolescence (USDHHS 2012). Similarly, youth e-cigarette experimentation and use could also extend into adulthood; ongoing

Figure 1 Trends in ever e-cigarette use[a] among U.S. middle and high school students; National Youth Tobacco Survey (NYTS) 2011–2015



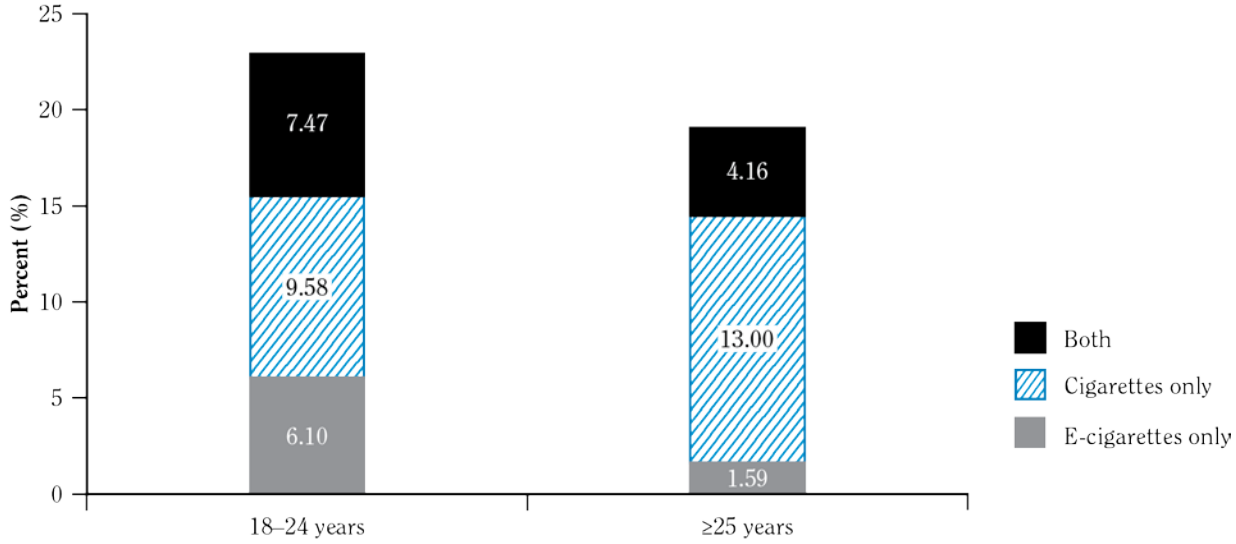
Source: Centers for Disease Control and Prevention 2013, 2014; unpublished data (data: NYTS 2015).
Note: In 2014, modifications were made to the e-cigarette measure to enhance its accuracy, which may limit the comparability of this estimate to those collected in previous years. The dotted lines from 2013 to 2015 represent these differences.
[a]Includes those who responded "yes" to the following question: "*Have you ever used an electronic cigarette or e-cigarette, even once or twice?*"

Figure 2 **Trends in past-30-day e-cigarette use[a] among U.S. middle and high school students; National Youth Tobacco Survey (NYTS) 2011–2015**



Source: Centers for Disease Control and Prevention 2013, 2014; unpublished data (data: NYTS 2015).
Note: In 2014, modifications were made to the e-cigarette measure to enhance its accuracy, which may limit the comparability of this estimate to those collected in previous years. The dotted lines from 2013 to 2015 represent these differences.
[a]Includes those who selected "1 or more" for the following question: *"During the last 30 days, on how many days did you use electronic cigarettes or e-cigarettes?"*

Figure 3 **Percentage of young adults who currently use e-cigarettes[a] and conventional cigarettes; National Adult Tobacco Survey (NATS) 2013–2014**



Source: Centers for Disease Control and Prevention, unpublished data (data: NATS 2013–2014).
[a]Current e-cigarette use was defined as those who reported they had heard of e-cigarettes and had tried e-cigarettes, and reported using e-cigarettes every day, some days, or rarely at the time of the interview.

Figure 4 Diversity of e-cigarette products

Source: Photo by Mandie Mills, CDC.

research should examine the long-term trajectories of e-cigarette use that begins in youth. The first Surgeon General's report on the health consequences of smoking was published in 1964; of the subsequent reports, those published in 1994 and 2012 focused solely on youth and young adults (USDHHS 1994, 2012). Most recently, the 2012 report documented the evidence regarding tobacco use among youth and young adults, concluding that declines in conventional cigarette smoking had slowed and that decreases in the use of smokeless tobacco had stalled. That report also found that the tobacco industry's advertising and promotional activities are causal to the onset of smoking in youth and young adults and the continuation of such use as adults (USDHHS 2012). However, that report was prepared before e-cigarettes were as widely promoted and used in the United States as they are now. Therefore, this 2016 report documents the scientific literature on these new products within the context of youth and young adults. This report also looks to the future by examining the potential impact of e-cigarette use among youth and young adults, while also summarizing the research on current use, health consequences, and marketing as it applies to youth and young adults.

Evidence for this report was gathered from scientific research that included one or more of three age groups. These age groups included young adolescents (11–13 years of age), adolescents (14–17 years of age), and young adults (18–24 years of age). Some studies refer to the younger groups more generally as *youth*. Despite important issues related to e-cigarette use in the general adult populations, clinical and otherwise (e.g., their potential for use in quitting conventional smoking), that literature is generally not included in this report unless it also discusses youth and young adults (Farsalinos and Polosa 2014; Franck et al. 2014; Grana et al. 2014a).

Organization of the Report

Chapter 1 ("Introduction, Conclusions, and Historical Background Relative to E-Cigarettes") presents a brief introduction to the report and includes its major conclusions, followed by the conclusions of each chapter, the historical background of e-cigarettes, descriptions of the products, a review of the marketing and promotional activities of e-cigarette companies, and the current status of regulations from the U.S. Food and Drug Administration (FDA). Chapter 2 ("Patterns of E-Cigarette Use Among U.S. Youth and Young Adults") describes the epidemiology of e-cigarette use, including current (i.e., past 30 day) use; ever use; co-occurrence of using e-cigarettes with other tobacco products, like cigarettes; and psychosocial factors associated with using e-cigarettes. This chapter relies on data from the most recent nationally representative studies available at the time this report was prepared. Chapter 3 ("Health Effects of E-Cigarette Use Among U.S. Youth and Young Adults") documents potential adverse health effects caused by direct exposure to aerosolized nicotine, flavorants, chemicals, and other particulates of e-cigarettes, secondhand environmental exposure to e-cigarette aerosol, and exposure to the surface-deposited aerosol contaminants. Literature regarding harmful consequences of close contact with malfunctioning e-cigarette devices and ingestion of the nicotine-containing liquids are also explored. Chapter 4 ("Activities of the E-Cigarette Companies") describes e-cigarette companies' influences on e-cigarette use and considers manufacturing and price; the impact of price on sales and use; the rapid changes in the industry, particularly the e-cigarette companies; and the marketing and promotion of e-cigarettes. Chapter 5 ("E-Cigarette Policy and Practice Implications") discusses the implications for policy and practice at the national, state, and local levels. The report ends with a Call to Action to stakeholders—including policymakers, public health practitioners and clinicians, researchers, and the public—to work to prevent harms from e-cigarette use and secondhand aerosol exposure among youth and young adults.

Because of the recency of research related to e-cigarettes (particularly in contrast with decades of research on conventional cigarette smoking) and since this report focuses on a vulnerable population for tobacco use (youth and young adults), the "precautionary principle" is employed to guide actions to address e-cigarette use among youth and young adults. This principle supports intervention to avoid possible health risks when the potential risks remain uncertain and have been, as yet, partially undefined (Bialous and Sarma 2014; Saitta et al. 2014; Hagopian et al. 2015).

The following is a brief summary of the report's Major Conclusions, each chapter, and their subsequent chapter conclusions.

Major Conclusions

1. E-cigarettes are a rapidly emerging and diversified product class. These devices typically deliver nicotine, flavorings, and other additives to users via an inhaled aerosol. These devices are referred to by a variety of names, including "e-cigs," "e-hookahs," "mods," "vape pens," "vapes," and "tank systems."

2. E-cigarette use among youth and young adults has become a public health concern. In 2014, current use of e-cigarettes by young adults 18–24 years of age surpassed that of adults 25 years of age and older.

3. E-cigarettes are now the most commonly used tobacco product among youth, surpassing conventional cigarettes in 2014. E-cigarette use is strongly associated with the use of other tobacco products among youth and young adults, including combustible tobacco products.

4. The use of products containing nicotine poses dangers to youth, pregnant women, and fetuses. The use of products containing nicotine in any form among youth, including in e-cigarettes, is unsafe.

5. E-cigarette aerosol is not harmless. It can contain harmful and potentially harmful constituents, including nicotine. Nicotine exposure during adolescence can cause addiction and can harm the developing adolescent brain.

6. E-cigarettes are marketed by promoting flavors and using a wide variety of media channels and approaches that have been used in the past for marketing conventional tobacco products to youth and young adults.

7. Action can be taken at the national, state, local, tribal, and territorial levels to address e-cigarette use among youth and young adults. Actions could include incorporating e-cigarettes into smokefree policies, preventing access to e-cigarettes by youth, price and tax policies, retail licensure, regulation of e-cigarette marketing likely to attract youth, and educational initiatives targeting youth and young adults.

Chapter 1. Introduction, Conclusions, and Historical Background Relative to E-Cigarettes

Chapter 1 presents the major conclusions of this Surgeon General's report and the conclusions of each chapter. E-cigarettes are presented within their historical context, with an overview of the components of these devices and the types of products. In May 2016, FDA published its final rule deeming e-cigarettes, among other products, to be subject to regulation under the *Federal Food, Drug, and Cosmetic Act,* as amended by the *Family Smoking Prevention and Tobacco Control Act* (*Federal Register* 2016). Chapter 1 outlines the current status of federal regulation of e-cigarettes, particularly as they relate to youth and young adults. The need to protect this population from initiating or continuing the use of tobacco products forms a strong basis for the need to regulate e-cigarettes at the local, state, and national levels, both now and in the future.

Conclusions

1. E-cigarettes are devices that typically deliver nicotine, flavorings, and other additives to users via an inhaled aerosol. These devices are referred to by a variety of names, including "e-cigs," "e-hookahs," "mods," "vape pens," "vapes," and "tank systems."

2. E-cigarettes represent an evolution in a long history of tobacco products in the United States, including conventional cigarettes.

3. In May 2016, the Food and Drug Administration issued the deeming rule, exercising its regulatory authority over e-cigarettes as a tobacco product.

Chapter 2. Patterns of E-Cigarette Use Among U.S. Youth and Young Adults

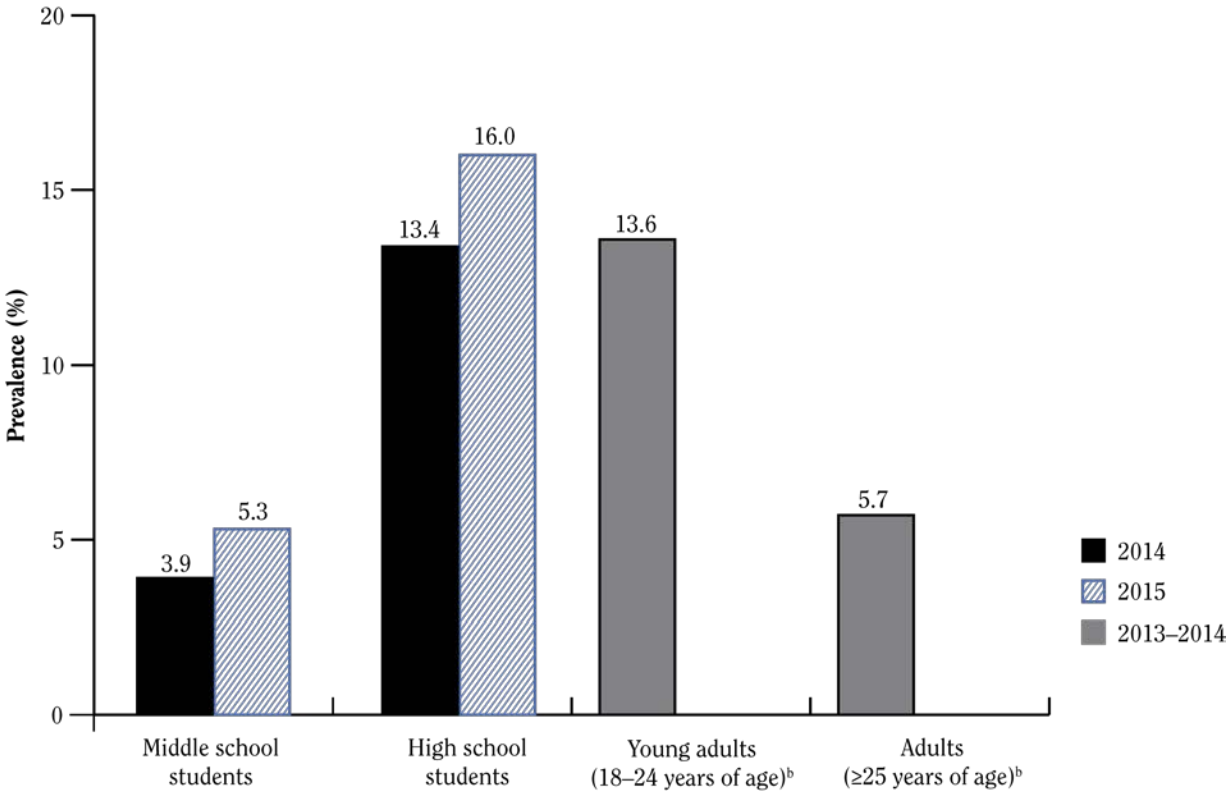
Among youth and young adults, rates of ever and past-30-day use of e-cigarettes have increased since the earliest e-cigarette surveillance efforts in 2011. According to the National Youth Tobacco Survey (NYTS), both ever use and past-30-day use of e-cigarettes have increased greatly among youth from 2011 to 2015 (Figures 1 and 2) (CDC 2013; Ambrose et al. 2014; Lippert 2015). Among young adults (18–24 years of age), the prevalence of ever use more than doubled from 2013 to 2014 (Figure 3; National Adult Tobacco Survey [NATS], 2013–2014, unpublished data). Figures 5 and 6 compare the prevalence of ever and current e-cigarette use among middle school students, high school students, young adults (18–24 years of age), and adults (≥25 years of age). Data for 2015 were not available for young adults and adults at the time this report was prepared; however, these trends are alarming and warrant continued surveillance.

Among youth, e-cigarette use increases with age and is highest among Hispanics and Whites (Tables 2.1a, 2.1b).[1] Among young adults, e-cigarette use is higher among males than females and lowest among Blacks and those with a college education (Table 2.4a). Continued research is necessary to monitor patterns of e-cigarette use across population groups by gender, age, race/ethnicity, and education, as well as sociodemographic characteristics for which disparities in tobacco use have previously been noted, including geography (e.g., subnational data at the state or local levels), sexual orientation and gender identity (e.g., lesbian, gay, bisexual, and transgender), disability/limitation, and socioeconomic status (e.g., household income, poverty status) (CDC 2014; Johnson et al. 2016).

According to data from the Monitoring the Future (MTF) study, in 2015, among youth, past-30-day exclusive use of e-cigarettes (6.7%, 10.4%, and 10.4% in 8th, 10th, and 12th grades, respectively) is more common than exclusive use of conventional cigarettes (1.4%, 2.2%, and 5.3% in those grades) or dual use of e-cigarettes and

[1]All tables that are cross-referenced in this Executive Summary can be found in the full report

Figure 5 Percentage of middle school students, high school students, young adults (18–24 years of age), and adults (≥25 years of age) who currently[a] use e-cigarettes



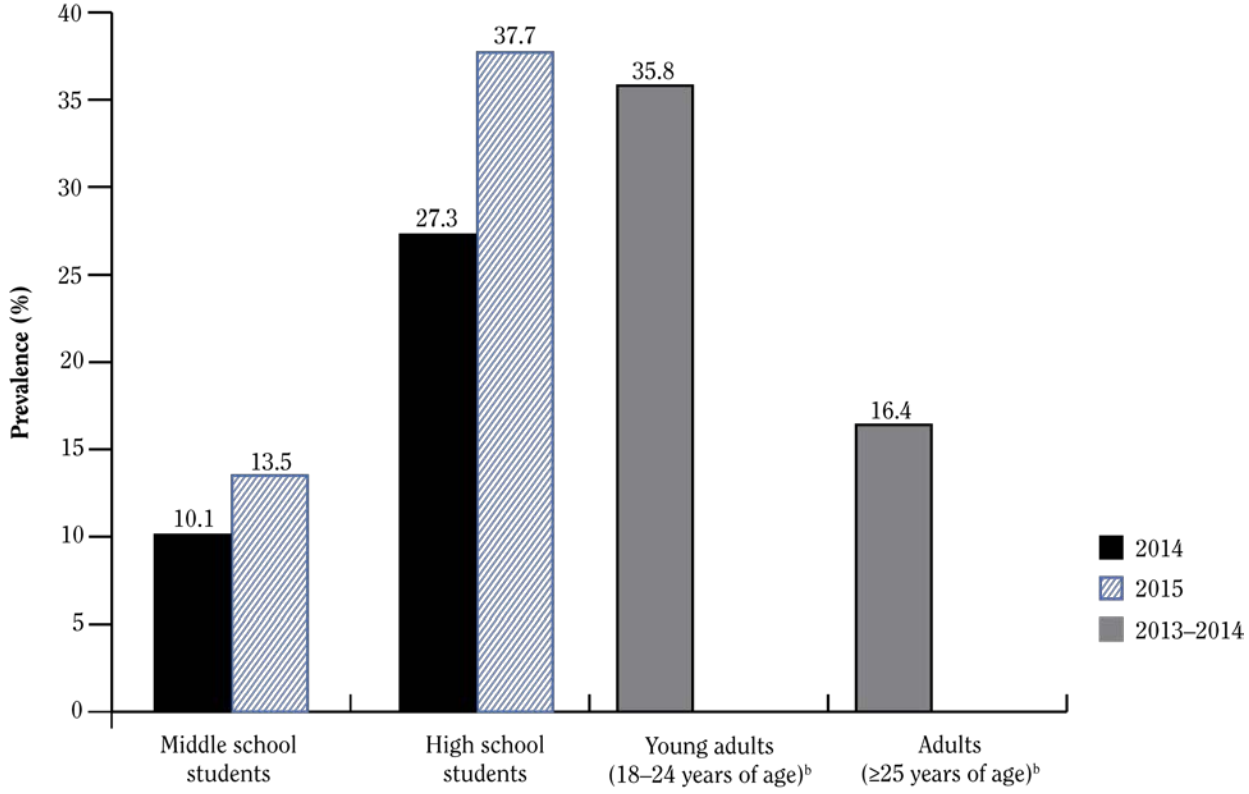
Source: Centers for Disease Control and Prevention, unpublished data (NYTS 2014, 2015; data: NATS 2013–2014).
[a]For middle school and high school students (NYTS 2014, 2015), current use included those who reported using e-cigarettes on 1 or more days in the past 30 days. For young adults and adults (NATS 2013–2014), current use included those who reported they had heard of, tried, and used e-cigarettes every day, some days, or rarely at the time of the interview.
[b]2013–2014 NATS data for young adults and adults were the latest data available when this Surgeon General's report was prepared.

conventional cigarettes (2.4%, 3.5%, and 5.8%) (Figure 7). However, among young adults 18–24 years of age, exclusive use of conventional cigarettes surpasses exclusive use of e-cigarettes and dual use of both products, according to data from the NATS (Figure 3; Table 2.8b). In 2013–2014, 9.6% of young adults were exclusive past-30-day conventional cigarette smokers, compared to 6.1% who were exclusive past-30-day e-cigarette users, and 7.5% who were past-30-day dual users.

Five longitudinal studies to date (Leventhal et al. 2015; Primack et al. 2015; Wills et al. 2016; Barrington-Trimis et al. 2016; Unger et al. 2016) suggest that e-cigarette use is related to the onset of other tobacco product use among youth and young adults, including cigarette smoking and other combustible tobacco product use (e.g., cigar and hookah use). However, these studies are limited in their ability to distinguish experimental conventional cigarette smokers from regular conventional cigarette smokers at follow-up. Therefore, more studies are needed to elucidate the nature of any true causal relationship between e-cigarette and combustible tobacco product use. Additionally, investigation of whether e-cigarette use is related to other types of substance use (e.g., marijuana, alcohol) might help distinguish the extent to which e-cigarette use may precede or follow other forms of substance use in the context of the common liability/vulnerability model (Vanyukov et al. 2012).

The most commonly cited reasons that youth and young adults report using e-cigarettes include curiosity (Schmidt et al. 2014; Biener and Hargraves 2015; Biener et al. 2015; Kong et al. 2015; McDonald and Ling 2015; Suris et al. 2015; Sutfin et al. 2015), flavorings/taste (Ambrose et al. 2015; University of Michigan 2015), use as a less harmful/less toxic alternative to conventional cigarettes

Figure 6 Percentage of middle school students, high school students, young adults (18–24 years of age), and adults (≥25 years of age) who have ever[a] used e-cigarettes



Source: Centers for Disease Control and Prevention, unpublished data (NYTS 2014, 2015; data: NATS 2013–2014).
[a]For middle school and high school students (NYTS 2014, 2015), ever use included those who reported using an e-cigarette, even once or twice. For young adults and adults (NATS 2013–2014), ever use included those who reported they had heard of and tried e-cigarettes.
[b]2013–2014 NATS data for young adults and adults were the latest data available when this Surgeon General's report was prepared.

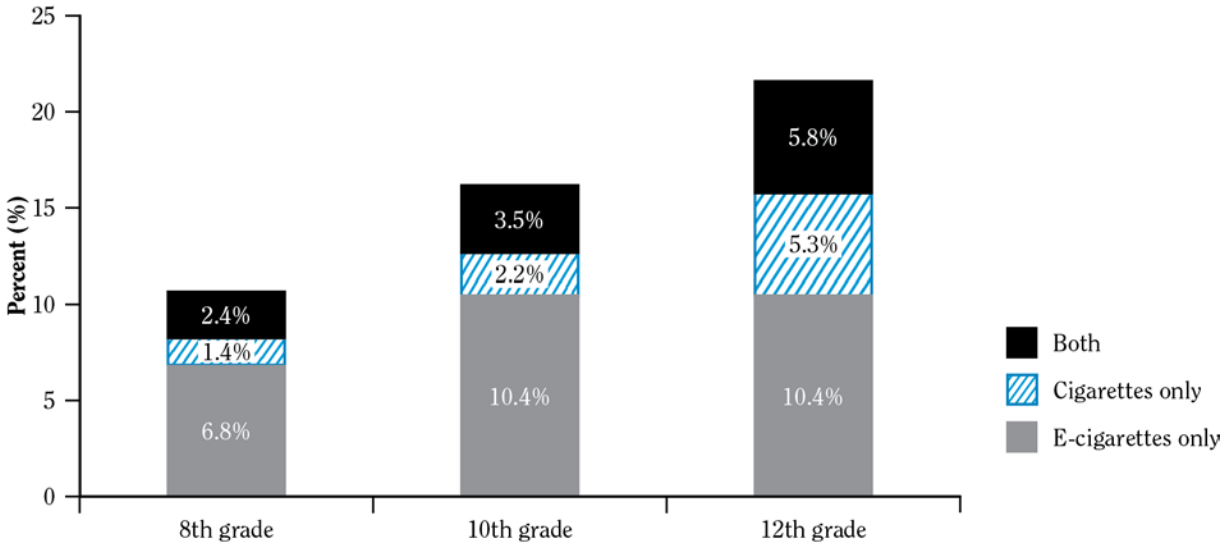
(Peters et al. 2013; Tucker et al. 2014; Ambrose et al. 2015; Kong et al. 2015; McDonald and Ling 2015; Sutfin et al. 2015), and avoidance of indoor smoking restrictions or disturbing people with secondhand smoke from conventional cigarettes (Tucker et al. 2014; Ambrose et al. 2015; Kong et al. 2015; McDonald and Ling 2015; Suris et al. 2015; Sutfin et al. 2015). Using e-cigarettes as an aid to conventional cigarette smoking reduction/cessation (Li et al. 2013; Schmidt et al. 2014; Tucker et al. 2014) does not appear to be a primary reason for use among youth and young adults. Youth and young adult smokers cite lack of satisfaction (Kong et al. 2015), poor taste (Pepper et al. 2014; Kong et al. 2015), and cost (Pepper et al. 2014; Kong et al. 2015) as reasons for discontinuing e-cigarette use. Additional research is needed to examine how reasons for use, including the appeal of flavored e-cigarettes, are causally related to the onset and progression of e-cigarette use among youth and young adults.

