Speed-by-Street™

inthinc's Revolutionary Speed Control Technology

inthinc™

inthinc Technology Solutions, Inc.

Telematics solutions that improve driver safety, reduce fleet management costs and support regulatory and policy compliance.

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Introduction

Speeding is a problem that affects every fleet or vehicle owner. It is costly, harmful to the environment, and results in over 1,000 deaths each month in the United States. For commercial fleets, speeding creates an unacceptable burden on employers, not to mention our planet and our families. When drivers maintain proper speeds, they have fewer crashes, burn less fuel, reduce damage and maintenance costs and promote goodwill in the community. Unfortunately, current attempts to slow drivers have been inadequate—until now. inthinc™, an industry leader in safe-driving technology, has developed Speed-by-Street™, the first real-time driver safety feature proven to dramatically alter speeding behavior.

The Consequences of Speeding

Accidents, Injuries and Deaths

In a high-speed crash, many vehicles are subjected to forces so severe that the vehicle structure cannot withstand the force of the crash and maintain survival space in the occupant compartment. Likewise, as crash speeds increase, restraint systems such as airbags and safety belts cannot keep the forces on occupants below severe injury levels.

Speed influences the risk of crashes and crash injuries in three basic ways:

- It increases the distance a vehicle travels from the time a driver detects an emergency to the time the driver reacts.
- It increases the distance needed to stop a vehicle once an emergency is perceived.
- It increases the crash energy by the square of the speeds. When impact speed increases from 40 to 60 mph (a 50 percent increase), the energy that needs to be managed increases by 125 percent.

For practical reasons, there are limits to the amount of crash energy that can be managed by vehicles, restraint systems, and roadway hardware such as barriers and impact attenuators. The higher the speed, the more likely these limits will be exceeded in crashes, thus reducing the protection available for vehicle occupants. To put speed into perspective, remember that government crash tests for occupant

Speeding kills more than 1,000 Americans every month and costs society more than $40 billion each year.

protection are conducted at speeds of 30-35 mph, and these are considered severe impact speeds.[i,ii]

According to the Executive Director of the Governor's Highway Safety Administration (GHSA),

> Speeding affects both the probability of a crash and the severity of injuries produced by a crash. Studies have documented three effects of speed on crashes and injuries. First, the probability of a crash is approximately proportional to the square of the travel speed. Second, in a crash, injury risk is approximately proportional to the impact forces on a person, which in turn are proportional to the square of the impact speed. These two effects can be summarized in a general rule of thumb:
>
> *When travel speed increases by 1%, the injury crash rate increases by about 2%, the serious injury crash rate increases by about 3%, and the fatal crash rate increases by about 4%.*
>
> The same relation holds in reverse: a 1% decrease in travel speed reduces injury crashes by about 2%, serious injury crashes by about 3%, and fatal crashes by about 4%. Consider the effect on a street with a speed limit of 35 mph and average travel speed of 40 mph. A reduction of just 2 mph, to 38 mph, is a 5% decrease, so crashes would be reduced by about 10%, serious injury crashes by about 14%, and fatal crashes by about 19%.
>
> Finally, the probability of a crash increases as a vehicle's travel speed rises above the average travel speed of surrounding vehicles. Extreme speeders have very high crash risks. For example, someone speeding at 80 mph on a road with average speed 70 mph has about a 31% greater crash risk, 49% greater injury crash risk, and 71% greater fatal crash risk than drivers at 70 mph.[iii]

Effects on the Environment

To a large degree, speed determines fuel efficiency. At slow speeds, the power required to go faster is easily outstripped by the increased effeciency of the engine. For example, it may take 30% more power to go from 5 to 10 mph, but you're covering 100% more ground, so fuel efficiency actually *increases* with speed in this case. However, at higher speeds, every incremental increase in velocity requires a very large amount of power that is not necessarily offset by increased distance traveled. At this point, fuel efficiency *decreases* with speed.

According to the Environmental Protection Agency and the Department of Energy, every 5 mph you drive over 60 mph is like paying an additional $0.28 per gallon for gas.

