FIREFIGHTER NEAR MISS

Auto Fire with Compressed Natural Gas (CNG) Fuel Tank Explosion

Prepared By Operations Division

REVISED Version November 24, 2007

Information Update 11/24/07

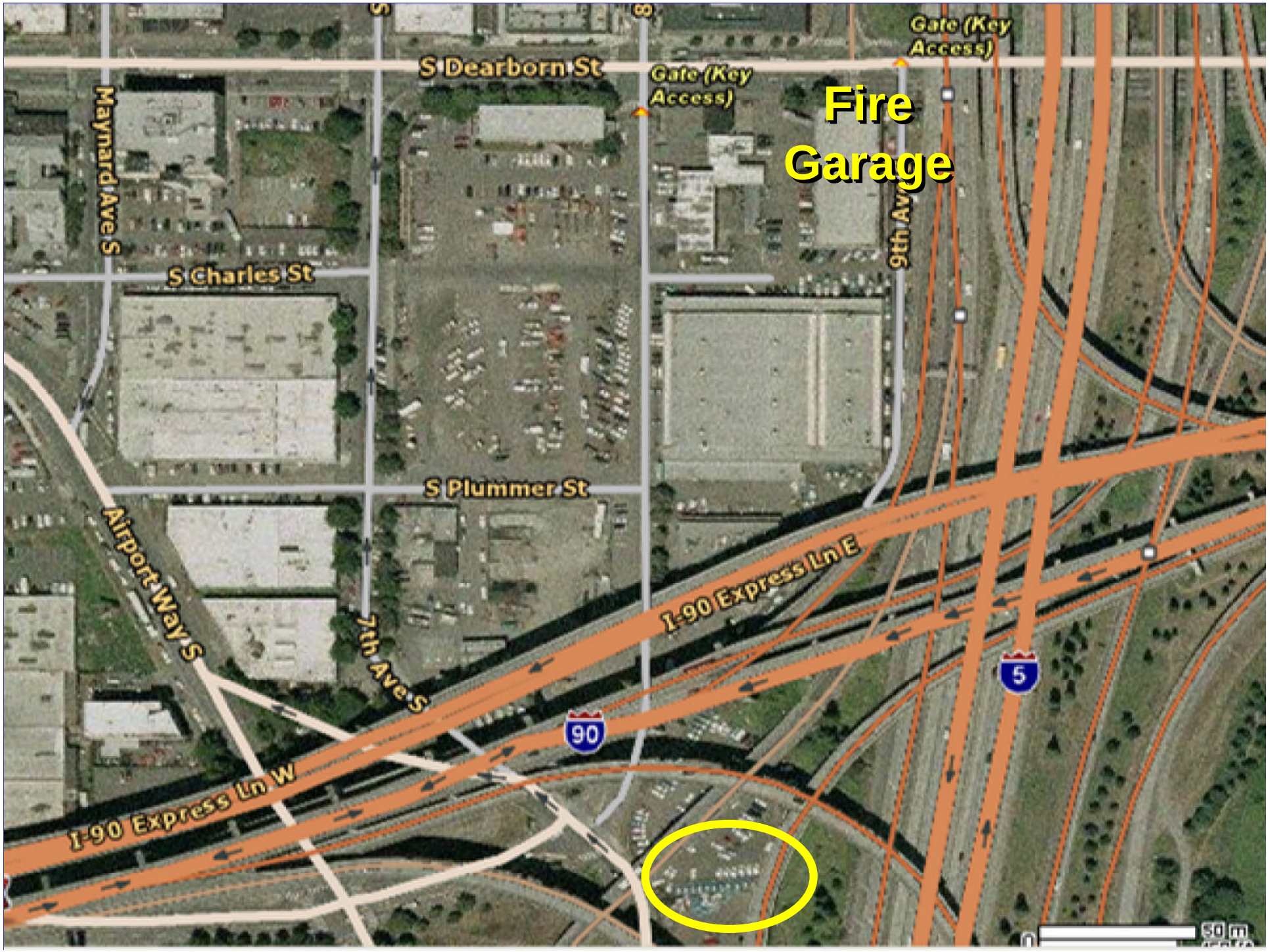
- On November 7, 2007, American Honda Service Division issued a bulletin to all Honda Sales, Service, and Parts Managers for a voluntary recall campaign of 1998-2007 Civic GX CNG vehicles
- Honda Motor Co. agreed to the recall in accordance with 49 CFR Part 573 Defect and Noncompliance Reporting

Information Update 11/24/07

- Honda will install a fire retardant blanket to the trunk side of the rear seat-back.
- The Bulletin stated the problem thus:
  "In the event of a severe interior fire in the area of the rear seat, the CNG tank may be heated unevenly, preventing the pressure relief device from venting the contents of the tank as designed. This could result in a tank rupture and even ejection of the tank from the vehicle. This situation was discovered after studying an act of arson on a Civic GX earlier this year."