Conclusions

1. Among middle and high school students, both ever and past-30-day e-cigarette use have more than tripled since 2011. Among young adults 18–24 years of age, ever e-cigarette use more than doubled from 2013 to 2014 following a period of relative stability from 2011 to 2013.

2. The most recent data available show that the prevalence of past-30-day use of e-cigarettes was similar among high school students (16% in 2015, 13.4% in 2014) and young adults 18–24 years of age (13.6%

Figure 7 Percentage of students in grades 8, 10, and 12 who used e-cigarettes and cigarettes in the past 30 days; Monitoring the Future (MTF) 2015



Source: University of Michigan, Institute for Social Research, unpublished data (data: MTF 2015).
Note: Questions on e-cigarette use were asked on four of six questionnaire forms. Data presented here are based on those four forms only.

in 2013–2014) compared to middle school students (5.3% in 2015, 3.9% in 2014) and adults 25 years of age and older (5.7% in 2013–2014).

3. Exclusive, past-30-day use of e-cigarettes among 8th-, 10th-, and 12th-grade students (6.8%, 10.4%, and 10.4%, respectively) exceeded exclusive, past-30-day use of conventional cigarettes in 2015 (1.4%, 2.2%, and 5.3%, respectively). In contrast—in 2013–2014 among young adults 18–24 years of age—exclusive, past-30-day use of conventional cigarettes (9.6%) exceeded exclusive, past-30-day use of e-cigarettes (6.1%). For both age groups, dual use of these products is common.

4. E-cigarette use is strongly associated with the use of other tobacco products among youth and young adults, particularly the use of combustible tobacco products. For example, in 2015, 58.8% of high school students who were current users of combustible tobacco products were also current users of e-cigarettes.

5. Among youth—older students, Hispanics, and Whites are more likely to use e-cigarettes than younger students and Blacks. Among young adults—males, Hispanics, Whites, and those with lower levels of education are more likely to use e-cigarettes than females, Blacks, and those with higher levels of education.

6. The most commonly cited reasons for using e-cigarettes among both youth and young adults are curiosity, flavoring/taste, and low perceived harm compared to other tobacco products. The use of e-cigarettes as an aid to quit conventional cigarettes is not reported as a primary reason for use among youth and young adults.

7. Flavored e-cigarette use among young adult current users (18–24 years of age) exceeds that of older adult current users (25 years of age and older). Moreover, among youth who have ever tried an e-cigarette, a majority used a flavored product the first time they tried an e-cigarette.

8. E-cigarette products can be used as a delivery system for cannabinoids and potentially for other illicit drugs. More specific surveillance measures are needed to assess the use of drugs other than nicotine in e-cigarettes.

Chapter 3. Health Effects of E-Cigarette Use Among U.S. Youth and Young Adults

There is little doubt that the use of e-cigarettes by youth and young adults represents self-administration of the drug nicotine, and this self-administration of nicotine puts youth at risk for addiction and many related harmful consequences. Animal research indicates adolescent brains are particularly sensitive to nicotine's effects, such that subsequent self-administration is more likely, and that same literature indicates that this age group is at risk for a constellation of nicotine-induced neural and behavioral alterations (Table A3.1-4 in Appendix 3.1). Studies of the effects of maternal smoking of conventional cigarettes during pregnancy, coupled with preclinical literature (e.g., animal studies) examining the effects of administration of nicotine during pregnancy, suggest that e-cigarette use by mothers during pregnancy could present a wide variety of risks to fetal, infant, and child brain development.

Users of e-cigarettes risk respiratory exposure to a variety of aerosolized chemicals, including solvents and flavorants added intentionally to e-liquids, adulterants added unintentionally, and other toxicants produced during the heating/aerosolization process (see the section on "Effects of the Inhalation of Aerosol Constituents Other than Nicotine" in Chapter 3). The health impacts of frequent exposure to the toxicants in e-cigarette aerosol are not well understood, though several are known carcinogens. The detection and level of these carcinogens depend on several factors, including the concentration of the e-liquid and the strength of the heating device. Although adults report using e-cigarettes as a cessation device, the evidence supporting the effectiveness of e-cigarettes as an aid for quitting conventional cigarettes remains unproven (Bullen et al. 2013; Caponnetto et al. 2013; Grana et al. 2014b) and nonexistent among youth (Bullen et al. 2013; Caponnetto et al. 2013; Grana et al. 2014b).

Further research is warranted to focus on the characteristics of e-cigarette devices, the constituents of e-liquids, and the user behaviors that can influence the yield of nicotine and other toxicants (Shihadeh and Eissenberg 2015). This close focus includes providing details of devices (e.g., voltage of the power supply, heating element resistance) and components of e-liquids (e.g., propylene glycol, vegetable glycerin, other additives), and measuring user puff topography. Standardization of procedures for producing and delivering the aerosol is likely a necessary component of at least some in vivo and in vitro work. Preclinical work examining the effects of e-cigarette aerosols is a clear research need and, again, the standardization of procedures for production and delivery of the aerosol is necessary. To enhance relevance, the parameters of aerosol production should span the range of those seen with humans (Shihadeh and Eissenberg 2011).

The huge variety of products of different origin and design, the rapid appearance of new products, and the varied ways in which consumers use these products make the development of standard measurement conditions challenging (Famele et al. 2015). Accordingly, more research is needed to understand how different design features relate to potential toxicity—for example, how various compounds in e-cigarettes are affected by heating, changes in chemical composition, or pH; to what extent these compounds are absorbed into the bloodstream; and how additives to the e-liquid affect the bioavailability of these compounds, among other considerations. Research is also needed to understand whether potential health risks may be ameliorated by changes in product engineering.

Conclusions

1. Nicotine exposure during adolescence can cause addiction and can harm the developing adolescent brain.

2. Nicotine can cross the placenta and has known effects on fetal and postnatal development. Therefore, nicotine delivered by e-cigarettes during pregnancy can result in multiple adverse consequences, including sudden infant death syndrome, and could result in altered corpus callosum, deficits in auditory processing, and obesity.

3. E-cigarettes can expose users to several chemicals, including nicotine, carbonyl compounds, and volatile organic compounds, known to have adverse health effects. The health effects and potentially harmful doses of heated and aerosolized constituents of e-cigarette liquids, including solvents, flavorants, and toxicants, are not completely understood.

4. E-cigarette aerosol is not harmless "water vapor," although it generally contains fewer toxicants than combustible tobacco products.

5. Ingestion of e-cigarette liquids containing nicotine can cause acute toxicity and possibly death if the contents of refill cartridges or bottles containing nicotine are consumed.

Chapter 4. Activities of the E-Cigarette Companies

Although the e-cigarette marketplace is complicated by the differences in brands that are owned by tobacco companies versus independent brands, e-cigarette companies continue to change and influence the manufacturing, price, marketing and promotion, and distribution of e-cigarette products and accessories. The e-cigarette market continues to grow, with projected sales of $3.5 billion in 2015. Consolidation of e-cigarette companies has been rapid, with the first major merger taking place in 2012. These mergers and acquisitions are likely to continue, but the rate of consolidation may slow down as sales of "cigalikes" (products that resemble cigarettes) have recently decelerated, and "vape shops" could have the potential to influence the e-cigarette marketplace based on the current structure of the marketplace and regulatory landscape. Chapter 4 shows that many of the marketing techniques used by e-cigarette companies are similar to those used by the tobacco industry for conventional cigarettes, and that awareness by youth and young adults of this marketing, and their levels of exposure to it, is high. Further, tracking marketing expenditures and product sales is difficult because of the rapidly changing venues, including "vape shops," use of social media and online advertising, and limited regulation of marketing.

Conclusions

1. The e-cigarette market has grown and changed rapidly, with notable increases in total sales of e-cigarette products, types of products, consolidation of companies, marketing expenses, and sales channels.

2. Prices of e-cigarette products are inversely related to sales volume: as prices have declined, sales have sharply increased.

3. E-cigarette products are marketed in a wide variety of channels that have broad reach among youth and young adults, including television, point-of-sale, magazines, promotional activities, radio, and the Internet.

4. Themes in e-cigarette marketing, including sexual content and customer satisfaction, are parallel to themes and techniques that have been found to be appealing to youth and young adults in conventional cigarette advertising and promotion.

Chapter 5. E-Cigarette Policy and Practice Implications

Chapters 1–4 document the particular challenges posed by the rapid emergence and dynamic nature of e-cigarette use among youth and young adults. The principles and strategies articulated in the 2014 Surgeon General's report and prior reports are also relevant to e-cigarettes. The 2014 report was written not long after the use of e-cigarettes began to surge dramatically; that report emphasized the need for rapid elimination of conventional cigarettes and other combustible tobacco products, but did not discuss strategies to minimize adverse effects among youth and young adults (USDHHS 2014). Building on this foundation, Chapter 5 sets out an evidence-based strategy for the future. It describes recommendations related to e-cigarettes that can be taken at the state and local levels to address e-cigarette use among youth and young adults, such as:

- Incorporating e-cigarettes into smokefree policies;
- Preventing access to e-cigarettes by youth;
- Significant increases in tax and price;
- Retail licensure;
- Regulation of e-cigarette marketing that is likely to attract youth and young adults, to the extent feasible under the law; and
- Educational initiatives targeting this population.

Conclusions

1. The dynamic nature of the e-cigarette landscape calls for expansion and enhancement of tobacco-related surveillance to include (a) tracking patterns of use in priority populations; (b) monitoring the characteristics of the retail market; (c) examining policies at the national, state, local, tribal, and territorial levels; (d) examining the channels and messaging for marketing e-cigarettes in order to more

fully understand the impact future regulations could have; and (e) searching for sentinel health events in youth and young adult e-cigarette users, while longer-term health consequences are tracked.

2. Strategic, comprehensive research is critical to identify and characterize the potential health risks from e-cigarette use, particularly among youth and young adults.

3. The adoption of public health strategies that are precautionary to protect youth and young adults from adverse effects related to e-cigarettes is justified.

4. A broad program of behavioral, communications, and educational research is crucial to assess how youth perceive e-cigarettes and associated marketing messages, and to determine what kinds of tobacco control communication strategies and channels are most effective.

5. Health professionals represent an important channel for education about e-cigarettes, particularly for youth and young adults.

6. Diverse actions, modeled after evidence-based tobacco control strategies, can be taken at the state, local, tribal, and territorial levels to address e-cigarette use among youth and young adults, including incorporating e-cigarettes into smoke-free policies; preventing the access of youth to e-cigarettes; price and tax policies; retail licensure; regulation of e-cigarette marketing that is likely to attract youth and young adults, to the extent feasible under the law; and educational initiatives targeting youth and young adults. Among others, research focused on policy, economics, and the e-cigarette industry will aid in the development and implementation of evidence-based strategies and best practices.

The Call to Action

Finally, the Call to Action is issued to accelerate policies and approaches that can reduce the public health threat posed by e-cigarette use among young people. It offers a list of goals and evidence-based strategies designed to reduce the public health threat posed by e-cigarette use among youth and young adults.

Goal 1. First, Do No Harm

- ***Strategy 1A.*** Implement a comprehensive strategy to address e-cigarettes that will avoid adverse consequences and give careful consideration to the risks for youth and young adults. This can be done by including e-cigarettes in policies and programs related to conventional cigarette smoking at the national, state, local, tribal, and territorial levels.

- ***Strategy 1B.*** Provide consistent and evidence-based messages about the health risks of e-cigarette use and exposure to secondhand aerosol from e-cigarettes.

Goal 2. Provide Information About the Dangers of E-Cigarette Use Among Youth and Young Adults

- ***Strategy 2A.*** Educate parents, teachers, coaches, and other influencers of youth about the risks of e-cigarette use among youth and young adults.

- ***Strategy 2B.*** Educate health professionals about the risks of e-cigarette use among youth and young adults.

Goal 3. Continue to Regulate E-Cigarettes at the Federal Level to Protect Public Health

- ***Strategy 3A.*** Implement FDA regulatory authority over the manufacturing, marketing, and distribution of e-cigarettes.

- ***Strategy 3B.*** Reinforce other federal agencies as they implement programs and policies to address e-cigarettes.

Goal 4. Promote Programs and Policies at the State and Local Levels to Prevent E-Cigarette Use Among Youth and Young Adults

- ***Strategy 4A.*** State, local, tribal, and territorial governments should implement population-level strategies to reduce e-cigarette use among youth and young adults, such as including e-cigarettes in smokefree indoor air policies, restricting youth access to e-cigarettes in retail settings, licensing retailers, and establishing specific package requirements.

- ***Strategy 4B.*** Coordinate, evaluate, and share best practices from state and local entities that have implemented programs and policies to address e-cigarette use among youth and young adults.

Goal 5. Curb Advertising and Marketing that Encourages Youth and Young Adults to Use E-Cigarettes

- ***Strategy 5A.*** Curb e-cigarette advertising and marketing that are likely to attract youth and young adults.

- ***Strategy 5B.*** Urge the e-cigarette companies to stop advertising and marketing that encourages and glamorizes e-cigarette use among youth and young adults.

Goal 6. Expand Surveillance, Research, and Evaluation Related to E-Cigarettes

- ***Strategy 6A.*** Improve the quality, timeliness, and scope of e-cigarette surveillance, research, and evaluation.

- ***Strategy 6B.*** Address surveillance, research, and evaluation gaps related to e-cigarettes.

Summary

We know a great deal about what works to effectively prevent tobacco use among young people (USDHHS 2012). Now we must apply these strategies to e-cigarettes—and continue to apply them to other tobacco products. To achieve success, we must work together, aligning and coordinating efforts across a wide range of stakeholders, including individuals and families; public health professionals and clinicians; federal, state, local, tribal, and territorial governments; public health agencies; and researchers. We must protect our nation's young people from a lifetime of nicotine addiction and associated problems by immediately addressing e-cigarettes as an urgent public health problem. Now is the time to take action.

References

Alexander JP, Coleman BN, Johnson SE, Tesseman GK, Tworek C, Dickinson DM. Smoke and vapor: exploring the terminology landscape among electronic cigarette users. *Tobacco Regulation Science* 2016;2(3):201–13.

Ambrose BK, Day HR, Rostron B, Conway KP, Borek N, Hyland A, Villanti AC. Flavored tobacco product use among U.S. youth aged 12–17 years, 2013–2014. *JAMA: the Journal of the American Medical Association* 2015;314(17):1871–3.

Ambrose BK, Rostron BL, Johnson SE, Portnoy DB, Apelberg BJ, Kaufman AR, Choiniere CJ. Perceptions of the relative harm of cigarettes and e-cigarettes among U.S. youth. *American Journal of Preventive Medicine* 2014;47(2 Suppl 1):S53–60.

Barrington-Trimis JL, Urman R, Berhane K, Unger JB, Cruz TB, Pentz MA, Samet JM, Leventhal AM, McConnell R. E-cigarettes and future cigarette use. *Pediatrics* 2016;138(1):e20160379.

Bialous SA, Sarma L. Electronic cigarettes and smoking cessation: a quandary? *Lancet* 2014;383(9915):407–8.

Biener L, Hargraves JL. A longitudinal study of electronic cigarette use among a population-based sample of adult smokers: association with smoking cessation and motivation to quit. *Nicotine & Tobacco Research* 2015;17(2):127–33.

Biener L, Song E, Sutfin EL, Spangler J, Wolfson M. Electronic cigarette trial and use among young adults: reasons for trial and cessation of vaping. *International Journal of Environmental Research and Public Health* 2015;12(12):16019–26.

Bullen C, Howe C, Laugesen M, McRobbie H, Parag V, Williman J, Walker N. Electronic cigarettes for smoking cessation: a randomised controlled trial. *Lancet* 2013;382(9905):1629–37.

Caponnetto P, Campagna D, Cibella F, Morjaria JB, Caruso M, Russo C, Polosa R. EffiCiency and Safety of an eLectronic cigAreTte (ECLAT) as tobacco cigarettes substitute: a prospective 12-month randomized control design study. *PloS One* 2013;8(6):e66317.

Centers for Disease Control and Prevention. Notes from the field: electronic cigarette use among middle and high school students—United States, 2011–2012. *Morbidity and Mortality Weekly Report* 2013;62(35):729–30.

Centers for Disease Control and Prevention. Tobacco product use among adults—United States, 2012–2013. *Morbidity and Mortality Weekly Report* 2014;63(25):542–7.

Centers for Disease Control and Prevention. Tobacco use among middle and high school students—United States, 2011–2014. *Morbidity and Mortality Weekly Report* 2015;64(14):381–5.

Centers for Disease Control and Prevention. Tobacco use among middle and high school students—United States, 2011–2015. *Morbidity and Mortality Weekly Report* 2016;65(14):361–7.

Famele M, Ferranti C, Abenavoli C, Palleschi L, Mancinelli R, Draisci R. The chemical components of electronic cigarette cartridges and refill fluids: review of analytical methods. *Nicotine & Tobacco Research* 2015;17(3):271–9.

Farsalinos KE, Polosa R. Safety evaluation and risk assessment of electronic cigarettes as tobacco cigarette substitutes: a systematic review. *Therapeutic Advances in Drug Safety* 2014;5(2):67–86.

Federal Register. U.S. Department of Health and Human Services, Food and Drug Administration. Deeming Tobacco Products To Be Subject to the Federal Food, Drug, and Cosmetic Act, as Amended by the Family Smoking Prevention and Tobacco Control Act; Restrictions on the Sale and Distribution of Tobacco Products and Required Warning Statements for Tobacco Products. 81 *Fed. Reg*. 28974 (2016); <https://federalregister.gov/a/2016-10685>; accessed: May 16, 2016.

Franck C, Budlovsky T, Windle SB, Filion KB, Eisenberg MJ. Electronic cigarettes in North America: history, use, and implications for smoking cessation. *Circulation* 2014;129(19):1945–52.

Grana RA, Benowitz N, Glantz SA. E-cigarettes: a scientific review. *Circulation* 2014a;129(19):1972–86.

Grana RA, Popova L, Ling PM. A longitudinal analysis of electronic cigarette use and smoking cessation. *JAMA Internal Medicine* 2014b;174(5):812–3.

Hagopian A, Halperin A, Atwater P, Fradkin N, Gilroy JH, Medeiros E. *E-Cigarettes: Evidence and Policy Options for Washington State*. Seattle (WA): University of Washington, School of Public Health, Department of Health Services, January 2015; <http://www.governor.wa.gov/sites/default/files/documents/ECigWhitePaper.PDF>; accessed: October 20, 2015.

Johnson SE, Holder-Hayes E, Tessman GK, King BA, Alexander T, Zhao X. Tobacco product use among sexual minority adults: findings from the 2012–2013 National Adult Tobacco Survey. *American Journal of Preventive Medicine* 2016;50(4):e91–e100.

Kong G, Morean ME, Cavallo DA, Camenga DR, Krishnan-Sarin S. Reasons for electronic cigarette experimentation and discontinuation among adolescents

and young adults. *Nicotine & Tobacco Research* 2015;17(7):847–54.

Leventhal AM, Strong DR, Kirkpatrick MG, Unger JB, Sussman S, Riggs NR, Stone MD, Khoddam R, Samet JM, Audrain-McGovern J. Association of electronic cigarette use with initiation of combustible tobacco product smoking in early adolescence. *JAMA: the Journal of the American Medical Association* 2015;314(7):700–7.

Li J, Bullen C, Newcombe R, Walker N, Walton D. The use and acceptability of electronic cigarettes among New Zealand smokers. *New Zealand Medical Journal* 2013;126(1375):48–57.

Lippert AM. Do adolescent smokers use e-cigarettes to help them quit? The sociodemographic correlates and cessation motivations of U.S. adolescent e-cigarette use. *American Journal of Health Promotion* 2015;29(6):374–9.

McDonald EA, Ling PM. One of several 'toys' for smoking: young adult experiences with electronic cigarettes in New York City. *Tobacco Control* 2015;24(6):588–93.

Pepper JK, Ribisl KM, Emery SL, Brewer NT. Reasons for starting and stopping electronic cigarette use. *International Journal of Environmental Research and Public Health* 2014;11(10):10345–61.

Peters RJ Jr, Meshack A, Lin MT, Hill M, Abughosh S. The social norms and beliefs of teenage male electronic cigarette use. *Journal of Ethnicity in Substance Abuse* 2013;12(4):300–7.

Primack BA, Soneji S, Stoolmiller M, Fine MJ, Sargent JD. Progression to traditional cigarette smoking after electronic cigarette use among U.S. adolescents and young adults. *JAMA Pediatrics* 2015:1–7.

Saitta D, Ferro GA, Polosa R. Achieving appropriate regulations for electronic cigarettes. *Therapeutic Advances in Chronic Disease* 2014;5(2):50–61.

Schmidt L, Reidmohr A, Harwell TS, Helgerson SD. Prevalence and reasons for initiating use of electronic cigarettes among adults in Montana, 2013. *Preventing Chronic Disease* 2014;11:E204.

Shihadeh A, Eissenberg T. Electronic cigarette effectiveness and abuse liability: predicting and regulating nicotine flux. *Nicotine & Tobacco Research* 2015;17(2):158–62.

Shihadeh AL, Eissenberg TE. Significance of smoking machine toxicant yields to blood-level exposure in water pipe tobacco smokers. *Cancer Epidemiology, Biomarkers and Prevention* 2011;20(11):2457–60.

Suris JC, Berchtold A, Akre C. Reasons to use e-cigarettes and associations with other substances among adolescents in Switzerland. *Drug and Alcohol Dependence* 2015;153:140–4.

Sutfin EL, Reboussin BA, Debinski B, Wagoner KG, Spangler J, Wolfson M. The impact of trying electronic cigarettes on cigarette smoking by college students: a prospective analysis. *American Journal of Public Health* 2015;105(8):e83–e89.

Tucker JS, Shadel WG, Golinelli D, Ewing B. Alternative tobacco product use and smoking cessation among homeless youth in Los Angeles County. *Nicotine & Tobacco Research* 2014;16(11):1522–6.

U.S. Department of Health and Human Services. *Preventing Tobacco Use Among Young People: A Report of the Surgeon General*. Atlanta (GA): U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 1994.

U.S. Department of Health and Human Services. *Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General*. Atlanta (GA): U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2012.

U.S. Department of Health and Human Services. *Smoking—50 Years of Progress: A Report of the Surgeon General*. Atlanta (GA): U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014.

Unger JB, Soto DW, Leventhal A. E-cigarette use and subsequent cigarette and marijuana use among Hispanic young adults. *Drug and Alcohol Dependence* 2016;163(1):261–4.

University of Michigan. Most youth use ecigarettes for novelty, flavors—not to quit smoking (press release), 2015; <http://www.monitoringthefuture.org/pressreleases/15ecigpr_complete.pdf>; accessed: January 25, 2015.

Vanyukov MM, Tarter RE, Kirillova GP, Kirisci L, Reynolds MD, Kreek MJ, Conway KP, Maher BS, Iacono WG, Bierut L, et al. Common liability to addiction and "gateway hypothesis": theoretical, empirical and evolutionary perspective. *Drug and Alcohol Dependence* 2012;123(Suppl 1):S3–S17.

Wills TA, Knight R, Sargent JD, Gibbons FX, Pagano I, Williams RJ. Longitudinal study of e-cigarette use and onset of cigarette smoking among high school students in Hawaii. *Tobacco Control* 2016.