For most vehicles, the fuel efficiency "sweet spot" is somewhere between 40 and 60 mph, but a good general rule of thumb is that smaller, lighter vehicles hit their sweet spot at higher speeds, while bigger, heavier vehicles hit their sweet spot at lower speeds.[iv]

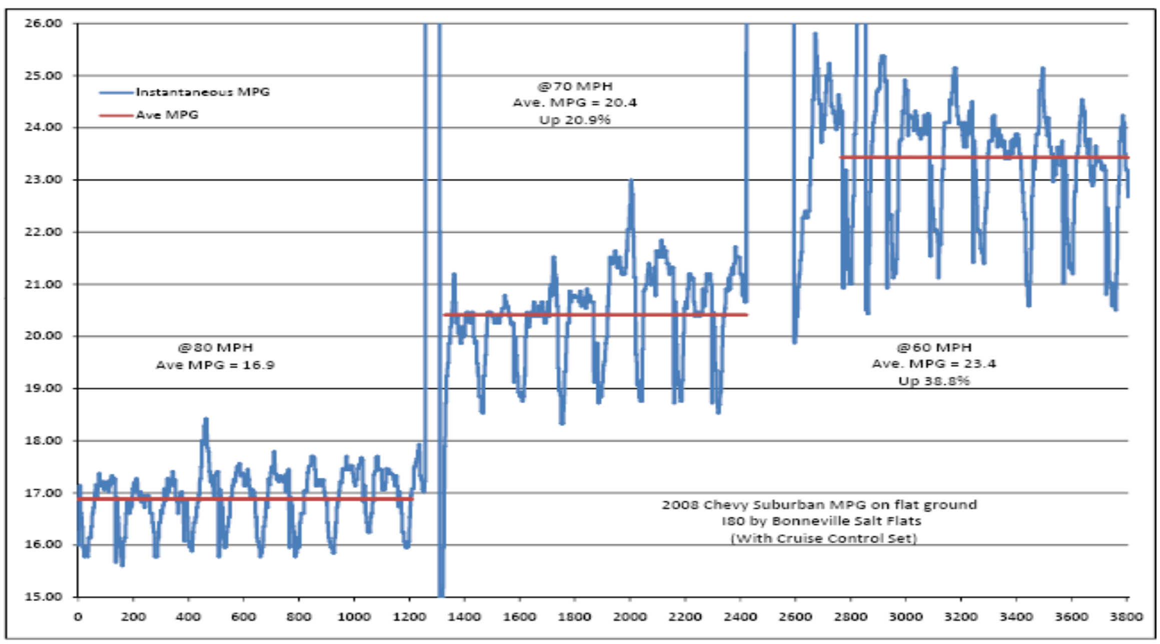
While each vehicle reaches its optimal fuel economy at a different speed (or range of speeds), gas mileage usually decreases rapidly at speeds above 60 mph.

According to the Environmental Protection Agency (EPA) and the Department of Energy, you can assume that each 5 mph you drive over 60 mph is like paying an additional $0.28 per gallon for gas (assuming $3.51 per gallon).[v]

Fuel efficiency changes dramatically at high speeds. inthinc's engineering team showed that decreasing speed from 80 mph to 60 mph in a Chevy Suburban resulted in over a 38% increase in fuel efficency (see Figure 1).[vi]

Figure 1

Fuel Efficiency at Different Speeds



Greater fuel consumption (less efficiency) results in greater CO_2 emissions. Driving the speed limit, and therefore limiting fuel consumption, can have an enormous positive effect on the environment. According to the UK Energy Research Center, merely enforcing the current 70 mph speed limit would result in 1million fewer tons of CO_2 produced in the UK in 2009. The UK Energy Research Center also found that decreasing the speed limit from 70 mph to 60 mph would reduce carbon emissions by almost half over four years—more than 7.5 million metric tons in all.[vii]