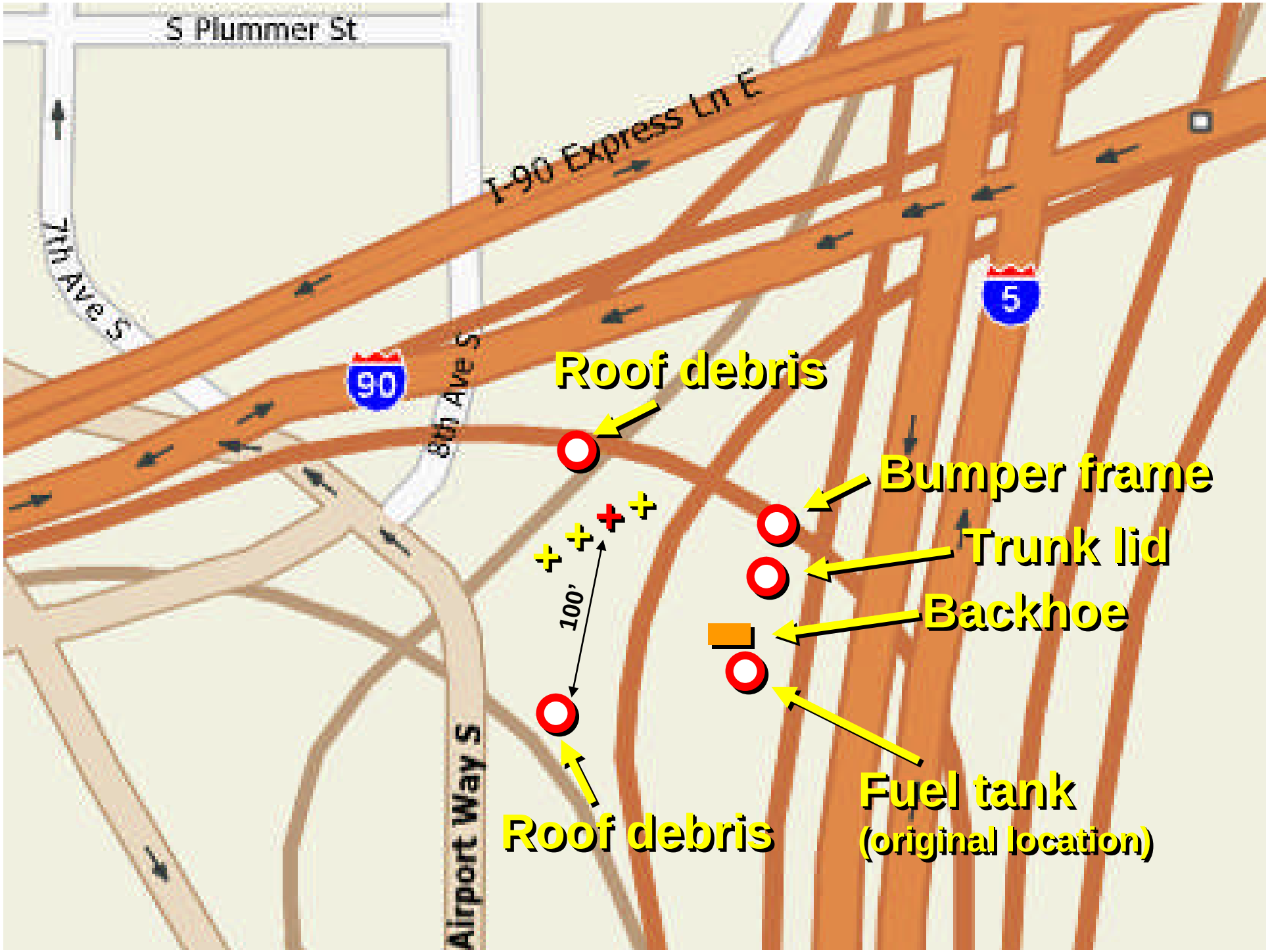
Incident #26564, March 26, 2007

- Dispatch 0230 hours for car fire (Engine 10)
- E10 arrived and requested FIB for multiple vehicles with possible structural exposures (freeway columns and overpasses)
- 12 vehicles damaged or destroyed
- Firefighter near miss when CNG vehicle exploded as E10 crew approached with a handline (approximately 50-75’ away)
- Determined to be arson