U.S. Department of Health and Human Services

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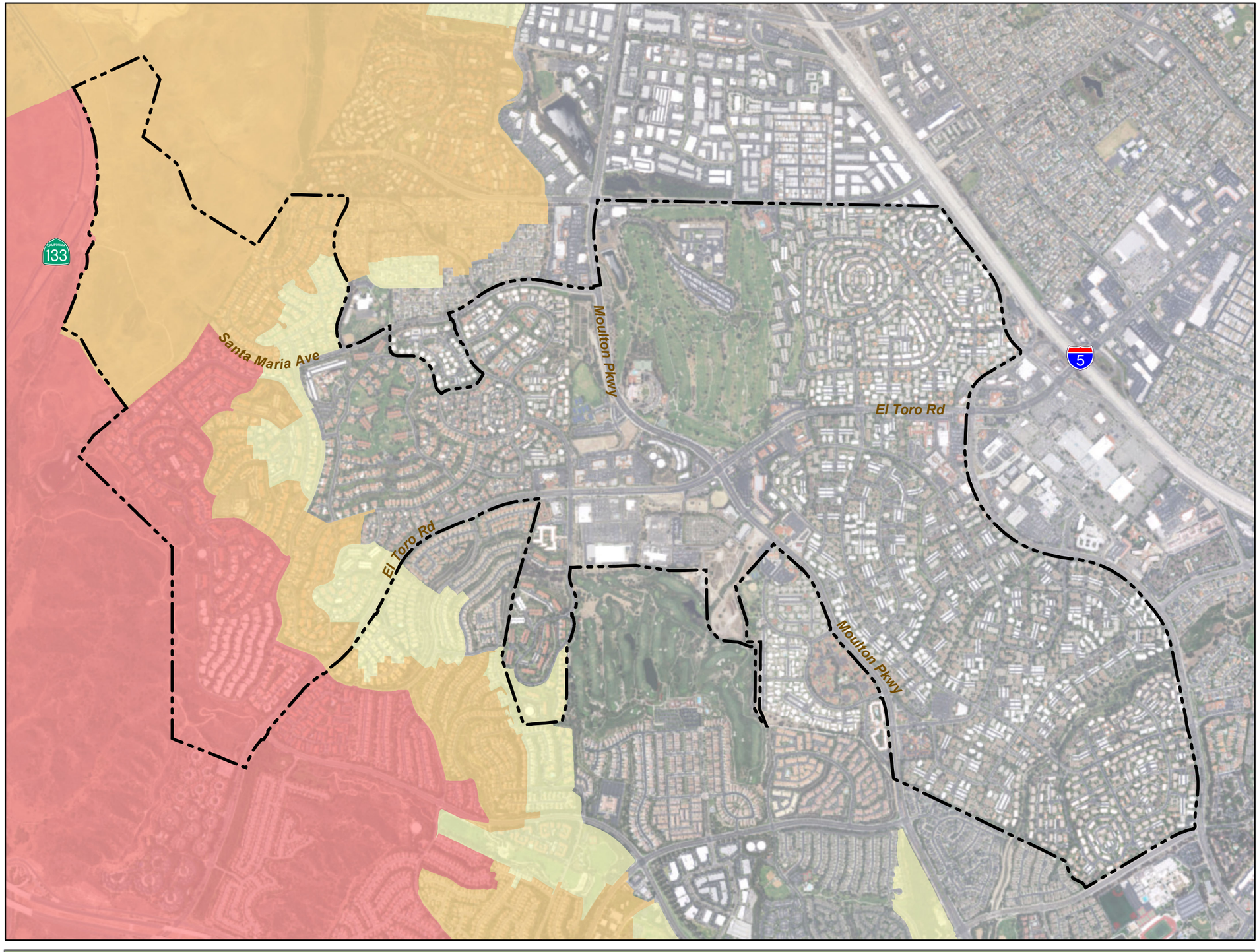
CITY OF LAGUNA WOODS



City of Laguna Woods
Founded 1999
California

FIRE HAZARD SEVERITY ZONES IN LOCAL RESPONSIBILITY AREA

Updated: August 25, 2017

Legend

City Limit

Fire Hazard Severity Zones in Local Responsibility Area (LRA)

- Very High / Incorporated LRA
- High / Incorporated LRA
- Moderate / Incorporated LRA

Reference: Laguna Woods Municipal Code Chapter 10.13

0 0.25 0.5 Miles

Michael Baker INTERNATIONAL

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8.4
SPEED LIMITS ON CITY STREETS

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City of Laguna Woods
Agenda Report

TO: Honorable Mayor and City Councilmembers

FROM: Christopher Macon, City Manager

FOR: November 15, 2017 Regular Meeting

SUBJECT: Speed Limits on City Streets

Recommendation

Approve second reading and adopt an ordinance – read by title with further reading waived – entitled:

> AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF LAGUNA WOODS, CALIFORNIA, AMENDING SECTION 8.06.010 OF THE LAGUNA WOODS MUNICIPAL CODE RELATED TO THE ADOPTION AND ESTABLISHMENT OF SPEED LIMITS ON EL TORO ROAD, MOULTON PARKWAY, RIDGE ROUTE DRIVE, AND SANTA MARIA AVENUE, INCLUDING AN INCREASED SPEED LIMIT ON EL TORO ROAD BETWEEN AVENIDA SEVILLA AND PASEO DE VALENICA, AND RE-ADOPTION AND RE-ESTABLISHMENT OF OTHER EXISTING SPEED LIMITS

Background

The process by which cities must establish and periodically review speed limits is set forth in the California Vehicle Code. In general, the law is based on the premise that the majority of motorists (85%) drive in a reasonable manner intended to avoid collisions and dangerous conditions. Therefore, speed limits are typically required to be established at the closest five mile per hour increment to the speed traveled by the majority of motorists (the "85th percentile speed"), unless unusual conditions – such as limited sight distance – exist. Cities are not able to simply lower speed limits based on perceptions that motorists are driving "too fast" or at unsafe speeds,

unless an engineering and traffic survey is performed in accordance with state law and yields data that validates those perceptions.

Earlier this fiscal year, staff solicited proposals from several traffic engineering consultants and selected Hartzog & Crabill, Inc. to perform an engineering and traffic survey for speed limits on City streets (Attachment B). Hartzog & Crabill, Inc. has performed similar work for the City in the past, as well as for the cities of Laguna Hills, Laguna Niguel, Lake Elsinore, San Juan Capistrano, and others.

The engineering and traffic survey studied the following City street segments:

Table 1: City Street Segments Surveyed

Street	**Segment**
El Toro Road	Aliso Creek Road to Calle Corta
El Toro Road	Calle Corta to Calle Sonora
El Toro Road	Calle Sonora to Moulton Parkway
El Toro Road	Moulton Parkway to Avenida Sevilla
El Toro Road	Avenida Sevilla to Paseo de Valencia
Moulton Parkway	Santa Maria Avenue to El Toro Road
Moulton Parkway	El Toro Road to Calle Cortez
Moulton Parkway	Calle Cortez to South City Limits
Ridge Route Drive	Moulton Parkway to East City Limits
Santa Maria Avenue	Moulton Parkway to Via Vista
Santa Maria Avenue	Santa Vittoria to Avenida Sosiega

The engineering and traffic survey included the review of three years of accident information provided by the Orange County Sheriff's Department for each of the City street segments surveyed.

On October 18, 2017, a public hearing was held and the City Council introduced and approved the first reading of an ordinance (Attachment A) which, if adopted, would amend Section 8.06.010 of the Laguna Woods Municipal Code related to the establishment of speed limits on El Toro Road, Moulton Parkway, Ridge Route Drive, and Santa Maria Avenue, including an increased speed limit on El Toro Road between Avenida Sevilla and Paseo de Valenica, and re-adoption and re-establishment of other existing speed limits.

Discussion

Today's meeting is an opportunity for City Council action, as well as public input, on the proposed amendments to Section 8.06.010 of the Laguna Woods Municipal Code related to the establishment of speed limits on El Toro Road, Moulton Parkway, Ridge Route Drive, and Santa Maria Avenue, including an increased speed limit on El Toro Road between Avenida Sevilla and Paseo de Valenica, and re-adoption and re-establishment of other existing speed limits (Attachment A). Staff recommends that the City Council adopt the proposed ordinance, in order to ensure compliance with state law.

Based on the engineering and traffic survey, City staff, the City Traffic Engineer, and Hartzog & Crabill, Inc. recommend that the City Council increase the speed limit on El Toro Road between Avenida Sevilla and Paseo de Valencia from 35 to 40 miles per hour. The speed limit on El Toro Road immediately west of Avenida Sevilla is 40 miles per hour. The speed limit on El Toro Road immediately east of Paseo de Valencia (in the City of Laguna Hills) is 35 miles per hour. If approved, the proposed speed limit change would result in a consistent 40 mile per hour speed limit along El Toro Road between Moulton Parkway and Paseo de Valencia.

With the exception of the speed limit on El Toro Road between Avenida Sevilla and Paseo de Valencia, all other speed limits are proposed to remain unchanged.

If the City Council takes the recommended action at today's meeting, the proposed ordinance would become effective in 30 days.

Environmental Review

This project is exempt from review under the California Environmental Quality Act ("CEQA") pursuant to sections 15061(b)(3) and 15078(b) of Title 14 of the California Code of Regulations, in that the project is not a project which has the potential for causing a significant effect on the environment and is a governmental activity that will not result in direct or indirect physical changes in the environment.

Fiscal Impact

Funds to support this project are included in the City's budget. The cost to purchase and install signage related to the recommended speed limit change is estimated at less than $1,000 and could be accommodated within existing budgets.

Attachments: A – Proposed Ordinance
Exhibit A – Code Amendment Text
B – Engineering and Traffic Survey (dated September 2017)

ORDINANCE NO. 17-XX

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF LAGUNA WOODS, CALIFORNIA, AMENDING SECTION 8.06.010 OF THE LAGUNA WOODS MUNICIPAL CODE RELATED TO THE ADOPTION AND ESTABLISHMENT OF SPEED LIMITS ON EL TORO ROAD, MOULTON PARKWAY, RIDGE ROUTE DRIVE, AND SANTA MARIA AVENUE, INCLUDING AN INCREASED SPEED LIMIT ON EL TORO ROAD BETWEEN AVENIDA SEVILLA AND PASEO DE VALENICA, AND RE-ADOPTION AND RE-ESTABLISHMENT OF OTHER EXISTING SPEED LIMITS

WHEREAS, the California Vehicle Code sets forth the process by which speed limits must be established and periodically reviewed; and

WHEREAS, speed limits for El Toro Road, Moulton Parkway, Ridge Route Drive, and Santa Maria Avenue are codified at Section 8.06.010 of the Laguna Woods Municipal Code; and

WHEREAS, an Engineering and Traffic Survey has been performed by the engineering consulting firm of Hartzog & Crabill, Inc. (dated September 2017), in accordance with applicable state law, to determine whether changes in pre-existing conditions have occurred where older speed limits should be modified; and

WHEREAS, the Engineering and Traffic Survey performed by Hartzog & Crabill, Inc. (dated September 2017) recommends no change in the speed limits for 10 of the 11 street segments studied, and an increase in the speed limit for El Toro Road between Avenida Sevilla and Paseo de Valencia from 35 miles per hour to 40 miles per hour; and

WHEREAS, City staff and the City Traffic Engineer have reviewed and concur with the recommendations contained in the Engineering and Traffic Survey performed by Hartzog & Crabill, Inc. (dated September 2017), and recommend amendments to the existing speed limits as set forth in the attached Exhibit A to this Ordinance (the "Code Amendments"); and

WHEREAS, on October 18, 2017, the City Council was presented with the Engineering and Traffic Survey performed by Hartzog & Crabill, Inc. (dated September 2017) and had an opportunity to consider all of the information, evidence, and comments presented, both written and oral.

THE CITY COUNCIL OF THE CITY OF LAGUNA WOODS DOES HEREBY ORDAIN AS FOLLOWS:

SECTION 1. The City Council hereby finds and determines that (i) each of the recitals to this Ordinance are true and correct, and are adopted herein as findings; (ii) the Code Amendments comply with all applicable requirements of state law; (iii) the Code Amendments will not adversely affect the health, safety, or welfare of the residents within the community; (iv) the Code Amendments are in the public interest of the City of Laguna Woods; and, (v) the Code Amendments are consistent with the Laguna Woods General Plan and its various elements.

SECTION 2. After reviewing the entire project record, the City Council hereby determines and certifies that the Code Amendments are exempt from review under the California Environmental Quality Act ("CEQA") pursuant to sections 15061(b)(3) and 15078(b) of Title 14 of the California Code of Regulations, in that the Code Amendments are not a project which has the potential for causing a significant effect on the environment and are a governmental activity that will not result in direct or indirect physical changes in the environment.

SECTION 3. Section 8.06.010 of the Laguna Woods Municipal Code is hereby amended to read as set forth in Exhibit A, attached to this Ordinance and incorporated herein by this reference.

SECTION 4. This Ordinance shall take effect and be in full force and operation thirty (30) days after adoption.

SECTION 5. If any section, subsection, subdivision, paragraph, sentence, clause, or phrase added by this Ordinance, or any part thereof, is for any reason held to be unconstitutional or invalid or ineffective by any court of competent jurisdiction, such decision shall not affect the validity of effectiveness of the remaining portions of this Ordinance or any part thereof. The City Council hereby declares that it would have passed each section, subsection, subdivision, paragraph, sentence, clause, or phrase thereof irrespective of the fact that any one or more subsections, subdivisions, paragraphs sentences, clauses, or phrases are declared unconstitutional, invalid, or ineffective.

SECTION 6. The Deputy City Clerk shall certify to the passage of this Ordinance and shall cause this Ordinance to be published or posted as required by law.

SECTION 7. All of the above-referenced documents and information have been and are on file with the City Clerk of the City.

PASSED, APPROVED AND ADOPTED this XX day of XX 2017.

_____
SHARI L. HORNE, Mayor

ATTEST:

_____
YOLIE TRIPPY, Deputy City Clerk

APPROVED AS TO FORM:

_____
DAVID B. COSGROVE, City Attorney

STATE OF CALIFORNIA)
COUNTY OF ORANGE) ss.
CITY OF LAGUNA WOODS)

I, YOLIE TRIPPY, Deputy City Clerk of the City of Laguna Woods, do HEREBY CERTIFY that the foregoing **Ordinance No. 17-XX** was duly introduced and placed upon its first reading at a regular meeting of the City Council on the XX day of XX 2017, and that thereafter, said Ordinance was duly adopted and passed at a regular meeting of the City Council on the XX day of XX 2017 by the following vote to wit:

AYES: COUNCILMEMBERS:
NOES: COUNCILMEMBERS:
ABSENT: COUNCILMEMBERS:

_____
YOLIE TRIPPY, Deputy City Clerk

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EXHIBIT A
CODE AMENDMENTS

Section 8.06.010 ("Speed limits") of Chapter 8.06 ("Vehicle Operation") of Title 8 ("Traffic Control") of the Laguna Woods Municipal Code is repealed in its entirety and replaced with the following:

Sec. 8.06.010. - Speed limits.

The following speed limits are established:

Street	Segment	Speed Limit
El Toro Road	Aliso Creek Road to Calle Corta	50 miles per hour
El Toro Road	Calle Corta to Calle Sonora	50 miles per hour
El Toro Road	Calle Sonora to Moulton Parkway	45 miles per hour
El Toro Road	Moulton Parkway to Avenida Sevilla	40 miles per hour
El Toro Road	Avenida Sevilla to Paseo de Valencia	40 miles per hour
Moulton Parkway	Santa Maria Avenue to El Toro Road	45 miles per hour
Moulton Parkway	El Toro Road to Calle Cortez	45 miles per hour
Moulton Parkway	Calle Cortez to South City Limits	45 miles per hour
Ridge Route Drive	Moulton Parkway to East City Limits	45 miles per hour
Santa Maria Avenue	Moulton Parkway to Via Vista	40 miles per hour
Santa Maria Avenue	Santa Vittoria to Avenida Sosiega	40 miles per hour

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ENGINEERING AND TRAFFIC SURVEY FOR SPEED LIMITS

CITY OF LAGUNA WOODS

SEPTEMBER 2017

PREPARED FOR:

CITY OF LAGUNA WOODS
24264 EL TORO ROAD
LAGUNA WOODS, CALIFORNIA 92637

PREPARED BY:

HARTZOG & CRABILL, INC.
17852 EAST 17TH STREET, SUITE 101
TUSTIN, CA 92780
(714) 731-9455

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CERTIFICATION

I, Gerald Stock, do hereby certify that this Engineering and Traffic Survey for the City of Laguna Woods was performed under my supervision and is accurate and complete. I certify that I am both experienced in performing surveys of this type and duly registered in the State of California as a professional Traffic Engineer.

Gerald Stock
RTE # 2049

File: Laguna Woods Radar Rpt 2017.doc

CITY OF LAGUNA WOODS
ENGINEERING AND TRAFFIC SURVEY FOR SPEED LIMITS

In accordance with procedures established by the State of California, this Engineering and Traffic Survey has been developed for the City of Laguna Woods as the basis for the establishment and enforcement of speed limits for selected streets within the City. The work provided herein was authorized by the City and was performed by the engineering consulting firm of Hartzog & Crabill, Inc. The goal of the survey was to determine whether changes in pre-existing conditions have occurred where older speed limits should be modified.

The requirement to perform Engineering and Traffic surveys for speed limits is based on the California Vehicle Code (CVC). CVC Section 40802 states that at least once every five (5), seven (7) or ten (10) years, States and local agencies should re-evaluate non-statuary speed limits on segments of their roadways. Engineering and Traffic Surveys must be performed with the use of radar or other approved electronic devices if the use of radar is to be employed to enforce speed limits. If such a survey is not performed within five years (or seven years, or 10 years as stated previously) of the date of the preceding survey, then the new data and its use will constitute a speed trap. Hence, evidence using such would not be admissible in court. From the Vehicle Code, a "speed trap" is either of the following:

(a) A particular section of a highway measured as to distance and with boundaries marked, designated, or otherwise determined in order that the speed of a vehicle may be calculated by securing the time it takes the vehicle to travel the known distance.

(b) A particular section of a highway with a prima facie speed limit provided by this code or by local ordinance under sub-paragraph (A) of paragraph (2) of subdivision (a) of Section 22352, or established pursuant to Section 22354, 22357, 22358, or 22358.3 if that prima facie speed limit is not justified by an engineering and traffic survey conducted within five years prior to the date of the alleged violation, and where enforcement involves the use of radar or other electronic devices that measures the speed of moving objects. This paragraph does not apply to a local street, road, or school zone.

The definition of a Traffic and Engineering Survey is contained in Section 627 of the Vehicle Code and is as follows:

Engineering and Traffic survey, as used in this code, means a survey of highway and traffic conditions in accordance with methods determined by the California Department of Transportation (Caltrans) for use by State and local authorities. An Engineering and Traffic survey shall include, among other requirements deemed necessary by the State Department of Transportation, consideration of the following:

(a) Prevailing speeds as determined by traffic engineering measurements.

(b) Accident records.

(c) Highway, traffic and roadside conditions not readily apparent to the driver.

The California Vehicle code has set certain regulations regarding the posting and enforcement of speed zones. These regulations generally reflect the viewpoint that speed zoning should be based on traffic conditions and natural driver behavior and not because of an arbitrary response to a traffic event or occurrence. Therefore, it is important to have a general understanding of the "Basic Speed Law", "Prima Facie Speed Limits" and "Intermediate Speed Zones".

Basic Speed Law (CVC 22350)

All fifty states base their speed regulations on the Basic Speed Law. In California, CVC 22350 defines the basic speed law as:

"No Person shall drive a vehicle upon a highway at a speed greater than is reasonable or prudent having due regard for weather, visibility, the traffic on, and the surface and width of the highway, and in no event at a speed which endangers the safety of persons or property."

This law recognizes that driving conditions vary widely from time-to-time and place-to-place and, therefore, no set of fixed driving rules will adequately serve all conditions. The motorist will constantly adjust their driving behavior to fit the conditions encountered, and must learn to do this with a minimum of assistance from the police. The Basic Speed Law is founded on the belief that a majority of motorists are able to modify their driving behavior properly, as long as they are aware of the conditions around them.

Prima Facie Speed Limits (CVC 22352)

All other speed limits are prima facie limits which, "on the face of it", are reasonable and prudent under normal conditions. The opportunity given to the driver to exceed a prima facie speed limit when it is safe to do so recognizes the fact that any posted speed limit cannot adequately reflect the many different conditions of traffic, weather, visibility, etc., that may be found on the same highway at different times.

Certain prima facie limits are automatically established by law (CVC 22352), including a 15 mph limit in alleys, blind intersections, blind railroad crossing, and the 25 mph limit in business and residence districts. There is also a part time 25 mph limit in school zones when children are present in route to or from school.

Business and residence districts are defined in the Vehicle Code as specific areas meeting a specified minimum density of roadside development. CVC Sections 235 and 515 define these regulations. A count of houses or active businesses facing on a highway must be made to determine whether or not a valid business or residence district exists. The law does not require posting these prima facie limits that are readily apparent.

Establishment of Speed Zones

The reason that speed limit areas and their required postings are done is to guard reasonable drivers from the unreasonable behavior of reckless, unreliable, or otherwise dangerous drivers. As with other similar laws, the limits identified are based on the consensus of the majority of

those who drive the highway as to what speed is reasonable and safe. It is this type of information that is reflected in the analysis section of this report. Namely, posted speed limits are a reflection of that speed which most people deem to be safe as opposed to a minority of drivers who do not drive in a reasonable manner.

Speed zones are also established to advise drivers of road conditions or hazards that may not be readily apparent to a reasonable driver. For that reason, a field review of related road/traffic variables is conducted which considers the analytical data and accident history of a particular roadway segment to determine a safe and reasonable speed limit.

Data Collection Procedures

Speed evaluation data was collected at 11 different segments on four different roadways in the Community of Laguna Woods. These areas and the number of segments on each are described as follows:

1.	El Toro Road	Aliso Creek to Calle Corta
2.		Calle Corta to Calle Sonora
3.		Calle Sonora to Moulton Pkwy
4.		Moulton Pkwy to Avenida Sevilla
5.		Avenida Sevilla to Paseo De Valencia
6.	Moulton Parkway	Santa Maria Ave to El Toro Rd
7.		El Toro Rd to Calle Cortez
8.		Calle Cortez to South City Limits
9.	Ridge Route Road	Moulton Pkwy to East City Limits
10.	Santa Maria Avenue	Moulton Pkwy to Via Vista
11.		Santa Vittoria To Avenida Sosiega

As described in various traffic engineering documents - including information provided by the State of California, the individual locations on which radar data collection procedures were used involved considerations for the following:

a. Stop sign or traffic signal locations;

b. Visibility issues;

c. Traffic flow at intersections, cross-traffic, major driveways, crosswalks, railroad crossings and unusual turning movements; and

d. The influence of other traffic factors on the speed of cars: such as on street parking, roadway features, adjacent land uses, and lighting.

Speed Zoning Methodology

The California Manual on Uniform Traffic Control Devices (California MUTCD) specifies a "short method" of determining speed limits in cities and counties through Highways, Arterial and Collector Roads Procedures.

Introduction - This short method of speed zoning is based on the premise that the reasonable speed limit is one that conforms to the actual behavior of the majority of motorists, and that by measuring motorist's speeds, one will be able to select a speed limit that is both reasonable and effective. Other factors that need to be considered include, but are not limited to: the most recent two-year collision record, roadway design speed, safe stopping sight distance, superelevation, shoulder conditions, profile conditions, intersection spacing and offsets, commercial driveway characteristics, and pedestrian traffic in the roadway without sidewalks.

Speed Zone Survey

- Only one person is required for the fieldwork. Speeds can be read directly from a radar speed meter.

- A section of road should be selected with representative operating speeds. If speeds vary on a given road, additional surveys should be conducted. In this case, it may be necessary to establish additional speed zones with different speed limits. The section selected should be straight and should have no traffic signal, stop sign or intersection with a major cross street.

- Speed measurements should be taken during off-peak hours on weekdays. The weather should be fair with no unusual conditions prevailing. It is important that the surveyor and the equipment be so inconspicuous as not to affect traffic speeds. For this reason, an unmarked car is recommended, with the radar speed meter located as inconspicuously as possible. It should be placed so as to be able to survey traffic in both directions, and should not make an angle greater than 15 degrees with the roadway centerline.

- It is desirable to have a minimum sample of 100 automobiles in each survey. This may result in excessive survey periods for low-volume roads. Under these conditions, the survey should be conducted for a minimum of two hours, but in no case should the sample for any survey contain less than 50 automobiles.

