The results business

RICK SCHUMAN and PETE COSTELLO hold court with a look at the National Traffic Scorecard. You are probably not alone in wondering why no-one has thought of this before...

What would you do with billions and billions of traffic data points over a span of a few years across a very large country?

Well, INRIX answered this question by developing the National Traffic Scorecard, the most comprehensive country-wide perspective and city-by-city analysis of one of the USA's most frustrating and intractable issues: traffic congestion. How bad is traffic overall? Which cities have the most traffic congestion? Where are the worst bottlenecks across the country? The National Traffic Scorecard, available at http://scorecard.INRIX.com, answers these questions and more.

The INRIX National Traffic Scorecard was created through extensive analysis of nearly 50,000 miles of primary roadways, using INRIX's traffic data warehouse of the most recent, complete and accurate data available anywhere. The focus of the Scorecard is the calendar year 2007. Calendar year 2006 data is utilized to enable year over year comparisons.

The INRIX National Traffic Scorecard is the first to measure the USA's traffic congestion problems by evaluating real-time traffic on almost every major metropolitan highway nationwide from a traveler's point of view. It leverages INRIX's Smart Dust Network, which collects data from nearly one million anonymous, GPS-equipped commercial vehicles that report their speed and location continually to INRIX - over a billion data points every month.

INRIX took a detailed look at traffic problems all across the USA - zooming in on the total hours spent in traffic, worst day of the week for commuting and average speeds for the top 100 cities in the US, along with hundreds of other details including the identification of the nation's worst bottlenecks that Americans drive through every day.

It's no revelation that cities such as Los Angeles, New York and Chicago are at the top of the list for worst traffic in the nation accounting for over 50 per cent of the top 1,000 bottlenecks nationwide. But Honolulu? The Scorecard reveals that traffic in cities such as Honolulu keep drivers idling, burning fuel and raising their blood pressure on roadways choked with traffic. If you happen to be driving on a Thursday from 5 to 6pm on its main highways you're no longer in the Aloha State: congestion-wise you're in the worst place and worst hour of any single roadway in the US, taking 88 per cent longer to get where you're going than if there were no congestion. Who would have though it (other than Honolulu residents, of course)?

Methodology

The INRIX National Traffic Scorecard draws from several existing approaches to calculating traffic congestion and leverages new methods made possible by INRIX's proprietary data.

The raw data comes from the historical traffic data warehouse of the INRIX Smart Dust Network. Since 2006, INRIX has acquired billions of discrete "GPS-enabled probe vehicle" reports from commercial fleet vehicles (including taxis, airport shuttles, service delivery vans, long haul trucks, etc) and cellular probe data. Each data report from these GPS-equipped vehicles includes at a minimum the speed, location and heading of a particular vehicle at a reported date and time.

INRIX has developed efficient methods for interpreting probe vehicle reports that are provided in real-time to establish a current estimate of travel patterns in all major cities in the United States. These same methods can aggregate data over periods of time to provide reliable information on speeds and congestion levels for segments of roads. With the nation's largest probe vehi-

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Table 1: Top 10 Drive Time Congestion Compared to Los Angeles

Rank	CBSA (Population Rank)	% Compared to Worst Market
1	Los Angeles-Long Beach-Santa Ana CA(2)	100
2	New York- Northern New Jersey-Long Island NY-NJ-PA (1)	88
3	Chicago-Naperville-Joliet IL-IN-WI (3)	44
4	Washington-Arlington-Alexandria DC-VA-MD-WV (8)	37
5	Dallas-Fort Worth-Arlington TX (4)	34
6	San Francisco-Oakland-Fremont (12)	34
7	Houston-Sugar Land-Baytown TX (6)	31
8	Boston-Cambridge-Quincy MA-MH (10)	28
9	Seattle-Tacoma-Bellevue WA (15)	26
10	Atlanta-Sandy Springs-Marietta GA (9)	25

cle network, INRIX has the ability to generate the most comprehensive congestion analysis to date across the country; the Scorecard covers the nation's 100 largest metropolitan areas according to the US Census Bureau's definition of Core Based Statistical Areas for 2007.

Roads/segments analyzed

The National Traffic Scorecard focuses on the major limited access roads in the top metropolitan areas in the United States. In all of its products, INRIX utilizes an existing industry standard known as "TMC location codes" developed and maintained by the leading electronic map databases vendors, including Tele Atlas, to uniquely define road segments.