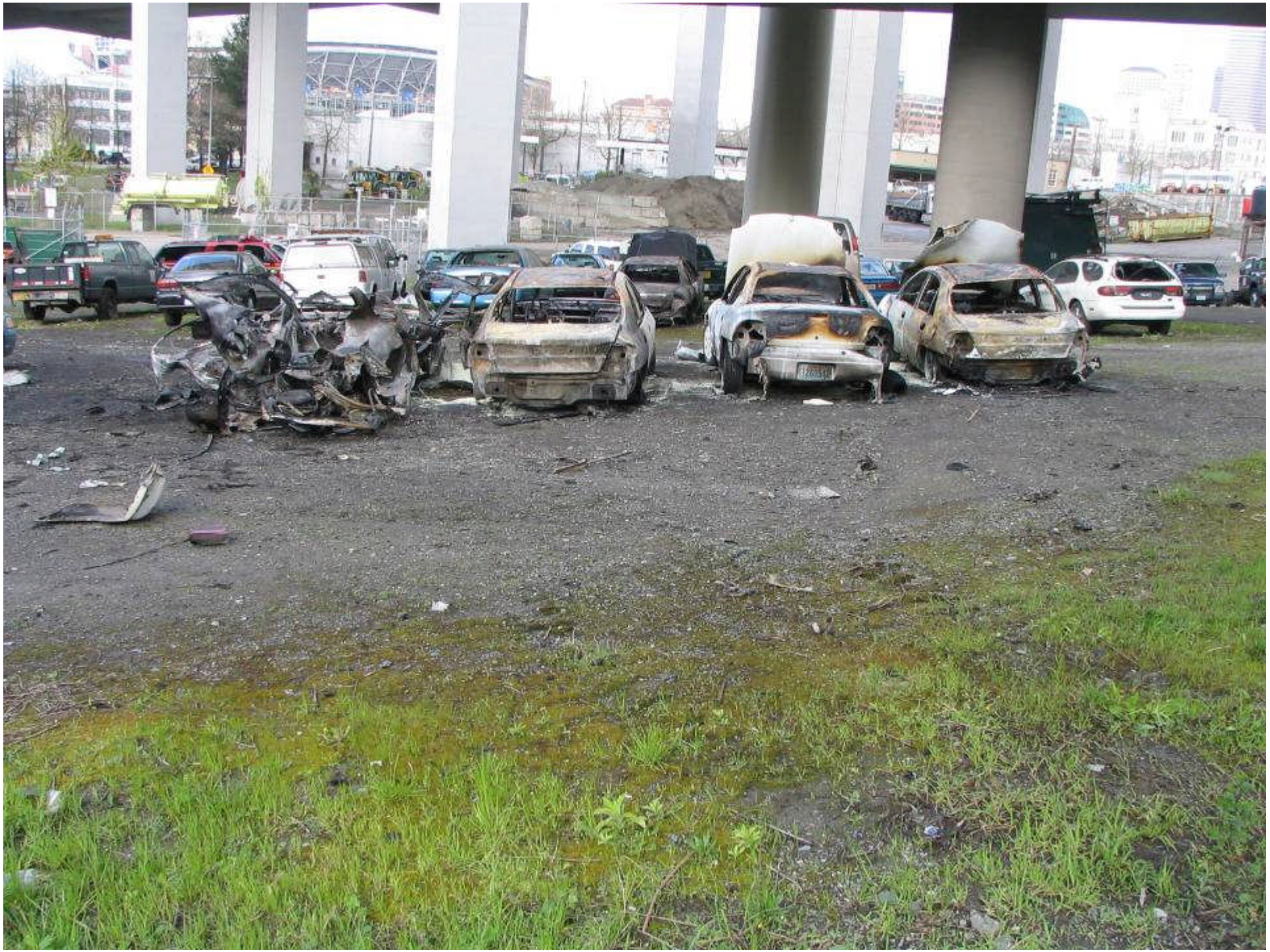

S Dearborn St
Gate (Key Access)
Gate (Key Access)
Fire Garage
Maynard Ave S
S Charles St
9th Ave
S Plummer St
Airport Way S
7th Ave S
I-90 Express Ln E
I-90 Express Ln W
90
5
50 m


I-90
2B
90
8th Ave South
Access Gate
E10
Royal Brougham
Airport Way S


E10 parked outside the gate here
Debris from the explosion was thrown up to 100’ in all directions including on the over-passes above the incident.