- The California MUTCD states that speed limits are established at or near the 85th percentile speed, which is defined as that speed at or below which 85 percent of the traffic is moving. This speed can be selected directly from the data sheet. However, roadway conditions not readily apparent to the motorist such as vertical or horizontal curves or other roadway conditions that may impact sight distance may result in a further reduction of 5 mph in the recommended speed limit.

- As a check on the validity of the proposed speed limit, an analysis should be made of the two-year accident record for the section of roadway under consideration. If this record shows an abnormally high percentage of accidents normally associated with excessive speeds, the proposed speed limit should be further reduced. This is a judgment situation, and will not usually be a factor.

- Short speed zones of less than half a mile should be avoided, except in transition areas.

- Speed zone changes should be coordinated with changes in roadway conditions or roadway development.

- Speed zoning in 5 mile per hour increments should be avoided if possible. A 10-mile per hour increment is preferable.

- Speed zoning should be coordinated between adjacent jurisdictions.

Local Street Exemptions (CVC 40802)

Many streets are designated as "Local" streets per CVC 40802. These streets are exempt from the radar study. Therefore, the speed limit for these streets does not require an Engineering and Traffic Survey. The code is as follows:

"For the purpose of this section, local streets and roads shall be defined by the latest functional usage and federal aid system maps as submitted to the Federal Highway Administration. When these maps have not been submitted, the following definition shall be used: A local street or road primarily provides access to abutting residential property and shall meet the following three conditions:

1. Roadway width of not more than 40 feet.
2. Not more than one half mile of uninterrupted length.
3. Not more than one traffic lane in each direction.

Other Considerations

Every street should be inspected for unusual traffic, roadway and roadside conditions not readily apparent to a motorist. A check should be made of the adequacy of traffic control devices, roadway alignment, width surface conditions, accident history and any unique traffic hazards that may exist. Any of these conditions may warrant the selection of a speed lower than the 85th percentile speed for speed zoning.

Radar Collection Time-Frames

The hours of radar operation were restricted to off-peak periods (when possible) for heavily traveled streets and to uncongested peak periods on lightly traveled streets. All surveys were conducted in fair weather.

The radar unit was mounted at the top of the front dash of an unmarked vehicle with the meter-reading unit sustained inside the vehicle. The radar unit's calibration was checked periodically using a tuning fork. The radar operator and assistant recorded the speed meter readings for each location on Radar Speed Survey Field Sheets included in Appendix A of this report. A representative sampling of at least 50 vehicles were surveyed in each direction or a cumulative sample of 100 vehicles for both directions where possible. On low volume roads, where a total

sample of 100 vehicles would result in an excessive time period, sampling was continued until a representative bell-shaped frequency distribution was attained.

Analysis Factors

Several factors were used as input to our recommendations for speed limits. These include the 85th Percentile, the 10 MPH Pace and others. These are described in detail below.

1. The **CRITICAL SPEED**, or the 85th percentile is defined as that speed at or below which 85 % of the traffic is moving. This is one of the key factors in determining appropriate speed limits and complies with State of California requirements.

   Hence, the accepted practice, and one that has been used in this case is to set the speed limit at or near the critical speed. This recognizes that other factors could be present where the above may not be appropriate. When this procedure is used, it not only conforms to that required by the State but it also provides a strong base for law enforcement personnel to properly enforce speed limits.

2. The **10 MPH PACE** is that continuous 10 mph incremental range of speeds in which the largest number of recorded vehicles is contained. It is a measure of the dispersion of speeds within the sample surveyed. For this element, the accepted practice to the greatest extent possible, is to try and keep the recommended speed limit within the 10 mph pace after considering the critical speed and any factors requiring a speed lower than the critical speed.

3. The **MEDIAN (MIDDLE) SPEED**, or 50th percentile speed, represents the mid-point value within the range of recorded speeds for a particular roadway location. In other words, 50% of the vehicles travel faster than, and 50% travel slower than the median speeds. This value is another measure of the central tendency of the vehicle speed distribution.

4. The **15th PERCENTILE SPEED** is that speed at or below which 15% of the vehicles are traveling. This value is important in determining the minimum allowable speed limit, given that the vehicles traveling below this speed tend to obstruct the flow of traffic, thereby increasing the accident potential.

5. **MODAL SPEED**: The modal speed is the speed, which occurs most frequently in the distribution (the most). It serves as another useful measure in verifying the correct recommendation for speed limits.

6. **STANDARD DEVIATION**: This is a mathematical element, which relates to measures of dispersion of data. It is used to assist in describing the center of speed distribution information around the arithmetic mean or the time mean speed. It also is used in the overall review of recommended speed limits and serves to verify the level of confidence of data used in making recommendations.

7. The **MEAN (AVERAGE)** is the sum of the speeds of the samples divided by the number of samples.

The numerical values of the above factors are derived from the speed distribution curves calculated for each survey location. These distribution curves represent a method of graphic analysis that compares the cumulative percentage of vehicles to the speed at which the vehicles are traveling.

Field Review

In addition to the availability of the above statistical data, a significant aspect of speed limit recommendations is based on the field review. Its importance is that existing conditions may warrant a lower speed than is actually indicated by the application of survey data. Examples of the field data collected for the purposes of analyzing related roadway characteristics as they pertain to the determination of appropriate speed limits are listed below:

1. Segment length, width and alignment.
2. Level of pedestrian activity.
3. Traffic flow characteristics.
4. Vertical and/or horizontal curves.
5. Driver sight distance constraints.
6. Adjacent residential/commercial/industrial etc. zoning.
7. Number of lanes and other channelization/striping factors.
8. Frequency of intersections, driveways and on street parking.
9. Location of stop signs, traffic signals, and other regulatory traffic control devices.
10. Roadway conditions, bumps and dips.
11. Obstructions to pedestrian visibility.
12. Land use and proximity of schools.
13. Uniformity with existing speed zones to/with adjacent jurisdictions.
14. Any other unusual conditions not readily apparent to the driver.

The results of the field review of related road/traffic variables are summarized on the Engineering and Traffic Survey forms found in Appendix A of this report.

Accident History

The Engineering and Traffic Survey forms summarize the available three-year accident information for the subject streets rather than the required twenty-four months. The accident information includes the total number of accidents within each street segment and of those accidents, the number that are speed-related. The annual accident rate figures represent the number of speed-related accidents divided by years of accident records. The evaluation of accidents is useful as a check on the accuracy of recommended or existing speed limits. Should this review show a high percentage of accidents associated with excessive speeds, then consideration based on professional traffic engineering judgement should be directed toward reducing the posted or recommended speed limit.

Results and Recommendations

The following Summaries: No Speed Limit Changes, New Speed Limit Postings, Speed Limit Increases, Speed Limit Reductions and Summary of Recommendations presents the results of the radar survey for the selected four streets. As shown, the Summary of Recommendations chart presents the necessary analysis elements that in addition to the field review of a registered traffic engineer, led to the recommendations indicated.

Locations of "No Speed Limit Changes"

Ten of the 11 segments studied are recommended for no speed limit changes. The reason centers mostly on the fact that the newly measured values of the 85th percentile and the 10 mph pace are still within the parameters of the existing speed limits. Additional factors such as the presence of horizontal or vertical curves reducing sight distance form the basis in some instances of our recommendation. Therefore, the current postings should remain as is. The segments recommended for "No Change" are listed below:

El Toro Road	
Aliso Creek Rd to Calle Corta	Remain posted at 50 mph
Calle Corta to Calle Sonora	Remain posted at 50 mph
Calle Sonora to Moulton Pkwy	Remain posted at 45 mph
Moulton Pkwy to Avenida Sevilla	Remain posted at 40 mph
Moulton Parkway	
Santa Maria Ave to El Toro Rd	Remain posted at 45 mph
El Toro Rd to Calle Cortez	Remain posted at 45 mph
Calle Cortez to South City Limits	Remain posted at 45 mph
Ridge Route Drive	
Moulton Pkwy to East City Limits	Remain posted at 45 mph
Santa Maria Avenue	
Moulton Parkway to Via Vista	Remain posted at 40 mph
Santa Vittoria to Avenida Sosiega	Remain posted at 40 mph

Location of Speed Limit Increase

At one location, the Engineering and Traffic Survey data indicates a need for a speed limit increase. The newly measured values of the 85th percentile speeds, the 10 mph pace range, and existing roadway characteristics were factors used to make this recommendation. This segment and reasons for the recommendations are explained below:

El Toro Road	
Avenida Sevilla to Paseo de Valencia	Increase from 35 mph to 40 mph

Support Explanation for "Speed Limit Increase"

El Toro Road

Avenida Sevilla to Paseo de Valencia

This section of El Toro Road is a six lane divided roadway. The adjacent land uses are non-fronting residential gated communities and commercial at Paseo de Valencia. Field observations include a wide off-street pedestrian walkway and bicycle path along south-side of the roadway (golf carts are also permitted to travel on this off-street area between Avenida Sevilla and the commercial at Paseo de Valencia), and a golf cart crossing at Avenida Sevilla.

There are no intersections between the intersection of Avenida Sevilla and Paseo de Valencia, two driveways near the intersection of Paseo de Valencia, and "No Stopping Anytime" due to no shoulders on both sides of the roadway. The speed survey resulted with an 85th percentile speed of 41.5 mph and a 10 mph pace range of 33 to 42 mph. With that, it is recommended that the existing 35 mph speed limit be increased to 40 mph.

SUMMARY OF RECOMMENDATIONS
2017

STREET LOCATION	EXISTING SPEED LIMIT	RECOMMENDED SPEED LIMIT	85TH PERCENTILE SPEED	AVERAGE SPEED	10 MPH PACE RANGE	PERCENT OF VEHICLES IN PACE	JUSTIFICATION / COMMENTS
EL TORO ROAD							
ALISO CREEK TO CALLE CORTA	50	**50**	49.3	42.9	38-47	59.7	NO CHANGE – 85TH PERCENTILE
CALLE CORTA TO CALLE SONORA	50	**50**	52.6	48.7	44-53	78.0	NO CHANGE – 85TH PERCENTILE
CALLE SONORA TO MOULTON PKWY	45	**45**	44.2	39.4	36-45	72.6	NO CHANGE –85TH PERCENTILE
MOULTON PKWY TO AVENIDA SEVILLA	40	**40**	43.9	38.5	34-43	66.5	NO CHANGE – 85TH PERCENTILE
AVENIDA SEVILLA TO PASEO DE VALENCIA	35	**40**	41.5	36.1	33-42	68.2	INCREASE – 85TH PERCENTILE
MOULTON PARKWAY							
SANTA MARIA AVE TO EL TORO RD	45	**45**	46.2	42.1	37-46	72.6	NO CHANGE – 85TH PERCENTILE
EL TORO RD TO CALLE CORTEZ	45	**45**	47.2	42.8	39-48	75.9	NO CHANGE – 85TH PERCENTILE
CALLE CORTEZ TO SOUTH CITY LIMITS	45	**45**	48.4	44.4	40-49	77.1	NO CHANGE – 85TH PERCENTILE
RIDGE ROUTE DRIVE							
MOULTON PKWY TO EAST CITY LIMITS	45	**45**	47.4	41.9	39-48	68.1	NO CHANGE – 85TH PERCENTILE
SANTA MARIA AVENUE							
MOULTON PKWAY TO VIA VISTA	40	**40**	43.9	39.1	36-45	80.6	NO CHANGE – 85TH PERCENTILE
SANTA VITTORIA TO AVENIDA SOSIEGA	40	**40**	41.2	37.1	32-41	75.0	NO CHANGE – 85TH PERCENTILE

APPENDIX A

ENGINEERING AND TRAFFIC SURVEY

CITY OF LAGUNA WOODS

HCI

EL TORO ROAD — **ALISO CREEK RD TO CALLE CORTA**

DATE: 8/28/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 12:15 PM - 12:50 PM — CHECKED BY: JERRY STOCK

PREVAILING SPEED DATA	
LOCATION OF SURVEY	**EAST OF ALISO CREEK**
DATE OF SURVEY	8/28/2017
85th PERCENTILE	49.3 MPH
10 MPH PACE	38 - 47 MPH
PERCENT IN PACE	59.7 %
POSTED SPEED LIMIT	50 MPH

ACCIDENT HISTORY	
NO. OF MONTHS OBSERVED	36
SPEED-RELATED ACCIDENTS	1
TOTAL ACCIDENTS	5
ANNUAL ACCIDENT RATE	0.33 ACCIDENTS PER YEAR (SPEED RELATED ONLY)
ACC./MILLION VEH. MILES	0.23 ACCIDENTS PER MVM (SPEED RELATED ONLY)

TRAFFIC FACTORS	
AVERAGE DAILY TRAFFIC	16,000
LANE CONFIGURATION	3 LANES PER DIRECTION
TRAFFIC CONTROLS	SIGNAL - CALLE CORTA / ALISO CREEK
CROSSWALKS	AT CALLE CORTA / ALISO CREEK
PEDESTRIAN/BICYCLES	FEW / YES
TRUCK TRAFFIC	YES
ON-STREET PARKING	NO STOPPING ANYTIME
OTHER	PAINTED BIKE LANES
	BUS STOPS

ROADWAY FACTORS	
LENGTH OF SEGMENT (MILES)	0.25
VERTICAL CURVE	SLIGHT UPHILL GRADES (EB)
HORIZONTAL CURVE	GRADUAL "S" CURVES
LATERAL VISIBILITY	LIMITED SIGHT DISTANCE (areas of)
ROAD CONDITIONS	GOOD
SIDEWALKS / DRIVEWAYS	YES / NO
STREET LIGHTING	YES
DRIVEWAY DENSITY	NOMINAL
OTHER	RAISED MEDIAN ISLAND

ADJACENT LAND USE	RESIDENTIAL (NF)
RECOMMENDED SPEED LIMIT	50 MPH
SPEED LIMIT CHANGE	NO CHANGE

JUSTIFICATION:

The recommended speed is within 0.7 mph of the 85th percentile speed and meets CVC standards.

NF = NON FRONTING TO ROADWAY

File: El Toro 2017-01

RADAR SPEED DISTRIBUTION SHEET

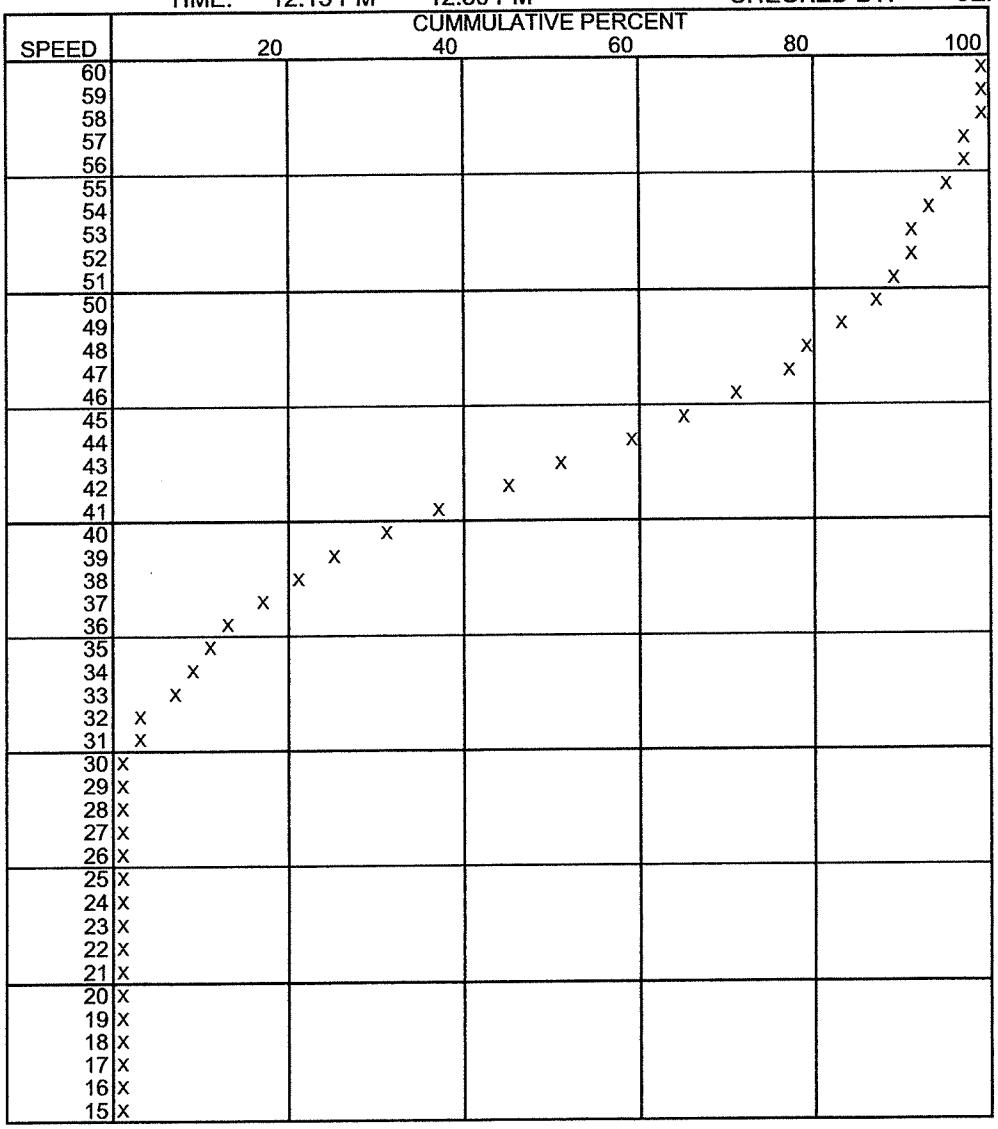
HCI

CITY OF LAGUNA WOODS

EL TORO ROAD — ALISO CREEK RD TO CALLE CORTA

DATE: 8/28/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 12:15 PM - 12:50 PM — CHECKED BY: JERRY STOCK



SPEED	CUMMULATIVE PERCENT		
60	100.0%		
59	99.5%		
58	99.1%		
57	97.6%		
56	96.7%		
55	95.3%		
54	92.4%		
53	91.9%		
52	90.5%		
51	88.6%		
50	87.7%		
49	83.9%	---85PCT	
48	79.1%		
47	76.3%	}PACE	
46	70.1%	}PACE	
45	64.5%	}PACE	
44	59.2%	}PACE	
43	50.7%	}PACE	
42	46.0%	}PACE	---MEAN
41	37.9%	}PACE	
40	30.8%	}PACE	
39	25.6%	}PACE	
38	21.8%	}PACE	
37	16.6%		
36	13.7%	---15PCT	
35	10.4%		
34	8.5%		
33	6.2%		
32	3.8%		
31	2.8%		
30	1.9%		
29	0.5%		
28	0.5%		
27	0.5%		
26	0.0%		
25	0.0%		
24	0.0%		
23	0.0%		
22	0.0%		
21	0.0%		
20	0.0%		
19	0.0%		
18	0.0%		
17	0.0%		
16	0.0%		
15	0.0%		

UPPER LIMIT 10 MPH PACE:	47	MPH
LOWER LIMIT 10 MPH PACE:	38	MPH
PERCENT OVER PACE:	23.7	%
PERCENT IN PACE:	59.7	%
PERCENT UNDER PACE:	16.6	%

85th PERCENTILE SPEED:	49.3	MPH
MEDIAN SPEED:	42.9	MPH
15th PERCENTILE SPEED:	36.4	MPH

Radar Speed Survey Field Sheet

HARTZOG AND CRABILL INC.
Consulting Traffic Engineers
17592 Irvine Blvd, Suite 122 Tustin CA 92680
(714) 731-5455

AGENCY: CITY OF LAGUNA WOODS
STREET: EL TORO ROAD
LOCATION: ALISO CREEK RD TO CALLE CORTA

WEATHER: SUNNY
ROAD CONDITION: DRY
OBSERVER: CATHY BUENDIA

DATE: 08/28/17
START TIME: 12:15 PM
END TIME: 12:50 PM VGR

DIRECTION: WESTBOUND

MPH	NUMBER OF VEHICLES	TOTAL
60		
59	/	1
58	/	1
57	/	1
56		0
55	///	3
54		0
53	/	1
52	/	1
51	/	1
50	////	5
49	////	5
48	///	3
47	//////	8
46	///	3
45	////	4
44	////////	8
43	/////	5
42	//////////	9
41	////////	8
40	///////	7
39	////	5
38	////	4
37	///	3
36	//	2
35	////	4
34	////	4
33	///	3
32	/	1
31	/	1
30	//	2
29		0
28		0
27	/	1
26		
25		
24		
23		
22		
21		
20		
19		
18		
17		
16		
15		

AVERAGE SPEED: _____
CRITICAL SPEED: _____
PACE SPEED: _____

DIRECTION: EASTBOUND

MPH	NUMBER OF VEHICLES	TOTAL
60	/	1
59		0
58	//	2
57	/	1
56	///	3
55	///	3
54	/	1
53	//	2
52	///	3
51	/	1
50	///	3
49	/////	5
48	///	3
47	/////	5
46	//////	6
45	///////	7
44	//////////	10
43	/////	5
42	////////	8
41	///////	7
40	////	4
39	///	3
38	///	3
37	///	3
36	///	3
35		0
34	/	1
33	//	2
32	/	1
31	/	1
30	/	1
29		
28		
27		
26		
25		
24		
23		
22		
21		
20		
19		
18		
17		
16		
15		

AVERAGE SPEED: _____
CRITICAL SPEED: _____
PACE SPEED: _____

CUMULATIVE TOTAL	MPH
1	60
1	59
3	58
4	57
7	56
10	55
11	54
14	53
18	52
20	51
28	50
38	49
44	48
49	47
58	46
68	45
73	44
80	43
87	42
91	41
99	40
107	39
114	38
118	37
122	36
127	35
132	34
134	33
135	32
137	31
140	30
140	29
141	28
141	27
	26
	25
	24
	23
	22
	21
	20
	19
	18
	17
	16
	15

CUMULATIVE (BOTH DIRECTIONS) _____

ITEM 8.4 - Attachment B

ENGINEERING AND TRAFFIC SURVEY

CITY OF LAGUNA WOODS

HCI

EL TORO ROAD — **CALLE CORTA TO CALLE SONORA**

DATE: 8/28/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 11:30 AM - 12:05 PM — CHECKED BY: JERRY STOCK

PREVAILING SPEED DATA	
LOCATION OF SURVEY	**WEST OF CALLE WREN**
DATE OF SURVEY	8/28/2017
85th PERCENTILE	52.6 MPH
10 MPH PACE	44 - 53 MPH
PERCENT IN PACE	78.0 %
POSTED SPEED LIMIT	50 MPH

ACCIDENT HISTORY	
NO. OF MONTHS OBSERVED	36
SPEED-RELATED ACCIDENTS	2
TOTAL ACCIDENTS	8
ANNUAL ACCIDENT RATE	0.67 ACCIDENTS PER YEAR (SPEED RELATED ONLY)
ACC./MILLION VEH. MILES	0.11 ACCIDENTS PER MVM (SPEED RELATED ONLY)

TRAFFIC FACTORS	
AVERAGE DAILY TRAFFIC	19,000
LANE CONFIGURATION	3 LANES PER DIRECTION
TRAFFIC CONTROLS	SIGNAL - CALLE SONORA / CALLE CORTA / CANYON WREN
CROSSWALKS	AT CALLE SONORA / CALLE CORTA / CANYON WREN
PEDESTRIAN/BICYCLES	YES / YES
TRUCK TRAFFIC	FEW
ON-STREET PARKING	NO STOPPING ANYTIME
OTHER	PAINTED BIKE LANES
	BUS STOPS

ROADWAY FACTORS	
LENGTH OF SEGMENT (MILES)	0.91
VERTICAL CURVE	GRADUAL UP/DOWNHILL GRADES
HORIZONTAL CURVE	GRADUAL-MODERATE "S" CURVES
LATERAL VISIBILITY	LIMITED SIGHT DISTANCE (areas of)
ROAD CONDITIONS	GOOD
SIDEWALKS / DRIVEWAYS	YES / NO
STREET LIGHTING	YES
DRIVEWAY DENSITY	NOMINAL
OTHER	GOLF CART XING AT INTERSECTIONS
	RAISED MEDIAN ISLAND

ADJACENT LAND USE	RESIDENTIAL (NF) / COMMERCAL (at Calle Sonora) / CHURCH
RECOMMENDED SPEED LIMIT	50 MPH
SPEED LIMIT CHANGE	NO CHANGE

JUSTIFICATION:

The recommended speed limit is within 2.6 mph of the 85th percentile speed as meets CVC standards.