The typical road segment is the interchange and the portion of linear road leading up to the interchange across all lanes in a single direction of travel. The length of a segment will depend upon the length of the distance between interchanges. For the National Traffic Scorecard, over 47,000 road miles in nearly 31,000 discrete road segments have been analyzed. Of note is the fact that over 8,000 of these segments experienced 1 hour or more of congestion per week as defined below.

Top 3

A study by a traffic information provider ranked Los Angeles as the most congested city in the country. Here are the three worst bottlenecks in the city:

1. The southbound 101 Freeway at Vermont Avenue.
2. The northbound 405 Freeway at the 90 Freeway.
3. The northbound 101 Freeway at Alameda Street.

SOURCE: INRIX

Road segment data

There are two key building blocks for the different analyses included in the National Traffic Scorecard:

- Reference speed (RS): For each road segment, all probe vehicle reports obtained in overnight hours (where congestion is usually unlikely) in 2007 are analyzed. The 85th percentile of those data points is identified as the "reference speed" for that particular road segment. This is typically the speed of "free flow" traffic if and when no congestion exists. Each segment has a single reference speed.
- Hourly average speed (HS): All probe vehicle reports for each road segment are grouped by hour of day, day of week (e.g. Monday from 3-4pm) and an "average speed" for each time slot is established for each road segment. Thus, each TMC location code across the 800,000 miles of US roadway that INRIX covers has 168 corresponding hourly average speed values – representing 24 hours of each day times the seven days in a week. The Scorecard focuses on the 47,000 urban limited access miles in the 100 largest metropolitan areas.

Overall congestion by metropolitan area

To assess congestion over a metropolitan area, INRIX utilizes concepts that have been used in similar studies.

- Travel Time Index (TTI): TTI is the ratio of actual travel time to free flow travel time. The TTI expresses the average amount of extra time it takes to travel relative to free-flow travel. A TTI of 1.3, for example, indicates that a 20-minute free-flow trip will take 26 minutes during the peak travel time periods, or a 6-minute (30 per cent) travel time penalty. For each road segment, a TTI is calculated for each hour of the week, using the formula TTI = RS/HS.
- Peak Hours: To assess and compare congestion levels year to year and between metropolitan areas, only "peak hours" are analyzed. Consistent with similar studies, peak hours are defined as the hours from 6 to 10am and 3 to 7pm, Monday through Friday – 40 of the 168 hours of a week.

For each Metropolitan Area, an overall level of congestion is determined for each of the 40 peak hours by determining the extent and amount of average congestion on the analyzed road network. This is easy to compute once hourly TTI's are calculated for each segment:

- Step 1: For each of the 40 peak hours, all road segments analyzed in the CBSA are checked
- Step 2: Each segment where the TTI > 1 is analyzed further
- Step 3: With each segment contributing a congestion factor, the average congestion (the amount the TTI is greater than 1) is multiplied by the length of the segment
- Step 4: For a given hour, overall metropolitan congestion is the sum of these congestion factors
- Step 5: To establish a Metropolitan Travel Time Index, this metropolitan congestion factor is divided by the number of road miles

Using 2007 as a baseline, INRIX computed a National Travel Time Index for the USA of 1.133 which will be used for comparison to future versions of the Scorecard. The 2007 National Travel Time Index represents a 1.9 per cent increase from 2006.

Bottlenecks

With the unique ability to examine in detail nearly 31,000 urban highway road segments, INRIX identifies the specific locations in each metropolitan area – and can compare locations across the country – that are consistently congested and labels them as "Bottlenecks."

Congestion – and how to measure it – can be in the eye of the beholder. Is congestion defined as how bad a road segment is at its worst or is it how often the segment gets "congested" (and what is the threshold for "congestion" anyways – tapping the brakes, stop and go conditions, etc.)? INRIX has developed a method that combines both the amount of time a road segment is congested with the intensity of congestion during those periods. The process used to analyze each road segment is as follows:

- The same RS and HS values are utilized as in the overall congestion by metropolitan area portion of the study
- All 168 hours of the week are considered, not just the 40 "peak hours." As will be evident in the data, severe Bottlenecks aren't just limited to peak hours
- For each hour of the week that the average speed is less than 50 per cent of the reference speed, the hour is considered "congested"
- For all "congested" hours, the average intensity of the congestion is determined by establishing an average travel time ratio
- The total Bottleneck factor equals the number of hours of congested by the average travel time ratio

Each road segment's Bottleneck factor can be compared with others in a metropolitan area and against all Bottlenecks nationally. It can also be compared year-to-year, as INRIX will do going forward.