According to the Society of Motor Manufacturers and Traders (SMMT), there were over 31 million vehicles on UK roads in 2010.[viii] The United States, on the other hand, supports over 250 million vehicles—more than eight times the number of vehicles in the UK.[ix] Assuming American vehicles achieve a similar reduction in CO_2 emissions, enforcing the speed limit in the US could result in roughly 55 million fewer tons of CO_2 over four years—the equivalent of removing over 8.3 million Toyota Camrys from the road.[x,xi]

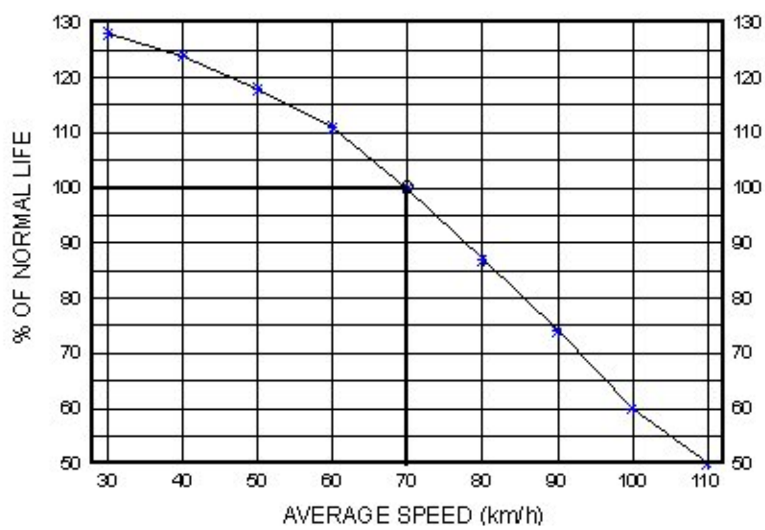
Vehicle Maintenance

Tires

The rate at which a tire wears is a function of several variables, including wheel alignment, road surface texture, tire rotation maintenance, vehicle weight, tire size, braking practices, and vehicle speed.[xii] On a basic level, friction between the road and tire causes the eventual erosion of tread. At higher speeds, greater stress (more friction) is applied to the tire's tread as it works harder to keep a grip on the road. The following chart illustrates the effect of speeding on tread wear.

Figure 3

Tread Wear as a Function of Average Speed



According to renowned tire manufacturer Pirelli, driving 70 kph rather than 85 kph (a difference of about 10 mph) results in 20% less tire wear. For large fleets using thousands of expensive tires each year, driving the speed limit could save several thousand dollars on tires alone.[xiii]

Brakes

The kinetic energy of a vehicle increases with the square of the vehicle velocity according to the following equation:

$$\text{Kinetic Energy} = \frac{1}{2} * \text{Mass} * \text{Velocity}^2$$

In simple terms, this equation says that at 20 mph, while vehicle speed is twice what it is at 10 mph, vehicle energy is four times greater than it was at 10 mph. In other words, brakes have to work four times harder to stop a vehicle traveling 20 mph than they would to stop a vehicle traveling 10 mph. At higher speeds, when a vehicle's kinetic energy is already very large, even relatively small increases in speed result in a massive increases in energy, requiring brakes to work *much* harder to stop or slow a vehicle.

Consider a simple example: A Toyota Camry (approx. 1,673 Kg) moving at 60 mph (26.82 meters-per-second) carries an energy of 601,714 joules.[1] However, with a 17% increase in speed (to 70 mph), the Camry now has an energy of 819,000 joules—a 36% increase in kinetic energy. Said another way, if the driver of the Camry consistently travels at 70 mph instead of 60 mph, his or her brakes will have to work 36% harder to slow the car, and therefore will wear out about 36% faster.

Speeding Effects Summary

After understanding the health, financial, and environmental consequences of speeding, one thing is clear: drivers need to slow down. However, as researchers Brenda Harsha and James Hedlund point out, government solutions have largely failed. Unfortunately, private enterprise has been equally ineffective in solving the speeding problem. A new approach is necessary.

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None of traffic safety's 'Three E' strategies—education, enforcement, and engineering—used in attempts to control speeding, has had much effect. A new approach is necessary.

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Governors and Monitors

Several fleet management and driving safety companies claim some type of "speed control" capability. These solutions generally come in two basic forms: governors and after-the-fact speed monitors.