NF = NON FRONTING TO ROADWAY

File: El Toro 2017-02

RADAR SPEED DISTRIBUTION SHEET

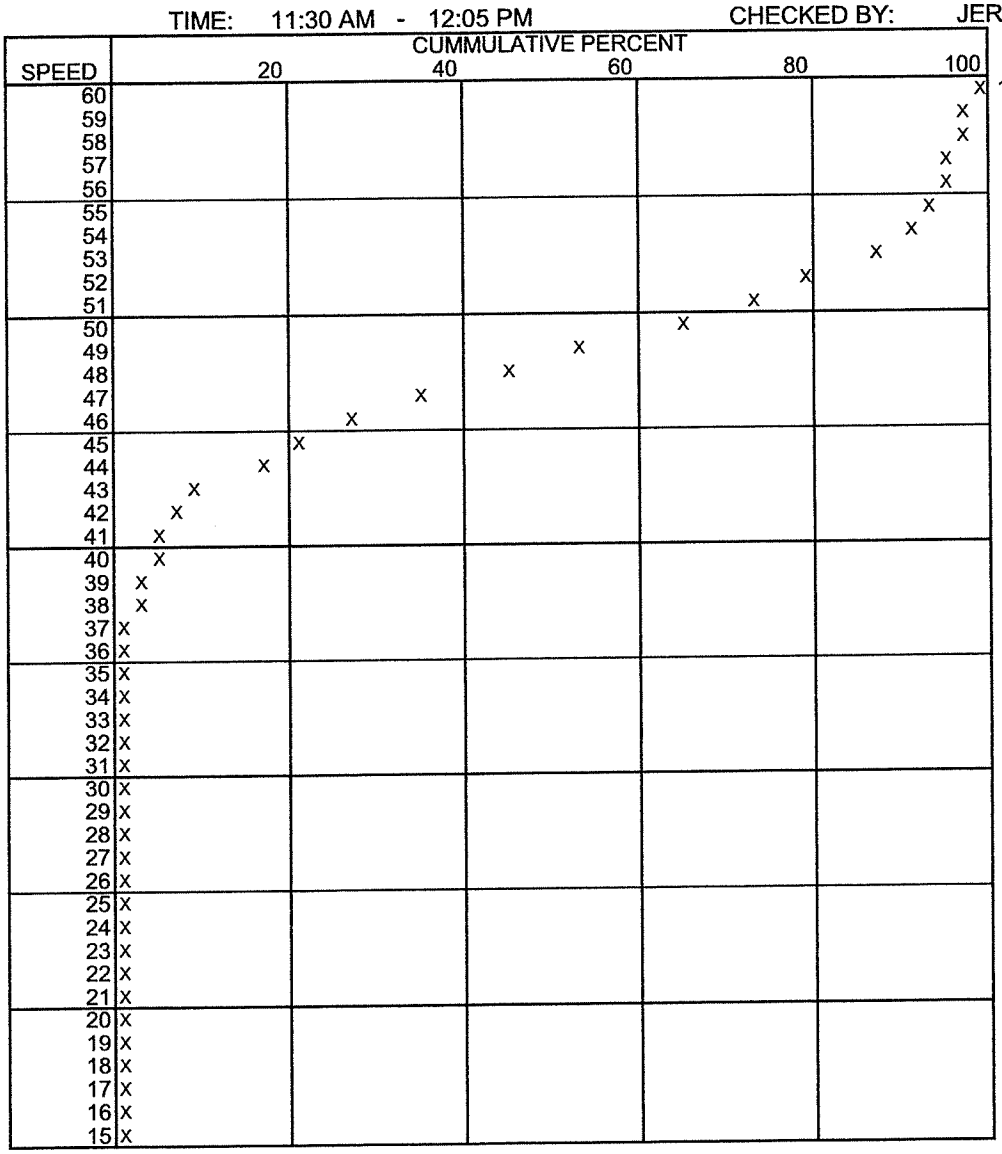
HCI

CITY OF LAGUNA WOODS

EL TORO ROAD — CALLE CORTA TO CALLE SONORA

DATE: 8/28/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 11:30 AM - 12:05 PM — CHECKED BY: JERRY STOCK



UPPER LIMIT 10 MPH PACE:	53	MPH	
LOWER LIMIT 10 MPH PACE:	44	MPH	
PERCENT OVER PACE:	12.0	%	
PERCENT IN PACE:	78.0	%	
PERCENT UNDER PACE:	9.9	%	
85th PERCENTILE SPEED:	52.6	MPH	
MEDIAN SPEED:	48.7	MPH	
15th PERCENTILE SPEED:	43.8	MPH	

El Toro 2017-02

Radar Speed Survey Field Sheet

HARTZOG AND CRABILL INC.
Consulting Traffic Engineers
17592 Irvine Blvd, Suite 122 Tustin CA 92680
(714) 731-5455

AGENCY: CITY OF LAGUNA WOODS
STREET: EL TORO ROAD
LOCATION: CALLE CORTA TO CALLE SONORA

WEATHER: SUNNY
ROAD CONDITION: DRY
OBSERVER: CATHY BUENDIA

DATE: 08/28/17
START TIME: 11:30 AM
END TIME: 12:05 PM

DIRECTION: WESTBOUND

MPH	NUMBER OF VEHICLES (5 / 10 / 15 / 20 / 25 / 30)	TOTAL
60	//	2
59	/	1
58	/	1
57		0
56	//	2
55	//	2
54	///	3
53	////////	9
52	////	4
51	///////	7
50	////////// //	13
49	//////	8
48	//////	6
47	//////////	11
46	////	4
45	//////	6
44	//////	7
43	//	2
42	///	4
41	/	1
40	/	1
39	//	2
38		0
37	/	1
36	/	1
35		
34		
33		
32		
31		
30		
29		
28		
27		
26		
25		
24		
23		
22		
21		
20		
19		
18		
17		
16		
15		

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

DIRECTION: EASTBOUND

MPH	NUMBER OF VEHICLES (5 / 10 / 15 / 20 / 25 / 30)	TOTAL
60	///	3
59		0
58	/	1
57	///	3
56	//	2
55	/	1
54	//	2
53	//////	7
52	//////	7
51	//////	8
50	//////////	12
49	//////	8
48	//////////	11
47	//////	7
46	////	4
45	////	5
44	////	5
43	//	2
42		0
41	//	2
40	/	1
39		0
38	/	1
37	/	1
36		
35		
34		
33		
32		
31		
30		
29		
28		
27		
26		
25		
24		
23		
22		
21		
20		
19		
18		
17		
16		
15		

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

CUMULATIVE TOTAL	MPH
5	60
1	59
2	58
3	57
4	56
3	55
5	54
16	53
14	52
15	51
25	50
16	49
17	48
18	47
8	46
11	45
12	44
4	43
4	42
3	41
2	40
2	39
1	38
2	37
	36
	35
	34
	33
	32
	31
	30
	29
	28
	27
	26
	25
	24
	23
	22
	21
	20
	19
	18
	17
	16
	15

CUMULATIVE (BOTH DIRECTIONS) _____

ITEM 8.4 - Attachment B

ENGINEERING AND TRAFFIC SURVEY

CITY OF LAGUNA WOODS

HCI

EL TORO ROAD — **CALLE SONORA TO MOULTON PARKWAY**

DATE: 8/28/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 10:45 AM - 11:20 AM — CHECKED BY: JERRY STOCK

PREVAILING SPEED DATA	
LOCATION OF SURVEY	**EAST OF TOWN CENTER**
DATE OF SURVEY	8/28/2017
85th PERCENTILE	44.2 MPH
10 MPH PACE	36 - 45 MPH
PERCENT IN PACE	72.6 %
POSTED SPEED LIMIT	45 MPH

ACCIDENT HISTORY	
NO. OF MONTHS OBSERVED	36
SPEED-RELATED ACCIDENTS	2
TOTAL ACCIDENTS	13
ANNUAL ACCIDENT RATE	0.67 ACCIDENTS PER YEAR (SPEED RELATED ONLY)
ACC./MILLION VEH. MILES	0.16 ACCIDENTS PER MVM (SPEED RELATED ONLY)

TRAFFIC FACTORS	
AVERAGE DAILY TRAFFIC	27,000
LANE CONFIGURATION	3 LANES PER DIRECTION
TRAFFIC CONTROLS	SIGNAL - CALLE SONORA / TOWN CTR / MOULTON
CROSSWALKS	AT CALLE SONORA / TOWN CTR / MOULTON
PEDESTRIAN/BICYCLES	YES / YES
TRUCK TRAFFIC	FEW
ON-STREET PARKING	NO STOPPING ENTIRE BLOCK
OTHER	PAINTED BIKE LANES / BUS STOPS
	GOLF CART XINGS AT INTERSECTIONS / DENSE TRAFFIC

ROADWAY FACTORS	
LENGTH OF SEGMENT (MILES)	0.43
VERTICAL CURVE	GRADUAL UPHILL GRADE (WB)
HORIZONTAL CURVE	SLIGHT "S" CURVES
LATERAL VISIBILITY	GOOD
ROAD CONDITIONS	GOOD
SIDEWALKS / DRIVEWAYS	YES / YES
STREET LIGHTING	YES
DRIVEWAY DENSITY	LIGHT
OTHER	RAISED MEDIAN ISLAND
	SHORT DISTANCE BTWN INTERSECTIONS - SURVEYED ON GREENS ONLY

ADJACENT LAND USE	COMMERCAL / BUSINESS

RECOMMENDED SPEED LIMIT	45 MPH

SPEED LIMIT CHANGE	NO CHANGE

JUSTIFICATION:

The recommended speed limit is within 0.8 mph of the 85th percentile speed and meets CVC standards.

NF = NON FRONTING TO ROADWAY

File: El Toro 2017-03

RADAR SPEED DISTRIBUTION SHEET

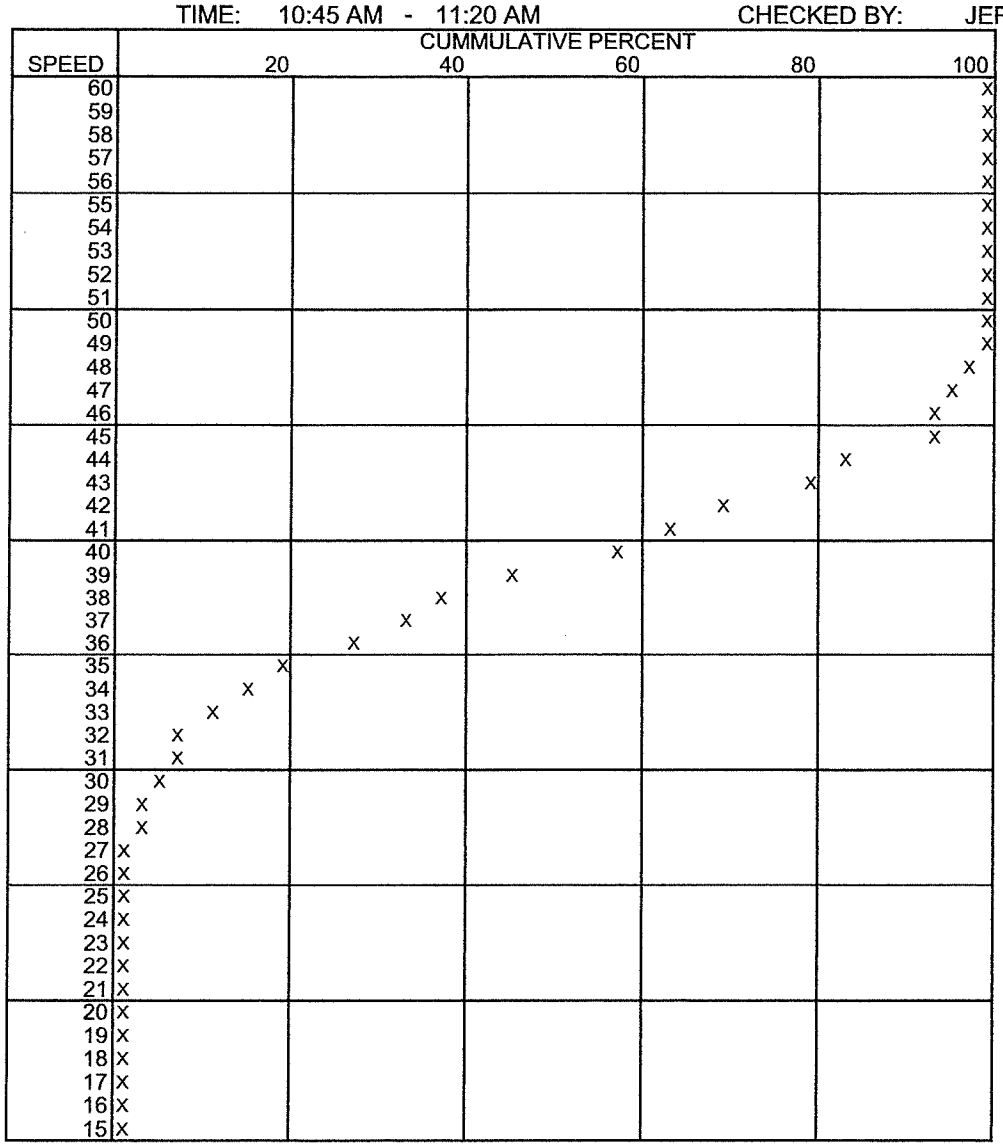
HCI

CITY OF LAGUNA WOODS

EL TORO ROAD — CALLE SONORA TO MOULTON PARKWAY

DATE: 8/28/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 10:45 AM - 11:20 AM — CHECKED BY: JERRY STOCK



SPEED	CUMMULATIVE PERCENT		
60	100.0%		
59	100.0%		
58	100.0%		
57	100.0%		
56	100.0%		
55	100.0%		
54	100.0%		
53	100.0%		
52	100.0%		
51	100.0%		
50	100.0%		
49	98.6%		
48	97.7%		
47	95.8%		
46	93.5%		
45	92.1%	}PACE	
44	83.7%	}PACE	- - -85PCT
43	78.1%	}PACE	
42	68.4%	}PACE	
41	63.3%	}PACE	
40	56.3%	}PACE	
39	45.6%	}PACE	- - - -MEAN
38	36.7%	}PACE	
37	32.6%	}PACE	
36	26.0%	}PACE	
35	19.5%		
34	14.9%		- - -15PCT
33	11.2%		
32	7.9%		
31	6.5%		
30	5.1%		
29	3.3%		
28	2.8%		
27	1.9%		
26	0.9%		
25	0.9%		
24	0.5%		
23	0.5%		
22	0.0%		
21	0.0%		
20	0.0%		
19	0.0%		
18	0.0%		
17	0.0%		
16	0.0%		
15	0.0%		

UPPER LIMIT 10 MPH PACE:	45	MPH			
LOWER LIMIT 10 MPH PACE:	36	MPH	85th PERCENTILE SPEED:	44.2	MPH
PERCENT OVER PACE:	7.9	%	MEDIAN SPEED:	39.4	MPH
PERCENT IN PACE:	72.6	%	15th PERCENTILE SPEED:	34.0	MPH
PERCENT UNDER PACE:	19.5	%			

El Toro 2017-03

Radar Speed Survey Field Sheet

HARTZOG AND CRABILL INC.
Consulting Traffic Engineers
17592 Irvine Blvd., Suite 122 Tustin CA 92680
(714) 731-5452

AGENCY: CITY OF LAGUNA WOODS
STREET: EL TORO ROAD
LOCATION: CALLE SONORA TO MOULTON PKWY

WEATHER: SUNNY - HOT
ROAD CONDITION: DRY
OBSERVER: CATHY BUENDIA

DATE: 08/28/17
START TIME: 10:45 AM
END TIME: 11:20 AM

DIRECTION: WESTBOUND

MPH	NUMBER OF VEHICLES (5 / 10 / 15 / 20 / 25 / 30)	TOTAL
60		
59		
58		
57		
56		
55		
54		
53		
52		
51	/	1
50	/	1
49	/	1
48	//	2
47	///	3
46	/	1
45	//////	6
44	////	4
43	/////	5
42	//////	6
41	//////	6
40	//////	7
39	//////	7
38	///	3
37	//////	6
36	//////	6
35	//////	6
34	////	4
33	///	3
32	//	2
31	//	2
30	/	1
29	/	1
28		0
27	/	1
26		
25		
24		
23		
22		
21		
20		
19		
18		
17		
16		
15		

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

CUMULATIVE (BOTH DIRECTIONS) _____

DIRECTION: EAST

MPH	NUMBER OF VEHICLES (5 / 10 / 15 / 20 / 25 / 30)	TOTAL	CUMULATIVE TOTAL	MPH
60				60
59				59
58				58
57				57
56				56
55				55
54				54
53				53
52				52
51	//	2	1	51
50	//	2	3	50
49	/	1	2	49
48	//	2	4	48
47	//	2	5	47
46	///	3	3	46
45	//////	6	18	45
44	//////	7	12	44
43	//////	10	21	43
42	////	4	11	42
41	//////	7	15	41
40	//////	13	23	40
39	//////	8	19	39
38	//////	6	9	38
37	//////	7	14	37
36	//////	8	14	36
35	//////	8	10	35
34	///	3	8	34
33	////	4	7	33
32			3	32
31			3	31
30	/	3	4	30
29		0		29
28	//	2	2	28
27	/	1	3	27
26		0		26
25	/	1	1	25
24		0		24
23	/	1		23
22				22
21				21
20				20
19				19
18				18
17				17
16				16
15				15

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

ITEM 8.4 - Attachment B

ENGINEERING AND TRAFFIC SURVEY

CITY OF LAGUNA WOODS

HCI

EL TORO ROAD — **MOULTON PARKWAY TO AVENIDA SEVILLA**

DATE: 8/28/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 10:00 AM - 10:40 AM — CHECKED BY: JERRY STOCK

PREVAILING SPEED DATA	
LOCATION OF SURVEY	**EAST OF MOULTON**
DATE OF SURVEY	8/28/2017
85th PERCENTILE	43.9 MPH
10 MPH PACE	34 - 43 MPH
PERCENT IN PACE	66.5 %
POSTED SPEED LIMIT	40 MPH

ACCIDENT HISTORY	
NO. OF MONTHS OBSERVED	36
SPEED-RELATED ACCIDENTS	2
TOTAL ACCIDENTS	8
ANNUAL ACCIDENT RATE	0.67 ACCIDENTS PER YEAR (SPEED RELATED ONLY)
ACC./MILLION VEH. MILES	0.13 ACCIDENTS PER MVM (SPEED RELATED ONLY)

TRAFFIC FACTORS	
AVERAGE DAILY TRAFFIC	32,000
LANE CONFIGURATION	3 LANES PER DIRECTION
TRAFFIC CONTROLS	SIGNAL - MOULTON / CHURCH ENTRANCE / AVD SEVILLA
CROSSWALKS	AT MOULTON / CHURCH ENTRANCE / AVD SEVILLA
PEDESTRIAN/BICYCLES	YES / YES
TRUCK TRAFFIC	FEW
ON-STREET PARKING	NO STOPPING ANYTIME
OTHER	BUS STOPS / GOLF CART XINGS AT INTERSECTIONS DENSE TRAFFIC-INTERSECTIONS BACK UP

ROADWAY FACTORS	
LENGTH OF SEGMENT (MILES)	0.43
VERTICAL CURVE	SLIGHT UP/DOWNHILL GRADES
HORIZONTAL CURVE	SLIGHT-GRADUAL "S" CURVES
LATERAL VISIBILITY	GOOD
ROAD CONDITIONS	GOOD
SIDEWALKS / DRIVEWAYS	YES / YES (EB) - YES / MINIMAL (WB)
STREET LIGHTING	YES
DRIVEWAY DENSITY	LIGHT
OTHER	RAISED MEDIAN ISLAND / NO SHOULDERS "NO GOLF CARTS ON PED WALK (EB)"

ADJACENT LAND USE	RESIDENTIAL ON GOLF COURSE (NF) / COMMERCAL / BUSINESS / CITY HALL
RECOMMENDED SPEED LIMIT	40 MPH
SPEED LIMIT CHANGE	NO CHANGE

JUSTIFICATION:

The recommended speed is within 3.9 mph of the 85th percentile speed and meets CVC standards.

NF = NON FRONTING TO ROADWAY

File: El Toro 2017-04

RADAR SPEED DISTRIBUTION SHEET

HCI

CITY OF LAGUNA WOODS

EL TORO ROAD — MOULTON PARKWAY TO AVENIDA SEVILLA

DATE: 8/28/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 10:00 AM - 10:40 AM — CHECKED BY: JERRY STOCK

SPEED	CUMMULATIVE PERCENT (20 / 40 / 60 / 80 / 100)		
60	x	100.0%	
59	x	100.0%	
58	x	100.0%	
57	x	100.0%	
56	x	100.0%	
55	x	100.0%	
54	x	100.0%	
53	x	100.0%	
52	x	99.5%	
51	x	99.5%	
50	x	99.0%	
49	x	98.1%	
48	x	98.1%	
47	x	96.2%	
46	x	93.8%	
45	x	90.0%	
44	x	85.6%	
43	x	79.9%	}PACE - - -85PCT
42	x	74.2%	}PACE
41	x	70.3%	}PACE
40	x	62.7%	}PACE
39	x	52.6%	}PACE
38	x	47.4%	}PACE - - - -MEAN
37	x	39.2%	}PACE
36	x	32.5%	}PACE
35	x	26.3%	}PACE
34	x	19.6%	}PACE
33	x	13.4%	- - -15PCT
32	x	9.6%	
31	x	6.7%	
30	x	3.3%	
29	x	2.4%	
28	x	1.0%	
27	x	0.5%	
26	x	0.5%	
25	x	0.5%	
24	x	0.0%	
23	x	0.0%	
22	x	0.0%	
21	x	0.0%	
20	x	0.0%	
19	x	0.0%	
18	x	0.0%	
17	x	0.0%	
16	x	0.0%	
15	x	0.0%	

UPPER LIMIT 10 MPH PACE:	43	MPH			
LOWER LIMIT 10 MPH PACE:	34	MPH	85th PERCENTILE SPEED:	43.9	MPH
PERCENT OVER PACE:	20.1	%	MEDIAN SPEED:	38.5	MPH
PERCENT IN PACE:	66.5	%	15th PERCENTILE SPEED:	33.3	MPH
PERCENT UNDER PACE:	13.4	%			

El Toro 2017-04

Radar Speed Survey Field Sheet

HARTZOG AND CRABILL INC.
Consulting Traffic Engineers
17592 Irvine Blvd., Suite 122 Tustin CA. 92680
(714) 731-5452

AGENCY: LAGUNA WOODS
STREET: EL TORO ROAD
LOCATION: MOULTON PKWY TO AVENIDA SEVILLA

WEATHER: SUNNY
ROAD CONDITION: DRY
OBSERVER: CATHY BUENDIA

DATE: 08/28/17
START TIME: 10:00 AM
END TIME: 10:40 AM / cal

DIRECTION: WESTBOUND

MPH	NUMBER OF VEHICLES (5 / 10 / 15 / 20 / 25 / 30)	TOTAL
60		
59		
58		
57		
56		
55		
54		
53	/	1
52		0
51	/	1
50		0
49		0
48	///	3
47		1
46	///	3
45	//////	7
44	/////	5
43	////////	9
42	/////	6
41	////////	8
40	//////////	10
39	///	4
38	//////	8
37	//////	8
36	//////	8
35	//////	6
34	//////////	11
33	/	1
32	////	4
31	/////	6
30	//	2
29	///	3
28	/	1
27		0
26		0
25	/	1
24		
23		
22		
21		
20		
19		
18		
17		
16		
15		