Findings

So, what are the results of all these billions of data points used to identify congestion and bottlenecks across the USA in 2007? INRIX summed up overall congestion in the 40 hours of peak drive time and Los Angeles had the

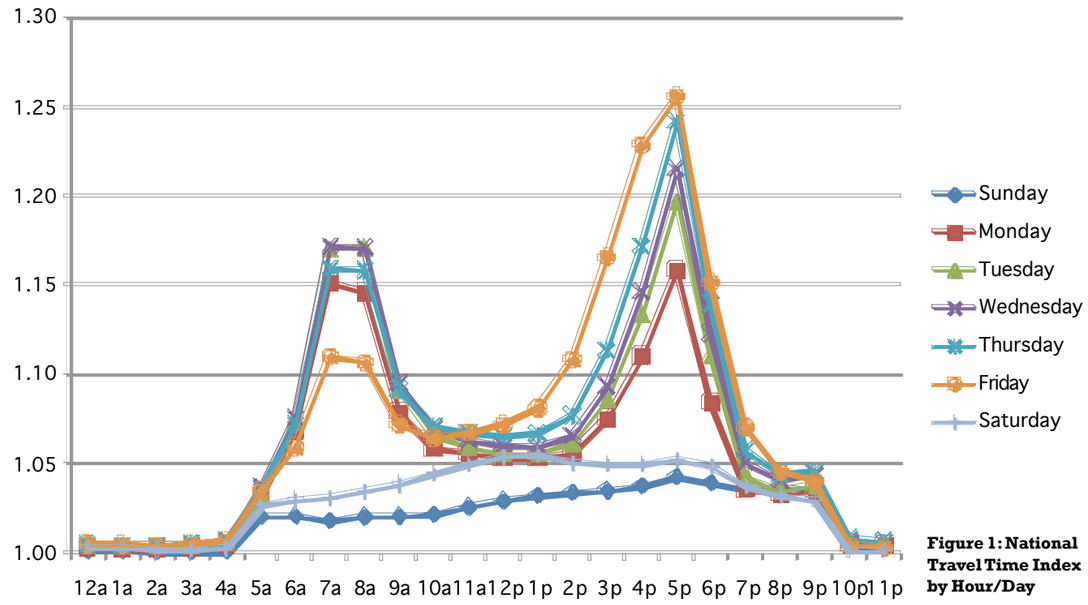

Figure 1: National Travel Time Index by Hour/Day

Table 2: Top 10 Congestion by Travel Time Index

Rank	CBSA (Population Rank)	Travel Time Index
1	Honolulu HI (56)	1.47
2	Los Angeles-Long Beach-Santa Ana CA (2)	1.45
3	Bridgeport-Stamford-Norwalk CT (56)	1.32
4	San Francisco-Oakland-Fremont CA (12)	1.31
5	New York- Northern New Jersey-Long Island NY-NJ-PA (1)	1.29
6	Seattle-Tacoma-Bellevue WA (15)	1.29
7	Austin-Round Rock TX (37)	1.28
8	Washington-Arlington-Alexandria DC-VA-MD-WV (8)	1.28
9	San Diego-Carlsbad-San Marcos CA (17)	1.24
10	Chicago-Naperville-Joliet IL-IN-WI (3)	1.23

highest amount of overall congestion. Using Los Angeles as a baseline of 100 per cent, INRIX compared all other metropolitan area's congestion to Los Angeles: New York was second and Chicago was third.

At number 10, Atlanta had 25 per cent of the overall congestion on its road network that Los Angeles experiences (see Table 1)

By examining the Hourly Travel Time Index in metropolitan areas across the country, the INRIX National Traffic Scorecard also identified unique patterns evolving out of U.S. traffic congestion (Figure 1):

- Worst Traffic Day: Friday
- Worst Week Day Commute: Friday pm
- Worst Commuting Hour: Friday 5-6pm
- Worst Morning Commute: Wednesday am
- Best Week Day for Traffic: Monday
- Best Week Day Commute: Friday am
- Best Week Day Commuting Hour: Friday 6-7am
- Best Week Day Afternoon: Monday pm

By determining a Travel Time Index, INRIX was able to make metropolitan area to metropolitan area comparisons to assess how much longer travelers took to travel as compared to free flow conditions. Surprisingly, INRIX identified Honolulu as having the worst peak drive time TTI in the nation and adding some fuel to an ongoing debate in Hawaii on appropriate measures to deal with their recurring traffic congestion situation (see Table 2)

INRIX also identified the Nation's worst bottlenecks and commuters on the Cross Bronx Expressway were not surprised that this area was worst in the nation with worst bottlenecks numbers 1 and 2 which are heavily congested at less than half the reference speed over 90 hours per week. The nation's third worst bottleneck was in a construction zone on I-580 in the San Francisco Bay Area – it will be interesting to see where this stretch of roadway ranks in 2008 as construction activities are finished. The metropolitan areas of Los Angeles, New York and Chicago account for more than half of the nation's worst bottlenecks reinforcing their top three finish in the congestion rankings.