Governors are devices that mechanically or electronically limit the speed a vehicle can travel. Governors are common on high performance cars with high top speeds (which are typically governed to travel no faster than 155 mph), but governors are making their way into more conventional driving situations as well. For example, as of 2010, Ford offers a consumer-focused product called MyKey that limits its user to a top speed of 80 mph.

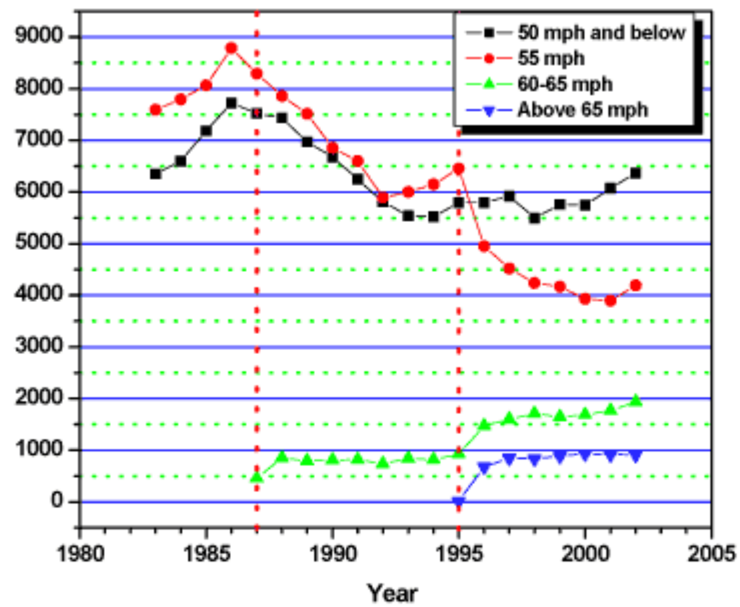
Driving monitors, on the other hand, are telematic devices that collect information from a vehicle and then report that data to a fleet administrator. Telematic devices "control" speed in much the same way governors do: by establishing a single maximum threshold and reporting speeds above the threshold.

There are numerous problems with governors and speed monitors. Their most fundamental shortcoming is that they address only a single top speed, and that does not get at the real problem.

[1] A joule is the basic unit of measurement for kinetic energy.

A common misconception is that speeding is only dangerous at high speeds. However speeding is deadly even on slower roadways. In fact, in 2003, half of the speed-related fatalities occurred on roads posted at 50 mph or less. One-quarter occurred on roads posted at 35 mph or less (Figure 4).[xiv]

Figure 4
Speeding-Related Fatalities by Speed Limit, 1983-2002



Source: FARS 1983-2002

The *majority* of fatal accidents occur on slower roads. Therefore, while a governor or telematic solution that addresses a single maximum threshold will do *some* good, they fail totally to address the pressing need for speed control on slow streets. A truly effective speed control system must address speeding on *all* roadways.

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Requirements of an Effective Speeding Solution

Governors and the vast majority of telematic solutions fall short of an effective solution in more than their ability to address speeding on all streets. In a May 2009 STET study, the Insurance Institute for Highway Safety (IIHS) found that, "Instances of speeding by more than 10 mph over the posted limit were significantly reduced only when each of three conditions was satisfied: (1) alarms sounded in the vehicle, (2) speed-related report cards were emailed to parents, (3) teen drivers were given the chance to cancel report card notifications by slowing down."[2]

While the IIHS focused on teen drivers, inthinc has found the same criteria hold for speed limit compliance in commercial applications. To change drivers' speeding habits, there must be real-time feedback when the speed limit is broken, a grace period for the driver to correct his behavior without repercussions, and finally there must be accountability to someone in authority in cases where speeding is not corrected. inthinc, a leader in safe driving telematics solutions, provides the only solution that meets these criteria.

Speed-by-Street™: A New way to Address Speeding

Speed-by-Street is a standard feature available in all inthinc solutions. It provides real-time alerts to users when their vehicle exceeds the speed limit. Using GPS technology, the system knows the location of the vehicle and the speed limit for that street.