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

CUMULATIVE (BOTH DIRECTIONS) _____

DIRECTION: EASTBOUND

MPH	NUMBER OF VEHICLES (5 / 10 / 15 / 20 / 25 / 30)	TOTAL	CUMULATIVE TOTAL	MPH
60				60
59				59
58				58
57				57
56				56
55				55
54				54
53			1	53
52			0	52
51			1	51
50	//	2	2	50
49		0	0	49
48	/	1	4	48
47	////	4	5	47
46	/////	5	8	46
45	//	2	9	45
44	///	3	12	44
43	///	3	12	43
42	//	2	8	42
41	////	8	16	41
40	//////	11	21	40
39	///	7	11	39
38	//////	7	17	38
37	//////	8	14	37
36	/////	5	13	36
35	///	3	14	35
34	//	2	13	34
33	/	1	8	33
32	//	2	6	32
31	/	1	7	31
30			2	30
29			3	29
28			1	28
27			0	27
26			0	26
25			1	25
24				24
23				23
22				22
21				21
20				20
19				19
18				18
17				17
16				16
15				15

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

ITEM 8.4 - Attachment B

ENGINEERING AND TRAFFIC SURVEY

CITY OF LAGUNA WOODS

HCI

EL TORO ROAD — **AVENIDA SEVILLA TO PASEO DE VALENCIA**

DATE: 8/25/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 10:00 AM - 10:45 AM — CHECKED BY: JERRY STOCK

PREVAILING SPEED DATA	
LOCATION OF SURVEY	**WEST OF PASEO DE VALENCIA**
DATE OF SURVEY	8/25/2017
85th PERCENTILE	41.5 MPH
10 MPH PACE	33 - 42 MPH
PERCENT IN PACE	68.2 %
POSTED SPEED LIMIT	35 MPH

ACCIDENT HISTORY	
NO. OF MONTHS OBSERVED	36
SPEED-RELATED ACCIDENTS	3
TOTAL ACCIDENTS	11
ANNUAL ACCIDENT RATE	1.00 ACCIDENTS PER YEAR (SPEED RELATED ONLY)
ACC./MILLION VEH. MILES	0.28 ACCIDENTS PER MVM (SPEED RELATED ONLY)

TRAFFIC FACTORS	
AVERAGE DAILY TRAFFIC	32,000
LANE CONFIGURATION	3 LANES PER DIRECTION
TRAFFIC CONTROLS	SIGNAL - AVD SEVILLA / PASEO DE VALENCIA
CROSSWALKS	AT AVD SEVILLA / PASEO DE VALENCIA
PEDESTRIAN/BICYCLES	YES / YES
TRUCK TRAFFIC	FEW
ON-STREET PARKING	NO STOPPING ANYTIME
OTHER	NO SHOULDERS / BUS STOPS
	GOLF CART XINGS AT INTERSECTIONS
	DENSE TRAFFIC-INTERSECTIONS BACK UP AT INTERSECTIONS

ROADWAY FACTORS	
LENGTH OF SEGMENT (MILES)	0.31
VERTICAL CURVE	NONE
HORIZONTAL CURVE	SLIGHT "C" CURVES
LATERAL VISIBILITY	GOOD
ROAD CONDITIONS	GOOD
SIDEWALKS / DRIVEWAYS	YES / YES (EB) - NO / NO (WB)
STREET LIGHTING	YES
DRIVEWAY DENSITY	LIGHT (at Paseo De Valencia)
OTHER	"NO GOLF CARTS ON PED WALK (EB)" / RAISED MEDIAN ISLAND
	SHORT DISTANCE BTWN INTERSECTINS - SURVEYED ON GREENS ONLY

ADJACENT LAND USE	RESIDENTIAL ON GOLF COURSE (NF) / COMMERCAL
RECOMMENDED SPEED LIMIT	40 MPH
SPEED LIMIT CHANGE	INCREASE

JUSTIFICATION:

This section of El Toro Road is a six lane divided roadway. The adjacent land uses are non-fronting residential gated communities and commercial at Paseo de Valencia. Field observations include a wide pedestrian walkway along south-side of the roadway, one driveway near intersection of Paseo de Valencia, "No Stopping Anytime" due to no shoulders on both sides of the roadway, and golf cart crossings at Avenida Sevilla. The speed survey resulted with an 85th percentile speed of 41.5 mph and a 10 mph pace range of 33 to 42 mph. With that, it is recommended that the existing 35 mph speed limit be increased to 40 mph.

NF = NON FRONTING TO ROADWAY

File: El Toro 2017-05

RADAR SPEED DISTRIBUTION SHEET

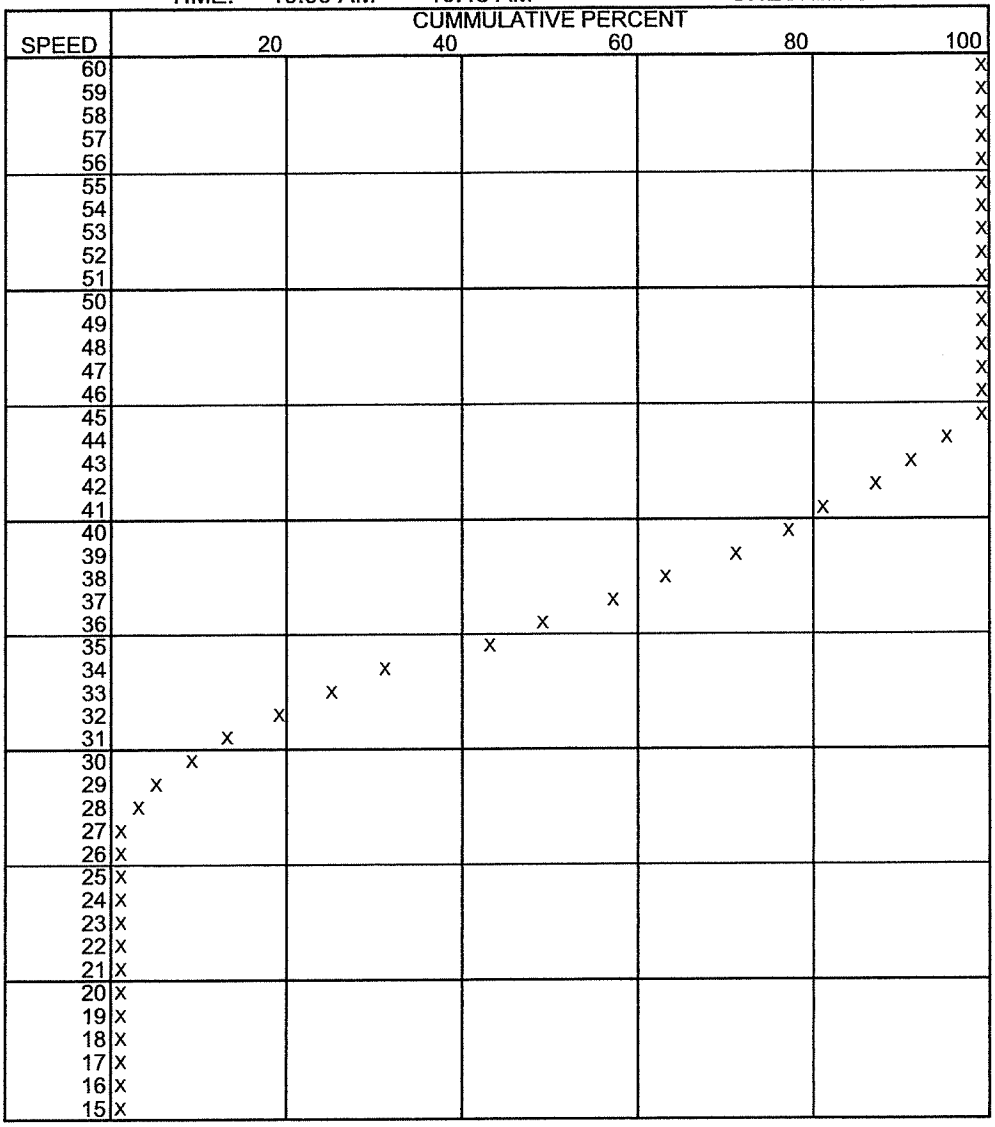
HCI

CITY OF LAGUNA WOODS

EL TORO ROAD — AVENIDA SEVILLA TO PASEO DE VALENCIA

DATE: 8/25/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 10:00 AM - 10:45 AM — CHECKED BY: JERRY STOCK



60	100.0%	
59	100.0%	
58	100.0%	
57	100.0%	
56	100.0%	
55	100.0%	
54	100.0%	
53	100.0%	
52	100.0%	
51	100.0%	
50	100.0%	
49	100.0%	
48	100.0%	
47	99.5%	
46	99.1%	
45	98.6%	
44	95.3%	
43	91.0%	
42	87.7%	}PACE
41	82.0%	}PACE - - -85PCT
40	76.3%	}PACE
39	70.6%	}PACE
38	63.0%	}PACE
37	56.9%	}PACE
36	49.3%	}PACE - - - -MEAN
35	42.2%	}PACE
34	31.3%	}PACE
33	24.2%	}PACE
32	19.4%	
31	13.7%	- - -15PCT
30	9.0%	
29	4.7%	
28	3.8%	
27	1.9%	
26	0.9%	
25	0.5%	
24	0.0%	
23	0.0%	
22	0.0%	
21	0.0%	
20	0.0%	
19	0.0%	
18	0.0%	
17	0.0%	
16	0.0%	
15	0.0%	

UPPER LIMIT 10 MPH PACE:	42	MPH
LOWER LIMIT 10 MPH PACE:	33	MPH
PERCENT OVER PACE:	18.0	%
PERCENT IN PACE:	68.2	%
PERCENT UNDER PACE:	19.4	%

85th PERCENTILE SPEED:	41.5	MPH
MEDIAN SPEED:	36.1	MPH
15th PERCENTILE SPEED:	31.2	MPH

El Toro 2017-05

Radar Speed Survey Field Sheet

HARTZOG AND CRABILL INC.
Consulting Traffic Engineers
17592 Irvine Blvd., Suite 122 Tustin CA 92680
(714) 731-5452

AGENCY: CITY OF LAGUNA WOODS
STREET: EL TORO ROAD
LOCATION: AVENIDA SEVILLA TO PASEO DE VALENCIA

WEATHER: SUNNY - HOT
ROAD CONDITION: DRY
OBSERVER: CATHY BUENDIA

DATE: 8/25/17
START TIME: 10:00 AM
END TIME: 10:45 AM VAL

DIRECTION: WESTBOUND

MPH	NUMBER OF VEHICLES (5 / 10 / 15 / 20 / 25 / 30)	TOTAL
60		
59		
58		
57		
56		
55		
54		
53		
52		
51		
50		
49		
48	/	1
47		0
46	/	1
45	///	3
44	////	4
43	////	4
42	/////	5
41	///// /	6
40	///// //	7
39	///// ///	8
38	///// ///	8
37	///// //	7
36	/////	5
35	///// /////	11
34	///// //	7
33	///// //	7
32	///// ///	8
31	/////	5
30	/////	5
29	//	2
28	//	2
27		0
26	/	1
25	/	1
24		
23		
22		
21		
20		
19		
18		
17		
16		
15		

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

CUMULATIVE (BOTH DIRECTIONS) _____

DIRECTION:

MPH	NUMBER OF VEHICLES (5 / 10 / 15 / 20 / 25 / 30)	TOTAL	CUMULATIVE TOTAL	MPH
60				60
59				59
58				58
57				57
56				56
55				55
54				54
53				53
52				52
51				51
50				50
49				49
48	/	1	1	48
47		0	1	47
46	/	1	1	46
45	////	4	7	45
44	/////	5	9	44
43	///	3	9	43
42	///// //	7	12	42
41	///// /	6	12	41
40	/////	5	12	40
39	///// ///	8	16	39
38	/////	5	13	38
37	///// /////	10	16	37
36	///// /////	10	15	36
35	///// ///// //	12	23	35
34	///// ///	8	15	34
33	///// /	6	10	33
32	/////	4	12	32
31	///// //	7	10	31
30	////	4	9	30
29		0	2	29
28	//	2	4	28
27	//	2	2	27
26				26
25				25
24				24
23				23
22				22
21				21
20				20
19				19
18				18
17				17
16				16
15				15

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

ITEM 8.4 - Attachment B

ENGINEERING AND TRAFFIC SURVEY

CITY OF LAGUNA WOODS

HCI

MOULTON PARKWAY — **SANTA MARIA AVE TO EL TORO RD**

DATE: 8/25/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 12:40 PM - 1:15 PM — CHECKED BY: JERRY STOCK

PREVAILING SPEED DATA	
LOCATION OF SURVEY	**SOUTH OF SANTA MARIA**
DATE OF SURVEY	8/25/2017
85th PERCENTILE	46.2 MPH
10 MPH PACE	37 - 46 MPH
PERCENT IN PACE	72.6 %
POSTED SPEED LIMIT	45 MPH

ACCIDENT HISTORY	
NO. OF MONTHS OBSERVED	36
SPEED-RELATED ACCIDENTS	8
TOTAL ACCIDENTS	15
ANNUAL ACCIDENT RATE	2.67 ACCIDENTS PER YEAR (SPEED RELATED ONLY)
ACC./MILLION VEH. MILES	0.35 ACCIDENTS PER MVM (SPEED RELATED ONLY)

TRAFFIC FACTORS	
AVERAGE DAILY TRAFFIC	32,000
LANE CONFIGURATION	3 LANES PER DIRECTION
TRAFFIC CONTROLS	SIGNAL - SANTA MARIA / GATE NO.12 + 16 / EL TORO
CROSSWALKS	AT SANTA MARIA / GATE NO.12+16 / EL TORO
PEDESTRIAN/BICYCLES	YES / FEW
TRUCK TRAFFIC	YES
ON-STREET PARKING	NO STOPPING ANYTIME
OTHER	NO SHOULDERS BUS STOPS / BIKE LANES

ROADWAY FACTORS	
LENGTH OF SEGMENT (MILES)	0.66
VERTICAL CURVE	GRADUAL-MODERATE UP/DOWNHILL GRADES
HORIZONTAL CURVE	MODERATE "S" CURVES
LATERAL VISIBILITY	LIMITED SIGHT DISTANCE (areas of)
ROAD CONDITIONS	GOOD
SIDEWALKS / DRIVEWAYS	YES / FEW
STREET LIGHTING	YES
DRIVEWAY DENSITY	NOMINAL
OTHER	RAISED MEDIAN ISLAND

ADJACENT LAND USE	GOLF COURSE / COMMERCAL
RECOMMENDED SPEED LIMIT	45 MPH
SPEED LIMIT CHANGE	NO CHANGE

JUSTIFICATION:

The recommended speed is within 1.2 mph of the 85th percentile speed and meets CVC standards.

NF = NON FRONTING TO ROADWAY

File: Moulton 2017-06

RADAR SPEED DISTRIBUTION SHEET

HCI

CITY OF LAGUNA WOODS

MOULTON PARKWAY — SANTA MARIA AVE TO EL TORO RD

DATE: 8/25/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 12:40 PM - 1:15 PM — CHECKED BY: JERRY STOCK

SPEED	CUMMULATIVE PERCENT 20 40 60 80 100						
60					X	100.0%	
59					X	100.0%	
58					X	100.0%	
57					X	100.0%	
56					X	100.0%	
55					X	100.0%	
54					X	100.0%	
53					X	100.0%	
52					X	100.0%	
51					X	99.0%	
50					X	98.5%	
49					X	95.5%	
48					X	91.0%	
47					X	88.1%	
46					X	84.1%	}PACE ---85PCT
45				X		77.6%	}PACE
44				X		66.7%	}PACE
43			X			56.7%	}PACE
42			X			49.3%	}PACE----MEAN
41			X			40.8%	}PACE
40		X				33.8%	}PACE
39		X				23.9%	}PACE
38		X				19.4%	}PACE
37		X				17.4%	}PACE
36		X				11.4%	---15PCT
35	X					8.5%	
34	X					5.0%	
33	X					5.0%	
32	X					4.0%	
31	X					2.0%	
30	X					0.5%	
29	X					0.0%	
28	X					0.0%	
27	X					0.0%	
26	X					0.0%	
25	X					0.0%	
24	X					0.0%	
23	X					0.0%	
22	X					0.0%	
21	X					0.0%	
20	X					0.0%	
19	X					0.0%	
18	X					0.0%	
17	X					0.0%	
16	X					0.0%	
15	X					0.0%	

UPPER LIMIT 10 MPH PACE:	46	MPH			
LOWER LIMIT 10 MPH PACE:	37	MPH	85th PERCENTILE SPEED:	46.2	MPH
PERCENT OVER PACE:	15.9	%	MEDIAN SPEED:	42.1	MPH
PERCENT IN PACE:	72.6	%	15th PERCENTILE SPEED:	36.6	MPH
PERCENT UNDER PACE:	11.4	%			

Radar Speed Survey Field Sheet

HARTZOG AND CRABILL INC.
Consulting Traffic Engineers
17532 Irvine Blvd., Suite 102 Tustin CA 92680
(714) 731-5432

AGENCY: CITY OF LAGUNA WOODS
STREET: MOULTON PARKWAY
LOCATION: SANTA MARIA AVE TO EL TORO RD

WEATHER: SUNNY
ROAD CONDITION: DRY
OBSERVER: CATHY BUENDIA

DATE: 08/25/17
START TIME: 12:40 PM
END TIME: 1:15PM

DIRECTION: NORTHBOUND

MPH	NUMBER OF VEHICLES (5 / 10 / 15 / 20 / 25 / 30)	TOTAL
60		
59		
58		
57		
56		
55		
54		
53		
52	/	1
51	/	1
50	//	2
49	////	4
48	///	3
47	/////	5
46	//////	7
45	//////////	13
44	//////////	13
43	/////////	9
42	//////////	10
41	////////	8
40	//////////	12
39	////	4
38	//	2
37	/////	5
36	///	3
35	///	3
34		0
33	/	1
32	//	2
31	//	2
30		
29		
28		
27		
26		
25		
24		
23		
22		
21		
20		
19		
18		
17		
16		
15		

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

CUMULATIVE (BOTH DIRECTIONS) _____

DIRECTION: SOUTHBOUND

MPH	NUMBER OF VEHICLES (5 / 10 / 15 / 20 / 25 / 30)	TOTAL	CUMULATIVE TOTAL	MPH
60				60
59				59
58				58
57				57
56				56
55				55
54				54
53				53
52	/	1	1	52
51		0	0	51
50	////	4	6	50
49	/////	5	9	49
48	///	3	6	48
47	///	3	8	47
46	///////	6	13	46
45	//////////	9	22	45
44	//////////	7	20	44
43	//////////	6	15	43
42	//////////	11	17	42
41	//////////	6	14	41
40	//////////	8	20	40
39	/////	5	9	39
38	//	2	4	38
37	///////	7	12	37
36	///	3	6	36
35	////	4	7	35
34		0	0	34
33			2	33
32	//	2	4	32
31	/	1	3	31
30	/	1	1	30
29				29
28				28
27				27
26				26
25				25
24				24
23				23
22				22
21				21
20				20
19				19
18				18
17				17
16				16
15				15

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

ITEM 8.4 - Attachment B

ENGINEERING AND TRAFFIC SURVEY

CITY OF LAGUNA WOODS

HCI

MOULTON PARKWAY — **EL TORO RD TO CALLE CORTEZ**

DATE: 8/25/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 11:45 AM - 12:30 PM — CHECKED BY: JERRY STOCK

PREVAILING SPEED DATA	
LOCATION OF SURVEY	**NORTH OF CALLE CORTEZ**
DATE OF SURVEY	8/25/2017
85th PERCENTILE	47.2 MPH
10 MPH PACE	39 - 48 MPH
PERCENT IN PACE	75.9 %
POSTED SPEED LIMIT	45 MPH

ACCIDENT HISTORY	
NO. OF MONTHS OBSERVED	36
SPEED-RELATED ACCIDENTS	3
TOTAL ACCIDENTS	11
ANNUAL ACCIDENT RATE	1.00 ACCIDENTS PER YEAR (SPEED RELATED ONLY)
ACC./MILLION VEH. MILES	0.14 ACCIDENTS PER MVM (SPEED RELATED ONLY)

TRAFFIC FACTORS	
AVERAGE DAILY TRAFFIC	34,000
LANE CONFIGURATION	3 LANES PER DIRECTION
TRAFFIC CONTROLS	SIGNAL - EL TORO / VIA CAMPO VERDE / CALLE CORTEZ
CROSSWALKS	AT EL TORO / VIA CAMPO VERDE / CALLE CORTEZ
PEDESTRIAN/BICYCLES	YES / FEW
TRUCK TRAFFIC	YES
ON-STREET PARKING	NO STOPPING ANYTIME
OTHER	PAINTED BIKE LANES
	BUS STOPS

ROADWAY FACTORS	
LENGTH OF SEGMENT (MILES)	0.56
VERTICAL CURVE	GRADUAL UP/DOWNHILL GRADES
HORIZONTAL CURVE	GRADUAL-MODERATE "S" CURVES
LATERAL VISIBILITY	LIMITED SIGHT DISTANCE (areas of)
ROAD CONDITIONS	GOOD
SIDEWALKS / DRIVEWAYS	YES / YES
STREET LIGHTING	YES
DRIVEWAY DENSITY	LIGHT
OTHER	RAISED MEDIAN ISLAND
	NARROW SHOULDERS

ADJACENT LAND USE	CHURCHES / BUSINESS / COMMERCIAL
RECOMMENDED SPEED LIMIT	45 MPH
SPEED LIMIT CHANGE	NO CHANGE

JUSTIFICATION:

The recommended speed is within 2.2 mph of the 85th percentile speed and meets CVC standards.

