August 8, 2002

THE FUTURE OF TRAFFIC SIGNALS

Back in 1997 I gave a presentation at the IMSA National Meeting in St. Petersburg entitled: "The Future of Traffic Signals". In that presentation, I took a somewhat tongue-in-cheek look at the way highway technology and traffic signal technology might change over the next 50 years. Although it was my primary intention that the presentation be entertaining, some attendees actually found the presentation thought-provoking and of some technical merit. In this article I am providing an updated summary of my "look-ahead" at the next 50 years of traffic in America:

2000: Widespread Use of LED Signals (side street reds first, then remaining reds, then yellows and greens) - I pretty much nailed this one, although I was a little optimistic in the timing.

2002: In-Vehicle Navigation via CD-ROM Available on Most Cars - I was once again a little optimistic on the timing, but we are definitely headed in this direction. However, it now appears that real-time wireless links via cell phone or satellite technology may replace CD-ROM's in the trunk. Wireless technology allows map updates to be centralized (which is better than having to swap-out a new CD every so often) and also allows the provision of real-time route information (construction activities, accident locations, incidents, draw bridge status, and so on). One day we may even get to the point where our travel time prediction algorithms are sophisticated enough to reliably recommend the best route to take given current traffic, weather and incident conditions. Eventually that computer in your car will provide you with almost any travel-related information that you might want, from the fastest route to Grandma's house to the closest AAA-rated hotel with an available room for under 50 dollars.

2003: Sub-Surface Radar Used to Locate Utilities - I can see the day when sub-surface technology currently being developed and perfected by other disciplines (archeology, mineral exploration, geotechnical engineering, etc.) will be used to accurately map underground utilities. As anyone involved in traffic signal design or construction knows, unknown or mis-located underground utilities are a common source of cost overruns and project delays. In extreme cases, utility location problems can require the complete re-design of a traffic signal installation. Technology which gives us exact three-dimensional GPS positioning of underground pipes and conduits would eliminate many design and construction problems. This technology would also eliminate the need for such items as detectable warning tape and conduit tracer wires. I think my previous timing was again optimistic, 2010 seems more reasonable.

2004: Hurricane Bubba Levels Miami

2004: NEMA and 170's Replaced by "Universal Control Module" - You can see this unification starting to happen already with manufacturer's marketing 170-type controllers that can be fitted into NEMA-type cabinets. I see the day when the NEMA/170 (or 2070) distinction will totally disappear with the best features of both types of controllers being incorporated into an interchangeable "universal control module" consistent with NTCIP requirements. Let's move this date back to 2008, although it will take decades to retro-fit all of our existing signalized intersections.

2005: Crime Rate in Florida Drops 42%

2005: Battery Back-Up Becomes Commonplace, Built Into Cabinets - A traffic signal with all LED's draws a fraction of the power that a signal using incandescent bulbs does, making it an excellent candidate for battery back-up. As battery technology continues to improve and as signal components become more energy efficient, one can easily envision compact, cost-effective battery back-up systems. The advent of such systems would allow the <u>routine</u> use of battery back-up during power outages caused by storms or utility breaks. Good-by to dark signals and the accidents and traffic jams they produce. We may even get to the point (maybe by 2015) where the signal could be continuously powered by solar-charged or "car-wind" charged batteries, making the need for electric service drops obsolete.

2007: Electric Cars Proliferate - Let me expand this to include all alternative-fuel cars, including hydrogen powered cars and hybrid gasoline-electric cars. With dependency on foreign oil reserves once again becoming a hot issue, and with automotive propulsion technology continuing to progress, I don't believe that we are too far away from affordable alternative-fuel cars that will have performance characteristics (speed, acceleration, range, etc.) comparable to gasoline engine cars. Just make sure you look both ways before crossing the street, electric vehicles can be dangerously quiet.

2008: Increased Use of Wireless Vehicle Detection - Until just recently, all vehicle detection systems had to be connected back to the traffic signal controller via some sort of lead-in cable. However, lead-in's and their associated conduit (or pavement saw-cuts) cost money to install and are a potential weak-point in the detection system (bad splice, lead-in severed, etc.). Wireless detection systems are starting to appear and they will become a more and more attractive alternative as battery technology progresses to the point where the in-pavement detection unit (or, in the more distant future, the above-pavement camera) can operate for many years without battery replacement.

2009: After 64 years Without a Championship, Indians Move From Cleveland to Tucson

2010: Graphics-Based GIS Database Used for Signal Inventory - Traffic signal as-built plans and inventories will increase in both completeness and accuracy as information (including pictures of the intersection, timing records, equipment repair records, and so on) are logged into user-friendly databases. GPS units will be used to accurately locate and dimension all physical features of the signal, including poles, pull boxes, signal heads, and inductance loops. The exact longitude, latitude, and altitude of every item will be recorded.

2011: Tucson Pueblos Win World Series, Defeat Pensacola Fire Ants 4 Games to 2. Suicide Rate in Cleveland Skyrockets.

2012: Traffic Signal Plans Go 3-D - Two dimensional black and white traffic signal plans will be replaced by electronic three dimensional color traffic signal "models". These models will have advanced simulation capabilities so that the engineer can see exactly how the signal will appear to drivers as they approach the intersection from each direction. Signing and sealing of engineering plans will be done by fingerprint or iris-scanning. All plan distribution, bidding, and contract documentation will be conducted over the internet. I'm getting all misty-eyed thinking of the good 'ol days of drafting tables, blueprint machines, highway curves, and slide-rules.