Sources of Data

Three sources of information comprise inthinc's speed limit database. The first source is inthinc's partnership with a leading global provider of digital map data. This relationship grants inthinc access to accurate speed limit data for most major metropolitan areas and all interstates. In addition to physically driving millions of miles of roads, inthinc's mapping partner has applied one of eight speed categories (Figure 7) to every road segment in the US and Canada. When an inthinc device travels along a road that has been physically driven, it will read the precise speed limit. On the other hand, when a device travels down a road with only a speed category, it will read the upper limit of the speed category as the speed limit. For example, on a category five road, the device will identify the bounds of the category (in this case, 31 – 40 mph), and alert when the vehicle exceeds the upper limit of 40 mph.

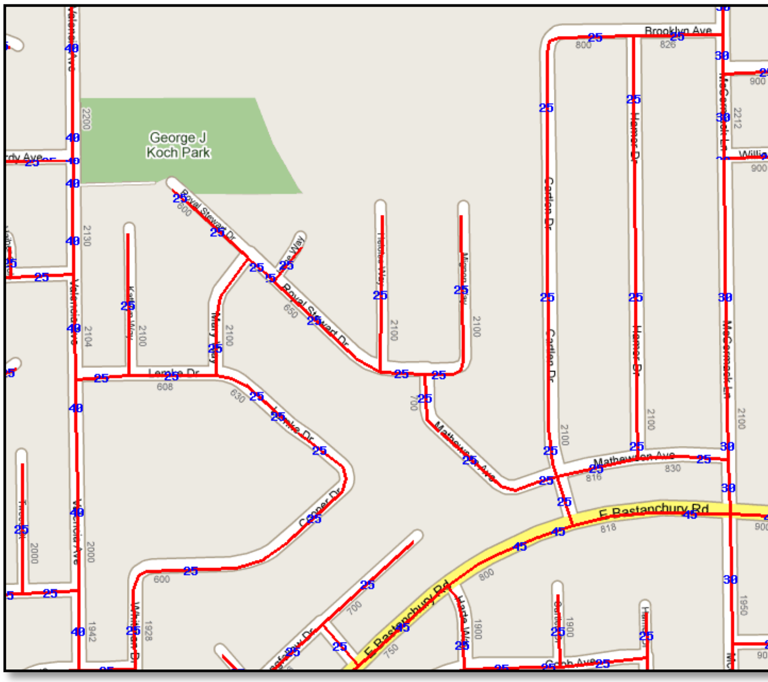
Figure 7
Speed Categories

Speed Category	Speed Band
1	Greater than 80 mph / 130 kph
2	65-80 mph / 101 - 130 kph
3	55-64 mph / 91 - 100 kph
4	41 - 54 mph / 71 -90 kph
5	31 - 40 mph / 51 - 70 kph
6	21 - 30 mph / 31 - 50 kph
7	6 - 20 mph / 11 - 30 kph
8	Less than 6 mph / 11 kph

[2] Farmer, Charles M., Bevan B. Kirley, and Anne T. McCartt. Effect of In-vehicle Monitoring on the Behavior of New Teenage Drivers. Insurance Institute for Highway Safety. May 2009.

Because inthinc is dedicated to improving on this information, the company has spent thousands of hours obtaining additional speed limit data directly from municipalities across the continent. A team of speed editors working across the United States gathers speed limit information from every municipality where inthinc has not already driven. These editors assimilate the data received from the municipality (Figure 8).