NF = NON FRONTING TO ROADWAY

File: Moulton 2017-07

RADAR SPEED DISTRIBUTION SHEET

HCI

CITY OF LAGUNA WOODS

MOULTON PARKWAY — EL TORO RD TO CALLE CORTEZ

DATE: 8/25/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 11:45 AM - 12:30 PM — CHECKED BY: JERRY STOCK

SPEED	CUMMULATIVE PERCENT 20	40	60	80	100		
60					X	100.0%	
59					X	100.0%	
58					X	100.0%	
57					X	100.0%	
56					X	100.0%	
55					X	100.0%	
54					X	100.0%	
53					X	100.0%	
52					X	99.5%	
51					X	97.6%	
50					X	95.8%	
49					X	91.0%	
48					X	88.7%	}PACE
47					X	84.0%	}PACE ---85PCT
46				X		79.2%	}PACE
45				X		71.7%	}PACE
44				X		62.7%	}PACE
43			X			52.4%	}PACE
42			X			42.5%	}PACE----MEAN
41		X				31.6%	}PACE
40		X				23.1%	}PACE
39	X					16.0%	}PACE
38	X					12.7%	---15PCT
37	X					9.0%	
36	X					6.6%	
35	X					3.8%	
34	X					2.8%	
33	X					1.9%	
32	X					1.4%	
31	X					0.5%	
30	X					0.5%	
29	X					0.0%	
28	X					0.0%	
27	X					0.0%	
26	X					0.0%	
25	X					0.0%	
24	X					0.0%	
23	X					0.0%	
22	X					0.0%	
21	X					0.0%	
20	X					0.0%	
19	X					0.0%	
18	X					0.0%	
17	X					0.0%	
16	X					0.0%	
15	X					0.0%	

UPPER LIMIT 10 MPH PACE:	48	MPH			
LOWER LIMIT 10 MPH PACE:	39	MPH	85th PERCENTILE SPEED:	47.2	MPH
PERCENT OVER PACE:	11.3	%	MEDIAN SPEED:	42.8	MPH
PERCENT IN PACE:	75.9	%	15th PERCENTILE SPEED:	38.7	MPH
PERCENT UNDER PACE:	12.7	%			

Radar Speed Survey Field Sheet

HARTZOG AND CRABILL INC.
Consulting Traffic Engineers
17592 Irvine Blvd., Suite 122 Tustin CA 92680
(714) 731-9455

AGENCY: CITY OF LAGUNA WOODS
STREET: MOULTON PARKWAY
LOCATION: EL TORO RD TO CALLE CORTEZ

WEATHER: SUNNY
ROAD CONDITION: DRY
OBSERVER: CATHY BUENDIA

DATE: 08/25/17
START TIME: 11:45 AM
END TIME: 12:30 PM VOL

DIRECTION: NORTHBOUND

MPH	NUMBER OF VEHICLES (5 10 15 20 25 30)	TOTAL
60		
59		
58		
57		
56		
55		
54		
53	/	1
52	///	3
51	/	1
50	////	4
49	/	1
48	/////	6
47	///	3
46	///////	7
45	//////////	13
44	//////////	11
43	//////////	10
42	//////////	12
41	//////////	11
40	//////	6
39	//	2
38	////	4
37	//	2
36	///	3
35		0
34	//	2
33		
32		
31		
30		
29		
28		
27		
26		
25		
24		
23		
22		
21		
20		
19		
18		
17		
16		
15		

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

CUMULATIVE (BOTH DIRECTIONS) _____

DIRECTION: SOUTHBOUND

MPH	NUMBER OF VEHICLES (5 10 15 20 25 30)	TOTAL	CUMULATIVE TOTAL	MPH
60				60
59				59
58				58
57				57
56				56
55				55
54				54
53			1	53
52	/	1	4	52
51	///	3	4	51
50	////	6	10	50
49	////	4	5	49
48	////	4	10	48
47	///////	7	10	47
46	///////	9	16	46
45	//////////	6	19	45
44	//////////	11	22	44
43	//////////	11	21	43
42	//////////	11	23	42
41	//////////	7	18	41
40	//////////	7	15	40
39	////////	5	7	39
38	////	4	8	38
37	///	3	5	37
36	///	3	6	36
35	//	2	2	35
34		0	2	34
33	/	1	1	33
32	//	2	2	32
31		0	0	31
30	/	1	1	30
29				29
28				28
27				27
26				26
25				25
24				24
23				23
22				22
21				21
20				20
19				19
18				18
17				17
16				16
15				15

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

ITEM 8.4 - Attachment B

ENGINEERING AND TRAFFIC SURVEY

CITY OF LAGUNA WOODS

HCI

MOULTON PARKWAY — **CALLE CORTEZ TO SOUTH CITY LIMITS**

DATE: 8/25/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 11:00 AM - 11:35 AM — CHECKED BY: JERRY STOCK

PREVAILING SPEED DATA	
LOCATION OF SURVEY	**NORTH OF CALLE CORTEZ**
DATE OF SURVEY	8/25/2017
85th PERCENTILE	48.4 MPH
10 MPH PACE	40 - 49 MPH
PERCENT IN PACE	77.1 %
POSTED SPEED LIMIT	45 MPH

ACCIDENT HISTORY	
NO. OF MONTHS OBSERVED	36
SPEED-RELATED ACCIDENTS	2
TOTAL ACCIDENTS	10
ANNUAL ACCIDENT RATE	0.67 ACCIDENTS PER YEAR (SPEED RELATED ONLY)
ACC./MILLION VEH. MILES	0.12 ACCIDENTS PER MVM (SPEED RELATED ONLY)

TRAFFIC FACTORS	
AVERAGE DAILY TRAFFIC	31,000
LANE CONFIGURATION	3 LANES PER DIRECTION
TRAFFIC CONTROLS	SIGNAL - CALLE CORTEZ / VIA IGLESIA / CALLE ARAGON
CROSSWALKS	AT CALLE CORTEZ / VIA IGLESIA / CALLE ARAGON
PEDESTRIAN/BICYCLES	YES / YES
TRUCK TRAFFIC	YES
ON-STREET PARKING	NO STOPPING ANYTIME
OTHER	PAINTED BIKE LANES
	BUS STOPS

ROADWAY FACTORS	
LENGTH OF SEGMENT (MILES)	0.48
VERTICAL CURVE	SLIGHT UP/DOWNHILL GRADES
HORIZONTAL CURVE	GRADUAL "S" CURVES
LATERAL VISIBILITY	LIMITED SIGHT DISTANCE (areas of)
ROAD CONDITIONS	GOOD
SIDEWALKS / DRIVEWAYS	YES / FEW
STREET LIGHTING	YES
DRIVEWAY DENSITY	NOMINAL
OTHER	RAISED MEDIAN ISLAND
	NARROW SHOULDERS

ADJACENT LAND USE	RESIDENTIAL (NF) / GOLF COURSE / BUSINESS / COMMERCIAL
RECOMMENDED SPEED LIMIT	45 MPH
SPEED LIMIT CHANGE	NO CHANGE

JUSTIFICATION:

The recommended speed is within 3.4 mph of the 85th percentile speed and meets CVC standards.

NF = NON FRONTING TO ROADWAY

File: Moulton 2017-08

RADAR SPEED DISTRIBUTION SHEET

HCI

CITY OF LAGUNA WOODS

MOULTON PARKWAY — CALLE CORTEZ TO SOUTH CITY LIMITS

DATE: 8/25/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 11:00 AM - 11:35 AM — CHECKED BY: JERRY STOCK

SPEED	CUMMULATIVE PERCENT (20 / 40 / 60 / 80 / 100)						
60					X	100.0%	
59					X	100.0%	
58					X	100.0%	
57					X	99.5%	
56					X	99.5%	
55					X	99.1%	
54					X	98.1%	
53					X	97.7%	
52					X	95.8%	
51					X	93.9%	
50					X	92.1%	
49					X	87.9%	}PACE
48					X	82.7%	}PACE - - -85PCT
47				X		76.6%	}PACE
46				X		69.2%	}PACE
45				X		60.7%	}PACE
44			X			49.5%	}PACE - - -MEAN
43			X			41.6%	}PACE
42		X				31.8%	}PACE
41		X				22.4%	}PACE
40	X					16.4%	}PACE
39	X					10.7%	- - -15PCT
38	X					7.9%	
37	X					7.0%	
36	X					3.3%	
35	X					2.8%	
34	X					0.9%	
33	X					0.5%	
32	X					0.0%	
31	X					0.0%	
30	X					0.0%	
29	X					0.0%	
28	X					0.0%	
27	X					0.0%	
26	X					0.0%	
25	X					0.0%	
24	X					0.0%	
23	X					0.0%	
22	X					0.0%	
21	X					0.0%	
20	X					0.0%	
19	X					0.0%	
18	X					0.0%	
17	X					0.0%	
16	X					0.0%	
15	X					0.0%	

UPPER LIMIT 10 MPH PACE:	49	MPH			
LOWER LIMIT 10 MPH PACE:	40	MPH	85th PERCENTILE SPEED:	48.4	MPH
PERCENT OVER PACE:	12.1	%	MEDIAN SPEED:	44.0	MPH
PERCENT IN PACE:	77.1	%	15th PERCENTILE SPEED:	39.8	MPH
PERCENT UNDER PACE:	10.7	%			

Moulton 2017-08

Radar Speed Survey Field Sheet

HARTZOG AND CRABILL INC.
Consulting Traffic Engineers
17592 Irvine Blvd., Suite 122 Tustin CA 92680
(714) 731-5452

AGENCY: CITY OF LAGUNA WOODS
STREET: MOULTON PARKWAY
LOCATION: CALLE CORTE TO SOUTH CITY LIMITS

WEATHER: SUNNY
ROAD CONDITION: DRY
OBSERVER: CATHY BUENDIA

DATE: 8/25/17
START TIME: 11:00 AM
END TIME: 11:35 AM

DIRECTION: NORTHBOUND

MPH	NUMBER OF VEHICLES (5 10 15 20 25 30)	TOTAL
60		
59		
58		
57		
56		
55	/	1
54		0
53	//	2
52	/	1
51	///	3
50	///	3
49	/////	5
48	/////	9
47	///// ///	13
46	///// ///	13
45	///// ///	13
44	///// ////	9
43	///// /	11
42	/////	5
41	/////	5
40	/////	5
39	///	3
38		0
37	//	2
36	/	1
35	/	1
34	/	1
33	/	1
32		
31		
30		
29		
28		
27		
26		
25		
24		
23		
22		
21		
20		
19		
18		
17		
16		
15		

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

CUMULATIVE (BOTH DIRECTIONS) _____

DIRECTION: SOUTHBOUND

MPH	NUMBER OF VEHICLES (5 10 15 20 25 30)	TOTAL	CUMULATIVE TOTAL	MPH
60				60
59				59
58	/	1	1	58
57		0	0	57
56	/	1	1	56
55	/	1	2	55
54	/	2	4	54
53	//	3	4	53
52	///	4	4	52
51	/	1	5	51
50	/////	6	9	50
49	/////	6	11	49
48	////	4	13	48
47	///	3	16	47
46	///	3	18	46
45	///// /	11	24	45
44	////	8	17	44
43	/////	10	21	43
42	/////	9	20	42
41	////	8	13	41
40	/////	7	12	40
39	///	3	6	39
38	//	2	8	38
37	/////	6	8	37
36		0	4	36
35	///	3	1	35
34				34
33				33
32				32
31				31
30				30
29				29
28				28
27				27
26				26
25				25
24				24
23				23
22				22
21				21
20				20
19				19
18				18
17				17
16				16
15				15

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

ITEM 8.4 - Attachment B

ENGINEERING AND TRAFFIC SURVEY

CITY OF LAGUNA WOODS

HCI

RIDGE ROUTE DRIVE — **MOULTON PKWY TO EAST CITY LIMITS**

DATE: 8/28/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 1:30 PM - 2:20 PM — CHECKED BY: JERRY STOCK

PREVAILING SPEED DATA	
LOCATION OF SURVEY	**WEST OF PERALTA**
DATE OF SURVEY	8/28/2017
85th PERCENTILE	47.4 MPH
10 MPH PACE	39 - 48 MPH
PERCENT IN PACE	68.1 %
POSTED SPEED LIMIT	45 MPH

ACCIDENT HISTORY	
NO. OF MONTHS OBSERVED	36
SPEED-RELATED ACCIDENTS	1
TOTAL ACCIDENTS	2
ANNUAL ACCIDENT RATE	0.33 ACCIDENTS PER YEAR (SPEED RELATED ONLY)
ACC./MILLION VEH. MILES	0.17 ACCIDENTS PER MVM (SPEED RELATED ONLY)

TRAFFIC FACTORS	
AVERAGE DAILY TRAFFIC	7,000
LANE CONFIGURATION	1 LANE PER DIRECTION
TRAFFIC CONTROLS	SIGNAL - MOULTON / PERALTA
CROSSWALKS	AT MOULTON / PERALTA
PEDESTRIAN/BICYCLES	YES / YES
TRUCK TRAFFIC	FEW
ON-STREET PARKING	NO STOPPING ANYTIME ENTIRE BLOCK
OTHER	

ROADWAY FACTORS	
LENGTH OF SEGMENT (MILES)	0.77
VERTICAL CURVE	SLIGHT UP/DOWNHILL GRADES
HORIZONTAL CURVE	NONE
LATERAL VISIBILITY	GOOD
ROAD CONDITIONS	GOOD
SIDEWALKS / DRIVEWAYS	YES / NO (WB) - NO / NO (EB)
STREET LIGHTING	YES
DRIVEWAY DENSITY	NOMINAL
OTHER	SOLID DBL YELLOW CENTERLINE NO SHOULDERS (WB) / DIRT PEDESTRIAN TRAIL-DOG WALK (EB)

ADJACENT LAND USE	RESIDENTIAL (NF) / BUSINESS / COMMERCIAL
RECOMMENDED SPEED LIMIT	45 MPH
SPEED LIMIT CHANGE	NO CHANGE

JUSTIFICATION:

The recommended speed is within 2.4 mph of the 85th percentile speed and meets CVC standards.

Note: Ridge Route Drive shares boundary with the City of Laguna Hills

NF = Non Fronting to the roadway

File: Ridge Route 2017-09

RADAR SPEED DISTRIBUTION SHEET

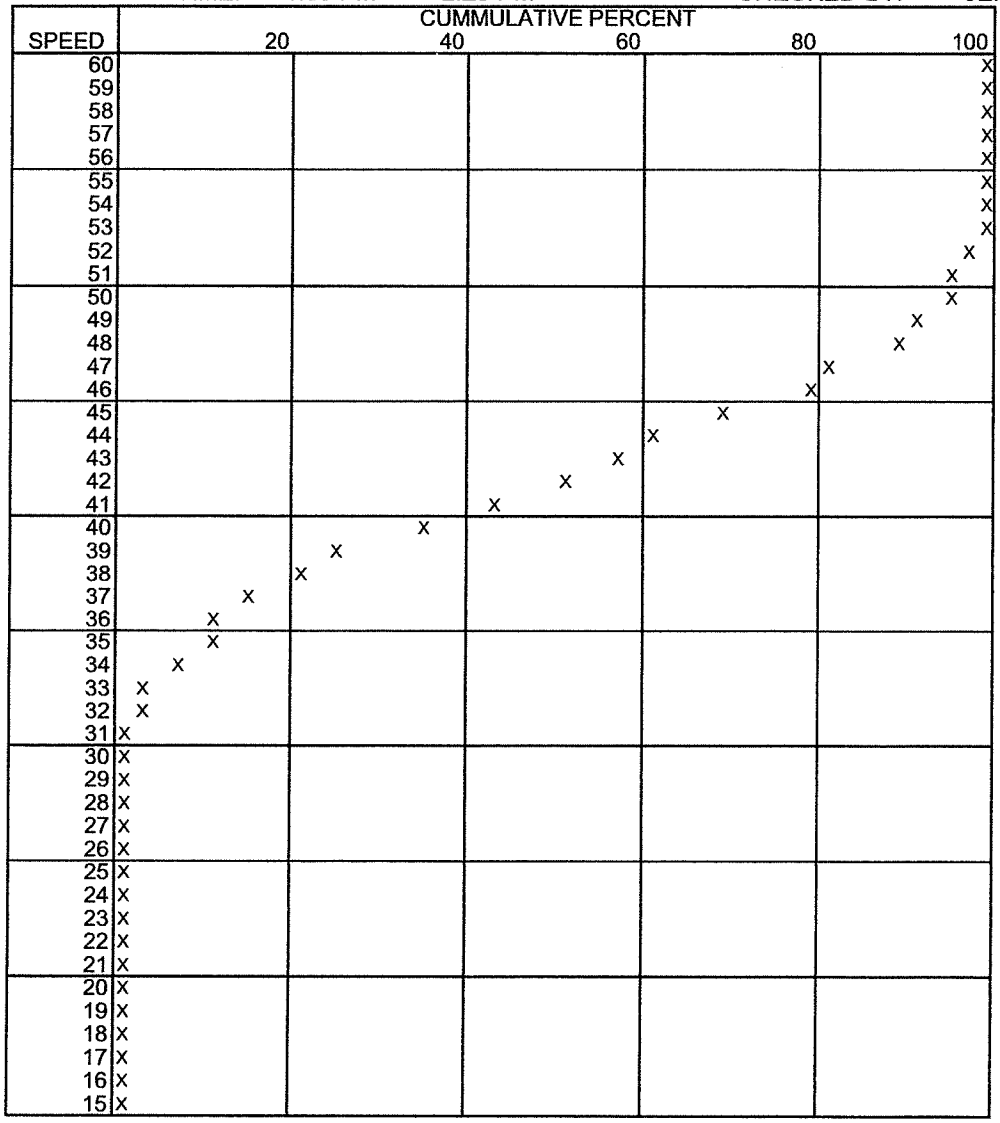
HCI

CITY OF LAGUNA WOODS

RIDGE ROUTE DRIVE — MOULTON PKWY TO EAST CITY LIMITS

DATE: 8/28/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 1:30 PM - 2:20 PM — CHECKED BY: JERRY STOCK



SPEED	CUMMULATIVE PERCENT		
60	100.0%		
59	100.0%		
58	100.0%		
57	100.0%		
56	100.0%		
55	100.0%		
54	100.0%		
53	98.9%		
52	97.3%		
51	95.7%		
50	94.1%		
49	91.0%		
48	88.8%	}PACE	
47	81.9%	}PACE	- - -85PCT
46	78.2%	}PACE	
45	69.7%	}PACE	
44	61.2%	}PACE	
43	57.4%	}PACE	
42	51.1%	}PACE	
41	43.1%	}PACE	- - - -MEAN
40	35.1%	}PACE	
39	25.0%	}PACE	
38	20.7%		
37	14.4%		- - -15PCT
36	10.6%		
35	10.1%		
34	6.4%		
33	3.7%		
32	3.7%		
31	1.1%		
30	1.1%		
29	1.1%		
28	0.5%		
27	0.0%		
26	0.0%		
25	0.0%		
24	0.0%		
23	0.0%		
22	0.0%		
21	0.0%		
20	0.0%		
19	0.0%		
18	0.0%		
17	0.0%		
16	0.0%		
15	0.0%		

UPPER LIMIT 10 MPH PACE:	48	MPH			
LOWER LIMIT 10 MPH PACE:	39	MPH	85th PERCENTILE SPEED:	47.4	MPH
PERCENT OVER PACE:	11.2	%	MEDIAN SPEED:	41.9	MPH
PERCENT IN PACE:	68.1	%	15th PERCENTILE SPEED:	37.1	MPH
PERCENT UNDER PACE:	20.7	%			

Ridge Route 2017-09

Radar Speed Survey Field Sheet

HARTZOG AND CRABILL INC.
Consulting Traffic Engineers
17592 Irvine Blvd., Suite 122 Tustin CA 92680
(714) 731-5455

AGENCY: CITY OF LAGUNA WOODS
STREET: RIDGE ROUTE DRIVE
LOCATION: MOULTON PKWY TO EAST CITY LIMITS

WEATHER: SUNNY
ROAD CONDITION: DRY
OBSERVER: CATHY BUENDIA

DATE: 08/28/17
START TIME: 1:30 PM
END TIME: 2:20 PM VEH

DIRECTION: EASTBOUND

MPH	NUMBER OF VEHICLES (5 / 10 / 15 / 20 / 25 / 30)	TOTAL
60		
59		
58		
57		
56		
55		
54	//	2
53	//	2
52		0
51	//	2
50	///	3
49	//	2
48	/////	5
47	//	2
46	//////	7
45	//////////	11
44	////	4
43	///	3
42	////////////	12
41	///////	7
40	//////////	10
39	////	4
38	////////	8
37	///	3
36	/	1
35	///	3
34	///	3
33		0
32	///	3
31		0
30		0
29	/	1
28	/	1
27		
26		
25		
24		
23		
22		
21		
20		
19		
18		
17		
16		
15		

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

CUMULATIVE (BOTH DIRECTIONS) _____

DIRECTION: WEST

MPH	NUMBER OF VEHICLES (5 / 10 / 15 / 20 / 25 / 30)	TOTAL	CUMULATIVE TOTAL	MPH
60				60
59				59
58				58
57				57
56				56
55				55
54			2	54
53	/	1	3	53
52	///	3	3	52
51	/	1	3	51
50	///	3	6	50
49	//	2	4	49
48	////////	8	13	48
47	/////	5	7	47
46	/////////	9	16	46
45	/////	5	16	45
44	///	3	7	44
43	///////	9	12	43
42	/////	5	15	42
41	////////	8	15	41
40	//////////	9	19	40
39	////	4	8	39
38	////	4	12	38
37	////	4	7	37
36		0	1	36
35	///	4	7	35
34	//	2	5	34
33		0	0	33
32	//	2	5	32
31			0	31
30			0	30
29			1	29
28				28
27				27
26				26
25				25
24				24
23				23
22				22
21				21
20				20
19				19
18				18
17				17
16				16
15				15

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

ITEM 8.4 - Attachment B

ENGINEERING AND TRAFFIC SURVEY

CITY OF LAGUNA WOODS

HCI

SANTA MARIA AVENUE — **MOULTON PKWY TO VIA VISTA**

DATE: 8/28/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 2:30 PM - 3:40 PM — CHECKED BY: JERRY STOCK

PREVAILING SPEED DATA	
LOCATION OF SURVEY	**EAST OF SAN REMO**
DATE OF SURVEY	0/28/2017
85th PERCENTILE	43.9 MPH
10 MPH PACE	36 - 45 MPH
PERCENT IN PACE	80.6 %
POSTED SPEED LIMIT	40 MPH

ACCIDENT HISTORY	
NO. OF MONTHS OBSERVED	36
SPEED-RELATED ACCIDENTS	0
TOTAL ACCIDENTS	7
ANNUAL ACCIDENT RATE	0.00 ACCIDENTS PER YEAR (SPEED RELATED ONLY)
ACC./MILLION VEH. MILES	0.00 ACCIDENTS PER MVM (SPEED RELATED ONLY)

TRAFFIC FACTORS	
AVERAGE DAILY TRAFFIC	7,000
LANE CONFIGURATION	2 LANES PER DIRECTION
TRAFFIC CONTROLS	SIGNAL - MOULTON / STOP - VIA VISTA
CROSSWALKS	AT MOULTON / VIA VISTA
PEDESTRIAN/BICYCLES	FEW / FEW
TRUCK TRAFFIC	NO
ON-STREET PARKING	NO STOPPING ANYTIME
OTHER	NO SHOULDERS

ROADWAY FACTORS	
LENGTH OF SEGMENT (MILES)	0.42
VERTICAL CURVE	SLIGHT-GRADUAL UP/DOWNHILL GRADES
HORIZONTAL CURVE	GRADUAL "S" CURVES
LATERAL VISIBILITY	LIMITED SIGHT DISTANCE (areas of)
ROAD CONDITIONS	GOOD
SIDEWALKS / DRIVEWAYS	YES / NO
STREET LIGHTING	YES
DRIVEWAY DENSITY	NONE
OTHER	RAISED MEDIAN ISLAND NO SHOULDERS

ADJACENT LAND USE	RESIDENTIAL (NF) / COMMERCIAL (at Moulton)
RECOMMENDED SPEED LIMIT	40 MPH
SPEED LIMIT CHANGE	NO CHANGE

JUSTIFICATION:

The recommended speed limit is within 3.9 mph of the 85th percentile speed and meets CVC standards.

NF = NON FRONTING TO ROADWAY

File: Santa Maria 2017-10

Note: Santa Maria Avenue has shared jurisdiction with the City of Laguna Hills and speed limit is 40 mph.