INRIX developed Metropolitan Summaries that reflect both congestion and bottlenecks for use by local officials to compare their situation to others across the nation and to identify areas where measures to mitigate congestion may be considered. To follow is a sample for the Dallas/Fort Worth metropolitan area.

Figure 3 Map of bottlenecks across US (in Red)

INRIX understands that there a few factors that make the National Traffic Scorecard different from other studies to date. The coverage for the National Traffic Score card is mainline highways only – no ramps, arterials, etc. INRIX's data is strictly focused on speeds – not including volume nor weighting for lane-miles. There is varying network coverage in regions based on CBSAs throughout the country and the INRIX TTI scores are likely lower than most studies as the Scorecard includes greater fringe metropolitan area coverage. INRIX used its reference speed vs. flat free flow speed (e.g. 60mph). The definition of metropolitan areas could be different amongst studies as INRIX used CBSAs and other reports do not and therefore include Baltimore with the Washington, DC metropolitan area region – if the National Traffic Scorecard did this as well, then that metropolitan area would be the third most congested in the USA.

Summary

The primary purpose of the National Traffic Scorecard is to show that "keeping score" of traffic can occur across the US (and other countries) in more markets, on more miles and for more discrete segments / time slices than previously thought possible. INRIX's traffic data in the National Traffic Scorecard is open to much interpretation, but there are some quick, obvious conclusions:

- Even in a slowing economy with high fuel prices, congestion is a pervasive problem
- Los Angeles and New York are far ahead of the pack in terms of scale of slowdowns which points more to how bad these cities are, not how good it is in other places
- Bottlenecks are everywhere – not just at big interchanges in the largest cities
- There is no margin for error in many cities and if there is an accident or bad weather, many of these roads become hopelessly congested very quickly.

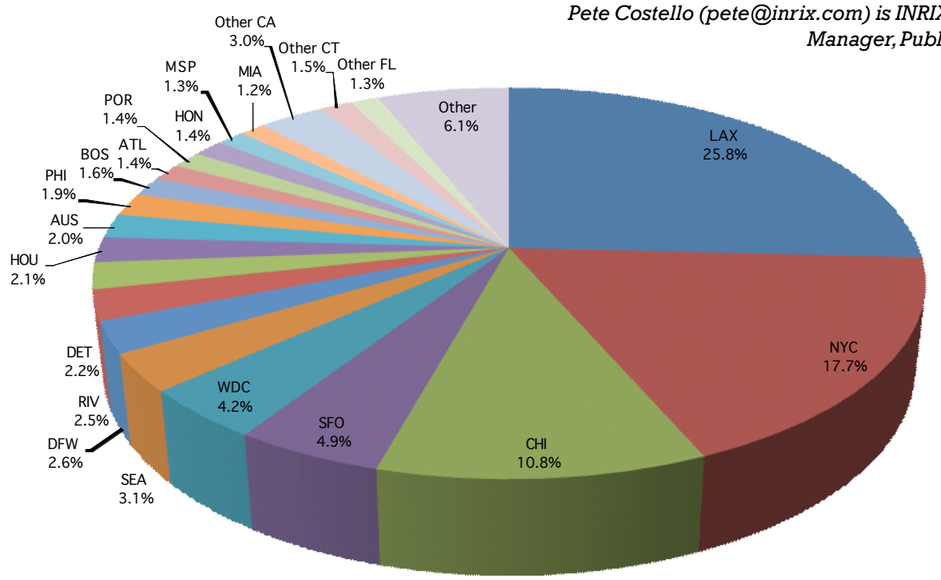

Figure 4 Pie chart of the 1000 worst bottlenecks by CBSA

Acknowledgements

INRIX historically works with data providers, technology partners, experts and our customers to address traffic issues in North America and Europe. Collaborating to create unique and important products has been key to INRIX's success.

This Scorecard is no different. INRIX would like to thank several organizations and individuals who have assisted in one way or another in creating the Scorecard. Tim Lomax and Shawn Turner of the Texas Transportation Institute, Rich Margiotta of Cambridge Systematics and Mark Hallenbeck of the University of Washington aided in development of the methodology used.

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The extensive data powering the INRIX National Traffic Scorecard is immediately available under license for further analysis and review by government agencies and commercial organizations including transportation industry organizations. TH

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