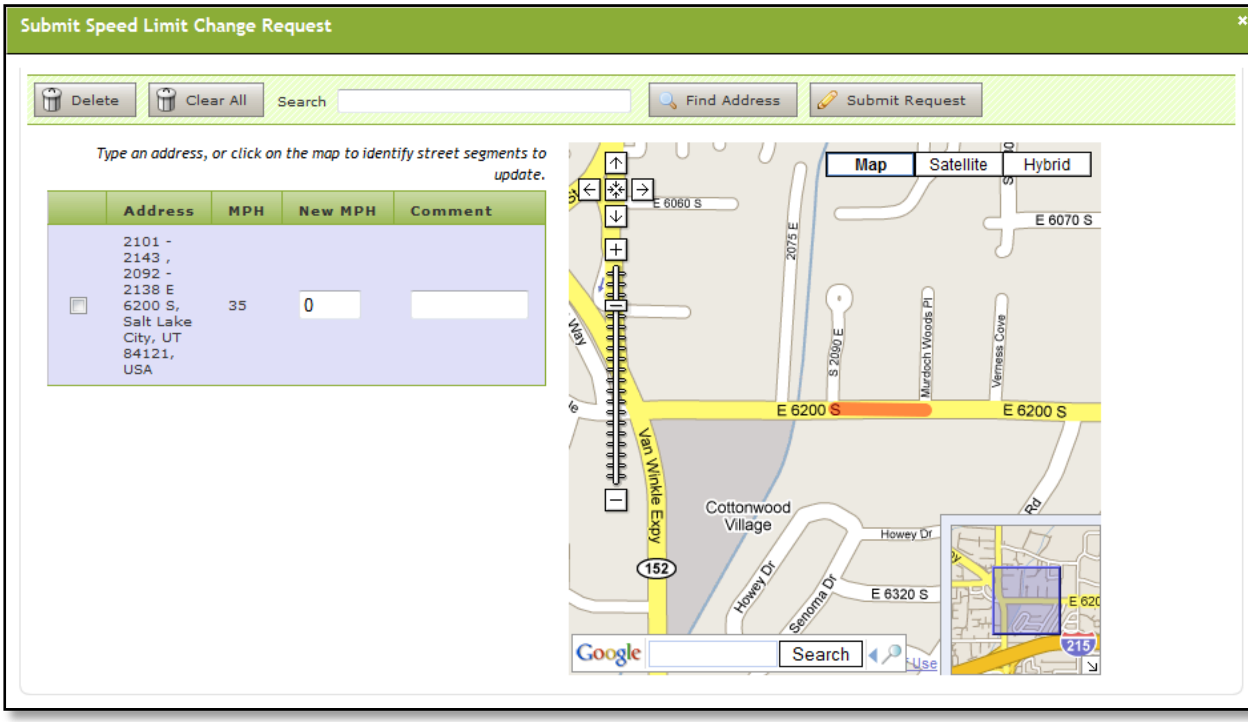
Figure 8
Proprietary inthinc Speed-by-Street™ Interface



inthinc users, another source of speed limit data, manage their devices through an online portal that shows vehicle trips, violations, locations, seat belt usage, vehicle speed, and many other important safe driving metrics. In addition to that information, the portal provides the user with an easy way to provide feedback on speed limit accuracy (Figure 9).

Figure 9

Speed Limit Change Request User Interface



User feedback is critical to refining and perfecting Speed-by-Street™. It also provides an efficient and accurate method to account for new development and changing speed limits.

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Speed-by-Street™ addresses speeding on every roadway in real-time by alerting drivers of speeding violations at all points rather than only in excess of a single maximum speed. No other safe driving solution has this capability.

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Combining the municipal speed data with partner information and customer feedback has resulted in the most reliable collection of speed limit information in the world.