RADAR SPEED DISTRIBUTION SHEET

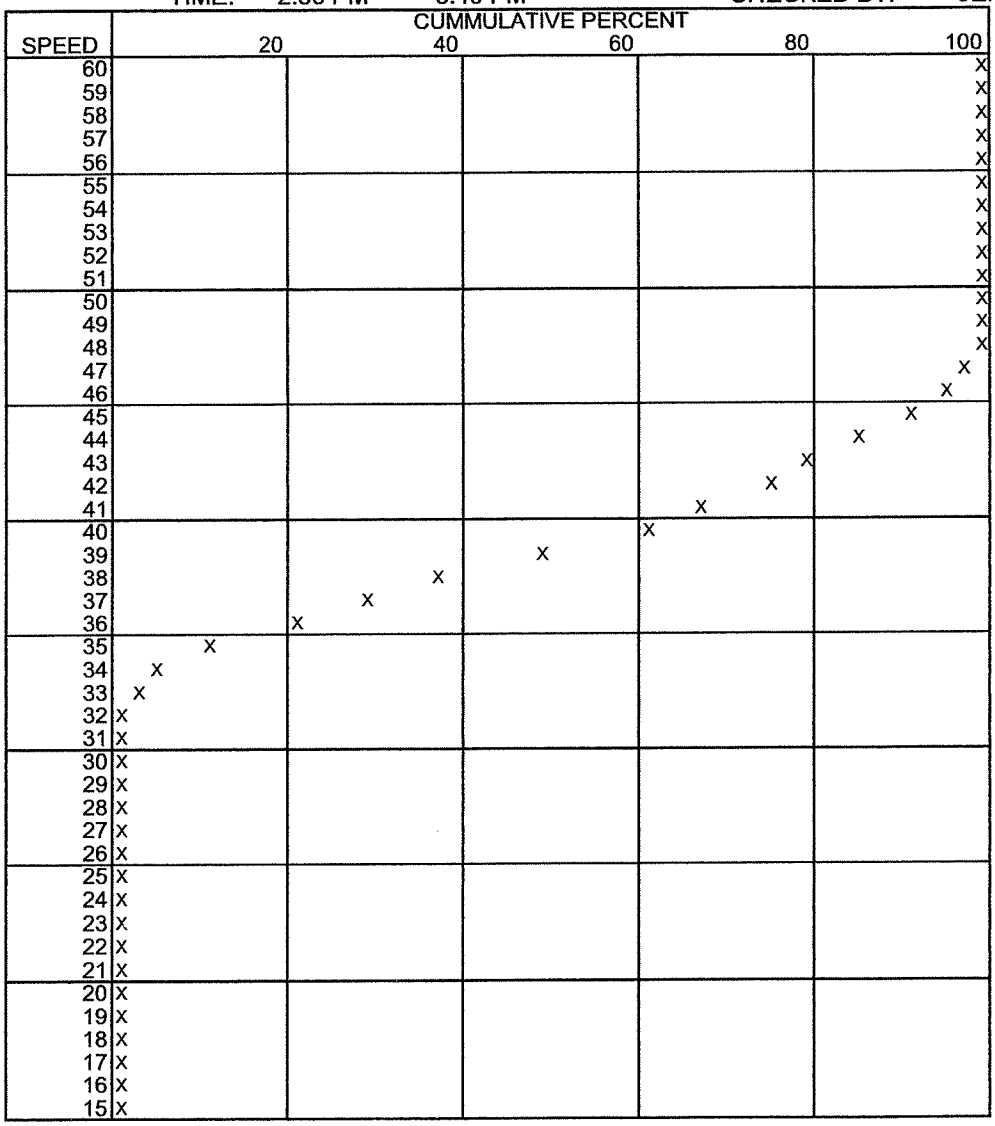
HCI

CITY OF LAGUNA WOODS

SANTA MARIA AVENUE — MOULTON PKWY TO VIA VISTA

DATE: 0/28/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 2:30 PM - 3:40 PM — CHECKED BY: JERRY STOCK



UPPER LIMIT 10 MPH PACE:	45	MPH	85th PERCENTILE SPEED:	43.9	MPH
LOWER LIMIT 10 MPH PACE:	36	MPH	MEDIAN SPEED:	39.1	MPH
PERCENT OVER PACE:	8.5	%	15th PERCENTILE SPEED:	35.4	MPH
PERCENT IN PACE:	80.6	%			
PERCENT UNDER PACE:	10.9	%			

Santa Maria 2017-10

Radar Speed Survey Field Sheet

HARTZOG AND CRABILL INC.
Consulting Traffic Engineers
17502 Irvine Blvd., Suite 122 Tustin CA 92680
(714) 731-5455

AGENCY: CITY OF LAGUNA WOODS
STREET: SANTA MARIA AVENUE
LOCATION: MOULTON PKWY TO VIA VISTA

WEATHER: SUNNY
ROAD CONDITION: DRY
OBSERVER: CATHY BUENDIA

DATE: 08/28/17
START TIME: 2:30 PM
END TIME: 3:40 PM VOL

DIRECTION: EASTBOUND

MPH	NUMBER OF VEHICLES (5 10 15 20 25 30)	TOTAL
60		
59		
58		
57		
56		
55		
54		
53		
52		
51	/	1
50		0
49		0
48	/	1
47	//	2
46	//	2
45	////	4
44	////	5
43	///	3
42	///	3
41	////	4
40	//////////	10
39	//////////	8
38	//////////	11
37	////	4
36	//////	8
35	//////	6
34	//	2
33		0
32	/	1
31	/	1
30		
29		
28		
27		
26		
25		
24		
23		
22		
21		
20		
19		
18		
17		
16		
15		

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

CUMULATIVE (BOTH DIRECTIONS) _____

DIRECTION: WESTBOUND

MPH	NUMBER OF VEHICLES (5 10 15 20 25 30)	TOTAL	CUMULATIVE TOTAL	MPH
60				60
59				59
58				58
57				57
56				56
55				55
54				54
53				53
52				52
51			1	51
50	/	1	1	50
49		0	1	49
48	//	2	3	48
47	/	1	4	47
46	////	4	8	46
45	//////	6	14	45
44	////	4	18	44
43	//////	6	24	43
42	////	4	28	42
41	///////	7	35	41
40	//////////	10	45	40
39	//////////	11	56	39
38	////	4	60	38
37	///////	7	67	37
36	//////////	10	77	36
35	///	3	80	35
34	///	3	83	34
33	//	2	85	33
32			85	32
31			85	31
30				30
29				29
28				28
27				27
26				26
25				25
24				24
23				23
22				22
21				21
20				20
19				19
18				18
17				17
16				16
15				15

AVERAGE SPEED: _____ CRITICAL SPEED: _____ PACE SPEED: _____

ITEM 8.4 - Attachment B

ENGINEERING AND TRAFFIC SURVEY

CITY OF LAGUNA WOODS

HCI

SANTA MARIA AVENUE — **SANTA VITTORIA TO AVENIDA SOSIEGA**

DATE: 8/25/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 1:30 PM - 2:30 PM — CHECKED BY: JERRY STOCK

PREVAILING SPEED DATA	
LOCATION OF SURVEY	**WEST OF MOULTON**
DATE OF SURVEY	8/25/2017
85th PERCENTILE	41.2 MPH
10 MPH PACE	32 - 41 MPH
PERCENT IN PACE	75.0 %
POSTED SPEED LIMIT	40 MPH

ACCIDENT HISTORY	
NO. OF MONTHS OBSERVED	36
SPEED-RELATED ACCIDENTS	0
TOTAL ACCIDENTS	0
ANNUAL ACCIDENT RATE	0.00 ACCIDENTS PER YEAR (SPEED RELATED ONLY)
ACC./MILLION VEH. MILES	0.00 ACCIDENTS PER MVM (SPEED RELATED ONLY)

TRAFFIC FACTORS	
AVERAGE DAILY TRAFFIC	7,000
LANE CONFIGURATION	2 LANES PER DIRECTION
TRAFFIC CONTROLS	STOP - AVENIDA SOSIEGA
CROSSWALKS	AT AVENIDA SOSIEGA
PEDESTRIAN/BICYCLES	FEW / FEW
TRUCK TRAFFIC	NO
ON-STREET PARKING	NO STOPPING ANYTIME
OTHER	NO SHOULDERS

ROADWAY FACTORS	
LENGTH OF SEGMENT (MILES)	0.14
VERTICAL CURVE	SLIGHT UP/DOWNHILL GRADES
HORIZONTAL CURVE	VERY SLIGHT CURVE
LATERAL VISIBILITY	GOOD
ROAD CONDITIONS	GOOD
SIDEWALKS / DRIVEWAYS	YES / NO
STREET LIGHTING	YES
DRIVEWAY DENSITY	NONE
OTHER	RAISED MEDIAN ISLAND NO SHOULDERS

ADJACENT LAND USE	RESIDENTIAL (NF) / ELEMENTARY SCHOOL / COMMERCIAL (at Moulton)
RECOMMENDED SPEED LIMIT	40 MPH
SPEED LIMIT CHANGE	NO CHANGE

JUSTIFICATION:

The recommended 40 mph is within 1.2 mph of the 85th percentile speed and meets CVC standards.

NF = NON FRONTING TO ROADWAY

File: Santa Maria 2017-11

Note: Santa Maria Avenue has shared jurisdiction with the City of Laguna Hills

RADAR SPEED DISTRIBUTION SHEET

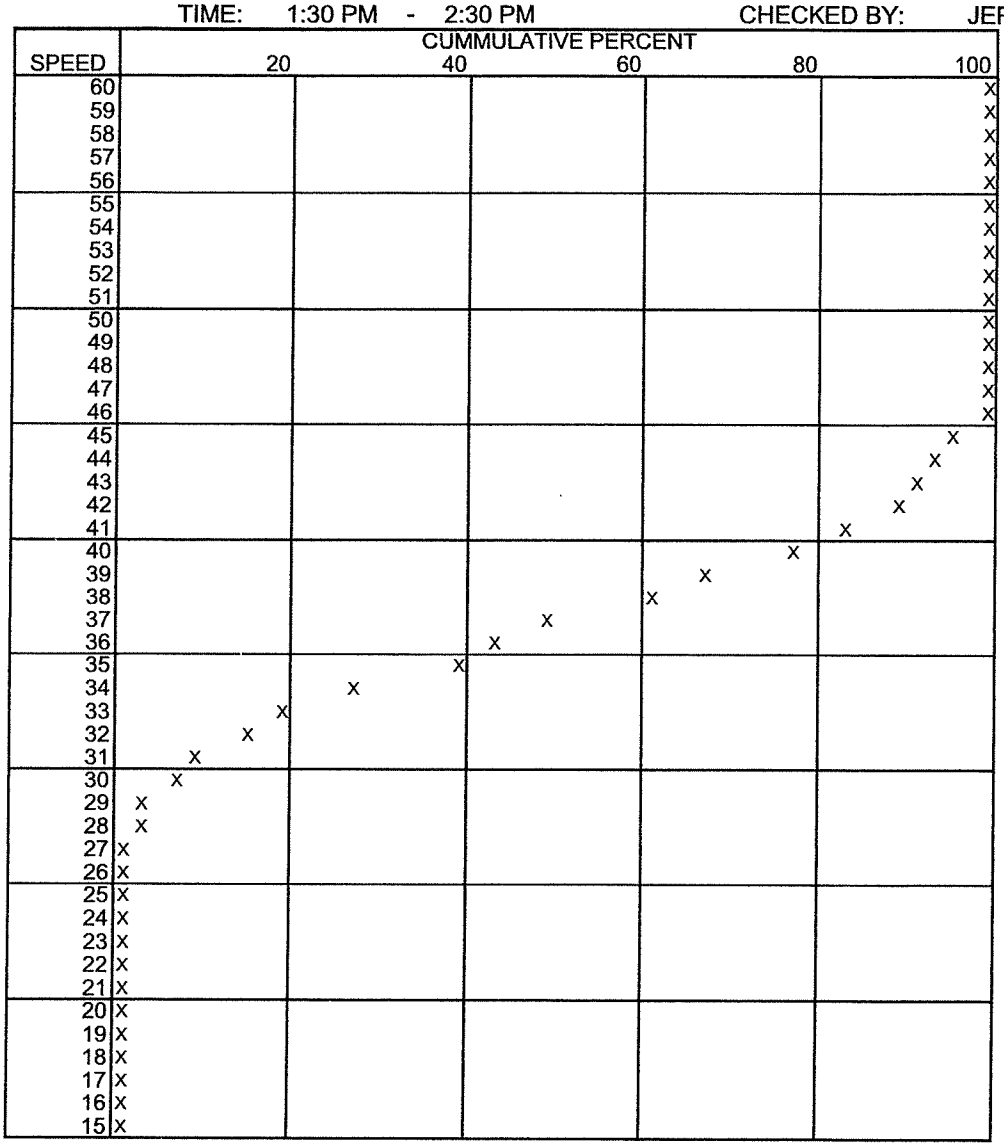
HCI

CITY OF LAGUNA WOODS

SANTA MARIA AVENUE — SANTA VITTORIA TO AVENIDA SOSIEGA

DATE: 8/25/2017 — SURVEY BY: HCI - C.BUENDIA

TIME: 1:30 PM - 2:30 PM — CHECKED BY: JERRY STOCK



SPEED	CUMMULATIVE PERCENT		
60	100.0%		
59	100.0%		
58	100.0%		
57	100.0%		
56	100.0%		
55	100.0%		
54	100.0%		
53	100.0%		
52	100.0%		
51	100.0%		
50	100.0%		
49	99.4%		
48	99.4%		
47	98.8%		
46	98.3%		
45	95.3%		
44	92.4%		
43	90.1%		
42	89.5%		
41	83.7%	}PACE	- - -85PCT
40	76.7%	}PACE	
39	66.9%	}PACE	
38	61.6%	}PACE	
37	48.8%	}PACE	- - - -MEAN
36	43.0%	}PACE	
35	38.4%	}PACE	
34	27.3%	}PACE	
33	18.0%	}PACE	
32	15.1%	}PACE	
31	8.7%		- - -15PCT
30	7.0%		
29	2.9%		
28	2.3%		
27	0.6%		
26	0.0%		
25	0.0%		
24	0.0%		
23	0.0%		
22	0.0%		
21	0.0%		
20	0.0%		
19	0.0%		
18	0.0%		
17	0.0%		
16	0.0%		
15	0.0%		

UPPER LIMIT 10 MPH PACE:	41	MPH			
LOWER LIMIT 10 MPH PACE:	32	MPH	85th PERCENTILE SPEED:	41.2	MPH
PERCENT OVER PACE:	16.3	%	MEDIAN SPEED:	37.1	MPH
PERCENT IN PACE:	75.0	%	15th PERCENTILE SPEED:	32.0	MPH
PERCENT UNDER PACE:	8.7	%			

Santa Maria 2017-11

SPD-HCT.dwg

Radar Speed Survey Field Sheet

HARTZOG AND CRABILL INC.
Consulting Traffic Engineers
17592 Irvine Blvd., Suite 122 Tustin CA 92680
(714) 731-5452

AGENCY: CITY OF LAGUNA WOODS
STREET: SANTA MARIA AVENUE
LOCATION: SANTA VITTORIA DR. TO AVENIDA SOSIEGA

WEATHER: SUNNY
ROAD CONDITION: DRY
OBSERVER: CATHY BUENDIA

DATE: 8/25/17
START TIME: 1:30 PM
END TIME: 2:30 PM / 0111

DIRECTION: WESTBOUND

MPH	NUMBER OF VEHICLES (5 / 10 / 15 / 20 / 25 / 30)	TOTAL
60		
59		
58		
57		
56		
55		
54		
53		
52		
51		
50		
49		
48		
47		
46	///	3
45	/	1
44		0
43		0
42	/////	5
41	///	3
40	//////////	10
39	//////	6
38	////////// ///	13
37	////////// ////	14
36	////	4
35	////////// ///	13
34	//////////	9
33	/////	5
32	//////	6
31		0
30	////	5
29		1
28	//	2
27	/	1
26		
25		
24		
23		
22		
21		
20		
19		
18		
17		
16		
15		

AVERAGE SPEED: _____
CRITICAL SPEED: _____
PACE SPEED: _____

DIRECTION: EASTBOUND

MPH	NUMBER OF VEHICLES (5 / 10 / 15 / 20 / 25 / 30)	TOTAL	CUMULATIVE TOTAL	MPH
60				60
59				59
58				58
57				57
56				56
55				55
54				54
53				53
52				52
51				51
50	/	1	1	50
49		0	0	49
48	/	1	1	48
47				47
46	//	2	5	46
45	////	4	5	45
44	////	4	4	44
43	/	1	1	43
42	/////	5	10	42
41	//////////	9	12	41
40	//////////	7	17	40
39	///	3	9	39
38	//////////	9	22	38
37	///	2	10	37
36	////	4	8	36
35	//////	6	9	35
34	//////	7	16	34
33		0	5	33
32	/////	5	11	32
31	///	3	3	31
30	//	2	7	30
29		0	1	29
28	/	1	3	28
27			1	27
26				26
25				25
24				24
23				23
22				22
21				21
20				20
19				19
18				18
17				17
16				16
15				15

AVERAGE SPEED: _____
CRITICAL SPEED: _____
PACE SPEED: _____

CUMULATIVE (BOTH DIRECTIONS) _____

ITEM 8.4 - Attachment B

APPENDIX B

RHF Inc.
Radar Repair

TRAFFIC RADAR CERTIFICATION

TESTED TO NHTSA SPECIFICATIONS / IACP CRITICAL PERFORMANCE STANDARDS
(NHTSA) National Highway and Traffic Safety Administration.
(IACP) International Association of Chiefs of Police.

16202 Keats Circle
Westminster, Calif. 92683

R.H.F. is a certified independent testing and repair facility.

1	TEST ID	Date Received 11-18-16		Certification Number 7114					
2	DEVICE ID	Manufacturer MPH		Model: K-15	Type (1-IV) III	Directional radar ☐ Yes ☑ No		Same direction ☐ Yes ☐ ☑ No	
		Counting unit S/N 12145		Antenna-1 S/N N/A		Antenna-2 S/N N/A			
3	§ 2.4 / § 5.4 TUNING FORK CALIBRATION	Low speed fork S/N 25560	Last date calib.	Freq. (Hz)	Speed (mph) 35	Measured (Hz) 2525		PASS	FAIL
		High speed fork S/N	Last date calib.	Freq. (Hz)	Speed (mph)	Measured (Hz)			
4	§ 2.5 / § 5.5 RADAR DEVICE TUNING FORK TESTS			Lo fork	High fork			PASS	FAIL
		Stationary mode	Fork speed (mph)	35	65				
			Disp. Speed (mph)	35	65				
		Moving mode Opposite Direction	TARGET SPEED (Hi fork – Lo fork)	Expected. (mph) N/A	Displayed. (mph) N/A				
		~~Moving mode~~ Same Direction	TARGET SPEED Hi fork + Lo fork Ho fork - Lo fork	Expected. (mph) N/A	Displayed. (mph) N/A				
5	§ 2.6.1. / § 5.6.1 TRANSMISSION FREQUENCY STABILITY	Standard supply Voltage (V) 13.6 V	Antenna 1 Freq. GHz 24.160	Antenna 2 Freq. GHz N/A				PASS	FAIL
		Standard supply Voltage – 20% (V) 10.8 V	Antenna 1 Freq. GHz 24.160	Antenna 2 Freq. GHz N/A					
		Standard supply voltage + 20% (V) 16.3 V	Antenna 1 Freq. GHz 24.160	Antenna 2 Freq. GHz N/A					
6	§ 2.6.5 / § 5.6.5 POWER DENSITY	Mfg. Spec. (max mW/cm) ≤ 5	Antenna 1 Power (mW/cm) .6	Antenna 2 Power (mW/cm) N/A				PASS	FAIL
7	§ 2.8 / § 5.8 LOW VOLTAGE	Mfg. spec. (V) ≤ 10.8V	LVA activates (V) N/A	LVA deactivates (V) N/A				PASS	FAIL
8	§ 2.9.1 / § 5.9.1 DOPPLER AUDIO	A. Audio tone correlates with received Doppler signal ☐ Yes ☐ No						PASS	FAIL
		B. Functioning audio volume-adjustment control ☑ Yes ☐ No							
9	§ 2.12.4 / § 5.12.4 INTERNAL CIRCUIT	Mfg. Spec. 32	Test results 32					PASS	FAIL
10	§ 2.12.6.5 / § 5.12.6.5 DIRECTIONAL	A. Selects only targets moving towards radar ☐ Yes ☐ No ☑ N.A.						PASS	FAIL
		B. Selects only targets moving away from radar ☐ Yes ☐ No ☑ N.A.							
11	§ 2.12.7 / § 2.12.8 / 5.12.7 / 5.12.8 LOW AND HIGH SPEED DISPLAY TEST	Stationary mode: target channel (mph)	Low speed spec. 20	Lo speed disp. 20				PASS	FAIL
			Hi speed spec. 199	Hi speed disp. 199					
		Moving Mode target channel (mph)	Low speed spec. N/A	Lo speed disp. N/A					
			Hi speed spec. N/A	Hi speed disp. N/A					
		Moving Mode: patrol channel (mph)	Low speed spec. N/A	Lo speed disp. N/A					
			Hi speed spec. N/A	Hi speed disp. N/A					
12	§ 2.13 / § 5.13 RFI TEST	N/A						PASS	FAIL
13	LABORATORY COMMENTS								
14	NHTSA/IACP CERTIFICATION	***This radar device meets or exceeds the minimal operational standards of the National Traffic Highway Safety Administration. California Vehicle Code Section 40802*** ☑ PASS ☐ FAIL							
		Certified by: Ford Bauman **Date:** 11-18-16							
15	INVENTORY	☐ Fork Cert ☐ Manual ☐ 2nd Ant. ☐ Remote ☐ Bat. ☐ Carrying Case ☐ Other: (please list)							

TRAFFIC RADAR CERTIFICATION

RHF Inc.
Radar Repair

16202 Keats Circle
Westminster, Calif. 92683

TESTED TO NHTSA SPECIFICATIONS / IACP CRITICAL PERFORMANCE STANDARDS
(NHTSA) National Highway and Traffic Safety Administration.
(IACP) International Association of Chiefs of Police.

R.H.F. is a certified independent testing and repair facility.

1	TEST ID	Date Received 11-18-16		Certification Number 71143					
2	DEVICE ID	Make: **Kustom Electronics**		Model: **KR-10SP**	Type (1-IV) **IV**	Directional radar ☐ Yes ☐ No	Same direction ☐ Yes ☐ No		
		Counting unit S/N EE 8364		Antenna-1 S/N CC9108		Antenna-2 S/N			
3	§ 2.4 / § 5.4 TUNING FORK CALIBRATION	Low speed fork S/N 6359	Last date calib.	Freq. (Hz)	Speed (mph) 35	Measured (Hz) 2543	PASS	FAIL	
		High speed fork S/N 15751	Last date calib.	Freq. (Hz)	Speed (mph) 65	Measured (Hz) 4732			
4	§ 2.5 / § 5.5 RADAR DEVICE TUNING FORK TESTS			Lo fork	High fork				
		Stationary mode	Fork speed (mph)	35	65				
			Disp. Speed (mph)	35	65				
		Moving mode Opposite Direction	TARGET SPEED (Hi fork – Lo fork)	Expected. (mph) 30	Displayed. (mph) 30		PASS	FAIL	
		Moving mode Same Direction	TARGET SPEED Hi fork + Lo fork Ho fork - Lo fork	Expected. (mph) N/A	Displayed. (mph) N/A				
5	§ 2.6.1. / § 5.6.1 TRANSMISSION FREQUENCY STABILITY	Standard supply Voltage (V) 13.6 V	Antenna 1 Freq. GHz 24.166	Antenna 2 Freq. GHz			PASS	FAIL	
		Standard supply Voltage – 20% (V) 10.8 V	Antenna 1 Freq. GHz 24.166	Antenna 2 Freq. GHz					
		Standard supply voltage + 20% (V) 16.3 V	Antenna 1 Freq. GHz 24.166	Antenna 2 Freq. GHz					
6	§ 2.6.5 / § 5.6.5 POWER DENSITY	Mfg. Spec. (max mW/cm) ≤ 5	Antenna 1 Power (mW/cm) .9	Antenna 2 Power (mW/cm)			PASS	FAIL	
7	§ 2.8 / § 5.8 LOW VOLTAGE	Mfg. spec. (V) ≤10.8 V	LVA activates (V) 9.9	LVA deactivates (V) 10.6			PASS	FAIL	
8	§ 2.9.1 / § 5.9.1 DOPPLER AUDIO	A. Audio tone correlates with received Doppler signal ☐ Yes ☐ No					PASS	FAIL	
		B. Functioning audio volume-adjustment control ☐ Yes ☐ No							
9	§ 2.12.4 / § 5.12.4 INTERNAL CIRCUIT	Mfg. Spec. 32	Test results 32				PASS	FAIL	
10	§ 2.12.6.5 / § 5.12.6.5 DIRECTIONAL	A. Selects only targets moving towards radar ☐ Yes ☐ No ☐ N.A.					PASS	FAIL	
		B. Selects only targets moving away from radar ☐ Yes ☐ No ☐ N.A.							
11	§ 2.12.7 / § 2.12.8 / 5.12.7 / 5.12.8 LOW AND HIGH SPEED DISPLAY TEST	Stationary mode: target channel (mph)	Low speed spec. 15	Lo speed disp. 15			PASS	FAIL	
			Hi speed spec. 175	Hi speed disp. 175					
		Moving Mode target channel (mph)	Low speed spec. 20	Lo speed disp. 20					
			Hi speed spec. 155	Hi speed disp. 155					
		Moving Mode: patrol channel (mph)	Low speed spec. 20	Lo speed disp. 20					
			Hi speed spec. 80	Hi speed disp. 80					
12	§ 2.13 / § 5.13 RFI TEST						PASS	FAIL	
13	LABORATORY COMMENTS								
14	NHTSA/IACP CERTIFICATION	***This radar device meets or exceeds the minimal operational standards of the National Traffic Highway Safety Administration. California Vehicle Code Section 40802*** ☑ PASS ☐ FAIL							
		Certified by: Fred Paumen				Date: 11-18-16			
15	INVENTORY	☐ Fork Cert ☐ Manual ☐ 2nd Ant. ☐ Remote ☐ Bat. ☐ Carrying Case ☐ Other: (please list)							

Radar Certification

Certificate of Completion and Competency
DOPPLER RADAR OPERATION

Name & Title: Cathy Buendia Technician

Department: Transportation

has successfully completed a course of instruction in the operation of Moving Car and Stationary Doppler Radar and is deemed competent to utilize the same Doppler Radar to determine the velocity of motor vehicles.

7/23/91
Date

Instructor

Subsidiaries of MPD, Inc.

316 East Ninth Street
Owensboro, KY 42301
(502) 685-6200

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