2013: Widespread Use of Traffic Signal Detection Systems to Collect and Tabulate Traffic Data - Vehicle detection systems at signalized intersections will become quite sophisticated in the type of data that they collect. Besides automatically recording and logging traffic volumes by lane

and movement, they will interface with vehicle transponders (first on probes, and then on all vehicles) to collect and tabulate travel time information, origin-destination information, and vehicle classification data. Us traffic engineers will know where you came from and when you left, as well as where you went and when you got there. I've always been afraid of big brother watching, but I feel much better about it now that I realize that I'll be on big brother's team!

2014: Telecommuting - The percentage of urban office employees telecommuting at least 1 day a week will rise to over 20% nationwide, significantly reducing peak hour traffic volumes in many major cities.

2015: Vehicles "Dummy-Proofed" - New vehicles will come equipped with a standard package of warning devices and associated controls on the steering, brake and accelerator that will greatly reduce the probability of the car leaving the road or hitting another vehicle. Sideswipe, rear-end and backing accidents will be almost totally eliminated with right-angle and run-off-the-road accidents being greatly reduced. The annual fatality rate due to traffic accidents will drop from its historic value of 40,000 per year to under 10,000 per year. We have much of this technology right now; it will become more powerful and more widespread in the near future.

2017: After Decades of Corporate Mergers and Acquisitions in the Traffic Control Industry, Philman Systems Acquires Fujiami Controls: Making Philman the World's Only Manufacturer of Signal Control Equipment.

2018: Fingerprint ID and Breathalyzer Test Required to Start Vehicle - Vehicle thefts and deaths due to drunk driving will drop drastically. Many criminals and potential subversives will also be caught via FBI and Homeland Security monitoring of this and the traffic signal data collection system discussed earlier. Big brother now knows who is driving each car as well as where each car is. Things are getting a little spooky.

2021: Full Deployment of "Truck-Trains" on Automated Freeways - Long Distance Trucks will be grouped into "trains" that use special freeway lanes. The speed and path of these truck-trains will be automatically controlled with individual vehicles travelling virtually "bumper-to-bumper" at speeds of over 80 mph. Special staging areas near freeways will be used to assemble and de-assemble the truck-trains.

2023: Utah DOT requires audit of Philman Systems prior to Awarding State Traffic Signal Controller Contract. Final Arthur Anderson report states that it "really does cost $43,000 to make a traffic signal controller".

2024: Comprehensive Road Pricing System Implemented Nationwide - Alternative fuel vehicles now comprise 90% of the vehicle fleet and gasoline consumption has fallen to all-time lows. Consequently, another revenue source is needed to fund highway construction. Drivers are automatically charged per-mile fees for driving through a monitoring system linked to each vehicles on-board computer system. To reduce traffic congestion, the fee schedule is set such that the fees are higher on congested routes, especially during peak travel periods. The car's navigational system now provides the driver with information on the cheapest route as well as the fastest route.

2025: Hawaii Sold to Japan to Pay National Debt, Federal Taxes Cut in Half - This is a great idea. Why didn't someone think of this sooner?

2026: Full Deployment of "Car-Trains" on Automated Freeways - Cars get into the act on the

special freeway lane. The speed and path of these car-trains is also automatically controlled with individual vehicles travelling virtually "bumper-to-bumper" at speeds of over 120 mph. Sit back and a read a magazine as you and your family go from Fargo to Bozeman in 4 hours. (Just make sure little Billy goes wee-wee before you "hop on the train".)

2027: Start of Automated Surveillance and Ticketing - Information collected by traffic signal data collection systems is used to automatically issue tickets to offending motorists (Speeding: $200 per mile over the speed limit, Run-the-Red: $1400, Illegal Turn: $1700, Illegal Lane Change: $900, Blocked Intersection: $2200). Money is used for highway safety improvements and to expand the Homeland Security Department, which is now headed by a guy named "Boris".

2028: Chelsea Clinton Elected for Second Term - Ouch!

2029: Steel Mast Arm Poles and Aluminum Signal Heads Replaced by Tungsten-Carbide and Titanium Components - The new components are so lightweight that the entire intersection can be constructed without the need for cranes or other heavy equipment. They are also extremely strong and flexible, able to withstand hurricane-force winds. Resistant to vandalism, the components are available in a variety of designer colors, including my personal favorite: Jaguar teal.

2035: Surface Street Deployment of Automated Highways - Sensor technology has progressed to the point that all urban highways have become automated. Just punch in your destination when you leave the house and your car is automatically routed to your destination via the best available route. In fact, by 2045 you only need to drive your car when you go outside the urban area and are not driving on a freeway (all freeways are also automated by this time). No more accidents or traffic tickets when driving in town and your hands and eyes are free to do other things, like surfing the internet or watching television. Traffic signals are no longer needed in urban areas as intersection right-of-way is automatically controlled by sophisticated computer systems that control the path of each vehicle. Road capacity increases dramatically resulting in a virtual moratorium on new road building. 14,000 IMSA Level VI traffic signal technicians lose their jobs.

2041: On December 7th, 2041 the US bombs Pearl Harbor, Takes Back Hawaii - Seems only fair to me.

2043: Holographic Projection System Introduced - Traffic signal supports are completely eliminated as holographic projectors are used to position images of signal indications above intersections. No more signal heads, no more signal cable, no more bucket trucks.

2049: Development of PLV (Personal Levitation Vehicle) by Sontachi Transport - Personal vehicle travel is no longer restricted to the ground. The first 1000 feet of airspace in rural areas is reserved for use by PLV's (except in the vicinity of airports, of course). PLV use is not allowed in urban areas due to congestion concerns.

2050: As PLV's become popular and rural PLV congestion increases, a 3-D Virtual Reality Traffic Signal System is deployed to Reduce PLV Mid-Air Collisions - "Air highways" are created by the Federal Aviation Administration and traffic-signal-like indications are incorporated into the PLV's heads-up display. Driving becomes fun again!

2052: Hawaii Sold to the Chinese