Accuracy

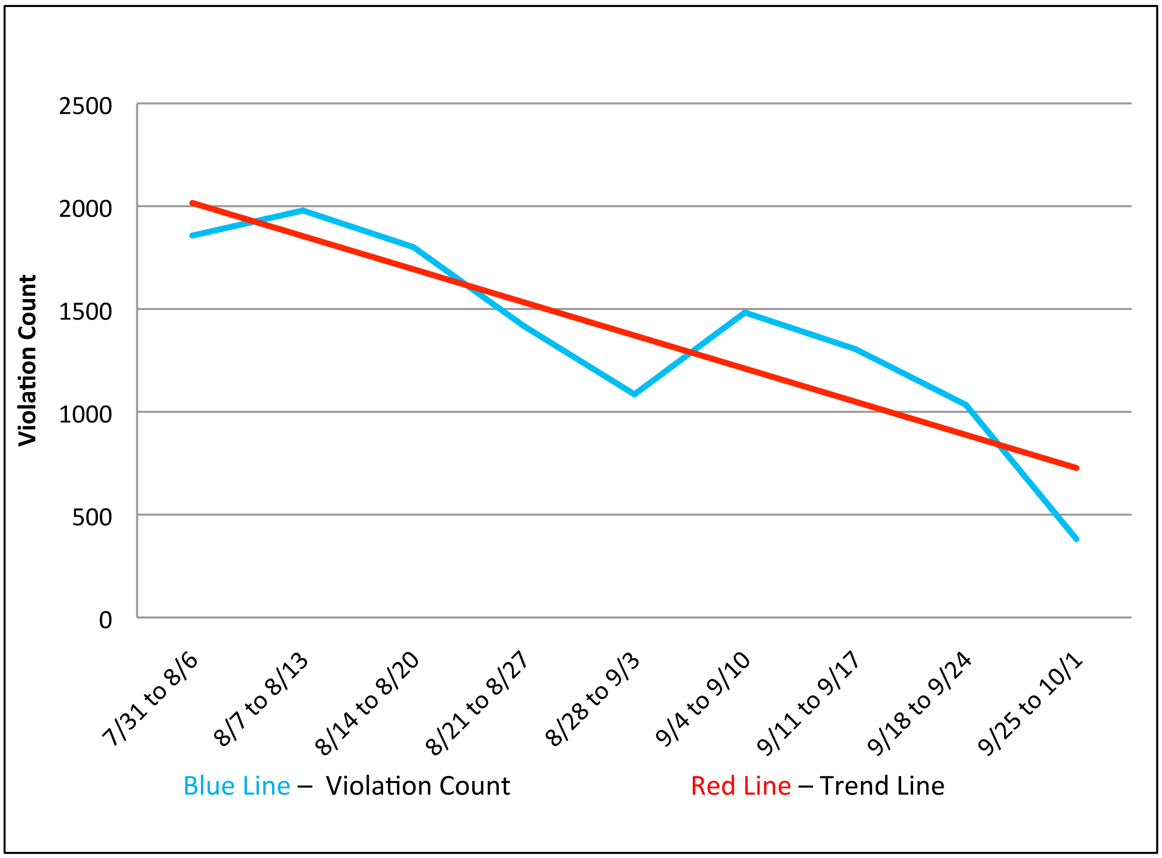
Speed limits can change and new roads are constantly under construction. Additionally, fallible human beings are often the source of our speed information and can be the source of mistakes in our data entry process; there will always be some error *built in* to the Speed-by-Street feature. However, after editing default speed limits and observing customer driving behavior, inthinc's information is correct roughly 90% of the time. Nevertheless, for *any* inaccuracy, inthinc has designed a user-friendly speed limit change request process that enables customers to provide feedback on speed limits for specific roadways. This process helps inthinc perfect the speed information for the areas its users drive in most.

Speed Reduction in a Real Fleet

In 2011, inthinc installed safety devices in a large oil field services fleet. The effect the devices had on speeding is displayed in Figure 10. From July 2011 to October 2011, speeding decreased from 75%.

Figure 10

Speeding Reduction in a Real inthinc Customer Fleet



It's reasonable to assume that this fleet experienced equivalent or greater decreases in total time speeding. This means that the fleet, which has installed several thousand vehicles, saved thousands if not millions of dollars on fuel, brakes and tires, expelled far less CO^2 into the atmosphere, and most importantly, reduced crashes and saved lives.

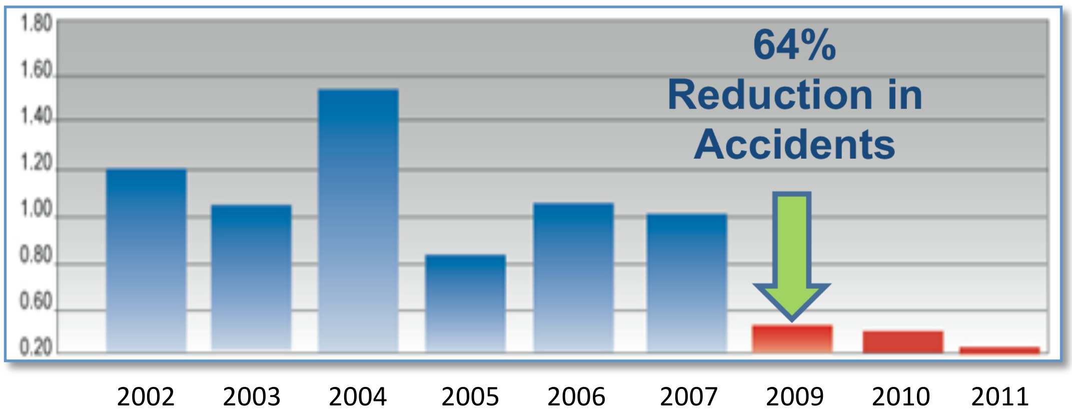
The inthinc Effect

A reduction in speeding (and other aggressive driving behavior) leads to a dramatic decrease in crash rates. As shown in Figure 11, the difference in crash rates in our current install base before utilizing inthinc technology and after utilizing inthinc technology is staggering (Figure 11).

Figure 11

The inthinc Effect

Crash Rates Per Million Miles



73% Improvement in Seat Belt usage

86% Reduction in Speeding Violations

89% Reduction in Aggressive Driving

Speeding is expensive, bad for the environment, and deadly. Speed-by-Street provides the formula to legitimately address this issue for the first time. This system, that knows the posted speed limit, provides real-time feedback, allows for a change in behavior without punishment, and reports to an authority, has been proven by independent research to *change dangerous speeding behavior*. True to inthinc's mission statement, Speed-by-Street users will save money, save the environment, and save lives.

About inthinc

inthinc is a global company centered on telematics, fleet solutions and driving safety. Its breakthrough driving safety solutions are designed to safeguard lives, save money and protect the environment. inthinc technology dramatically improves driver behavior and has been documented to reduce accidents by more than 80 percent. For more information, please visit http://www.inthinc.com.

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[i] Insurance Institute for Highway Safety: http://www.iihs.org/research/qanda/speed_limits.html
[ii] National Highway Traffic Safety Association. http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/Rpts/2005/809_839/pages/figure5.html
[iii] Harsha, Barbara and James Hedlund. Chaning America's culture of speed on the roads. Retrieved Jun 2009 from http://www.aaafoundation.org/pdf/HarshaHedlund.pdf
[iv] http://auto.howstuffworks.com/question477.htm
[v] http://www.fueleconomy.gov/feg/driveHabits.shtml
[vi] Internal inthinc Experiments, 2008.
[vii] The UK Energy Resource Center. Quick Hits: *Limiting Speeding*. October 2006. http://www.ukerc.ac.uk/Downloads/PDF/Q/Quick%20Hits/0610LimitingSpeed.pdf
[viii] Society of Motor Manufacturers and Traders. Retrieved Nov 2011 from http://www.smmt.co.uk/2010/04/number-of-cars-on-the-road-declines-for -first-time-since-second-world-war
[ix] Department of Transportation. Bureau of Transportation Statistics. Retrieved Jan 2009 from http://www.bts.gov/publications/national_transportation_statistics/html/table_01_11.html
[x] EPA. Retrieved Jan 2009 from http://www.epa.gov/oms/consumer/f00013.htm
[xi] Data360. Retrieved Jun 2009 from http://www.data360.org/dsg.aspx?Data_Set_Group_Id=629
[xii] Gilles, Tim. Automotive Chassis: Brakes, Steering & Suspension. Page 270.
[xiii] Pirelli Tire North America. Retrieved June 2009 from http://www.us.pirelli.com/web/technology/about-tyres/tyres-advice/tread-wear-func-avg-speed/default.page
[xiv] Compton, slide 22; NHTSA (2005), Traffic Safety Facts 2003. DOT HS 809 775. Retrieved June 2009 from www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSFAnn/TSF2003.pdf