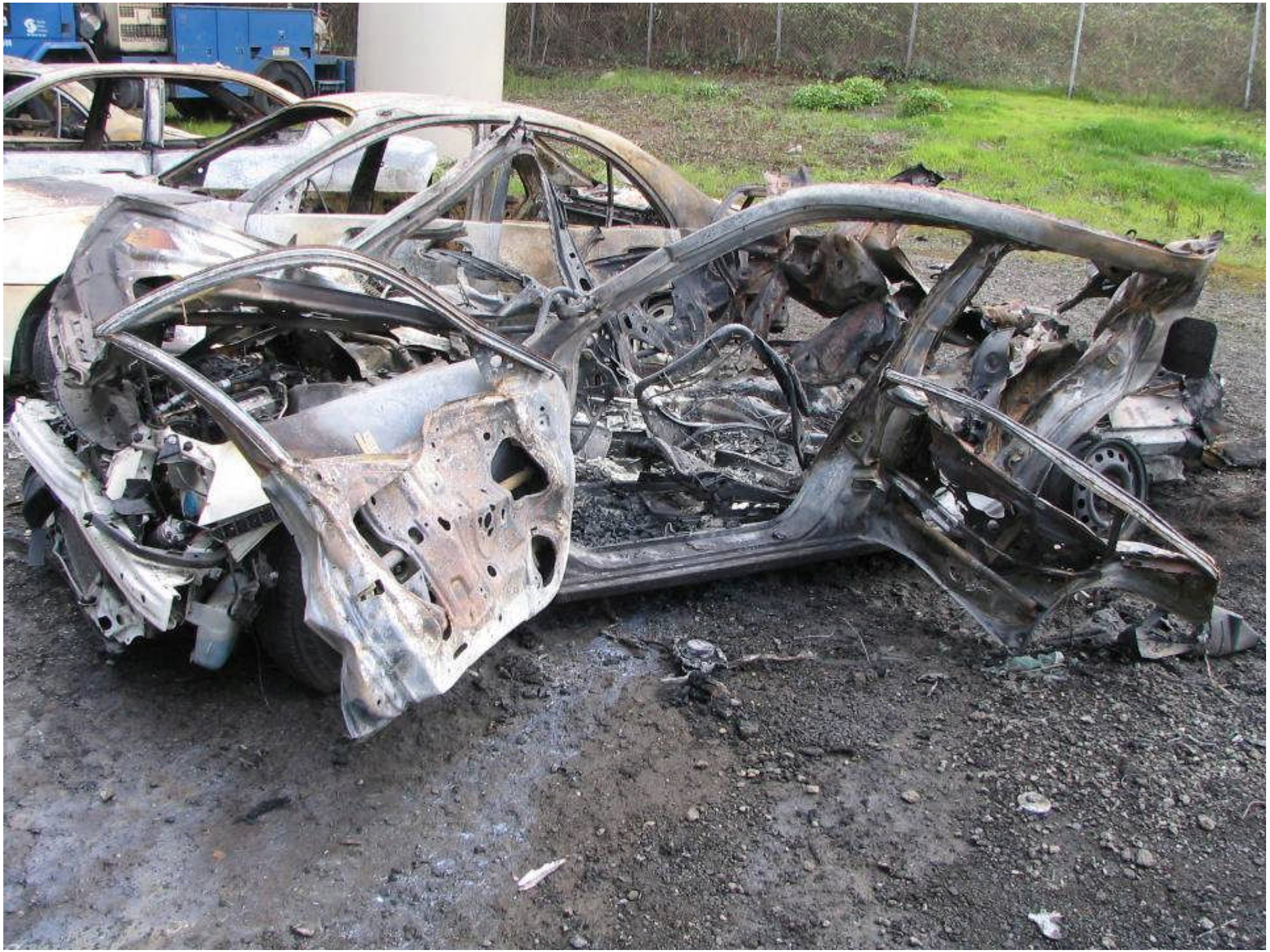

S Plummer St
7th Ave S
I-90 Express Ln E
90
8th Ave S
5
Roof debris
Bumper frame
Trunk lid
Backhoe
100'
Roof debris
Fuel tank
(original location)
Airport Way S


Honda CNG Vehicle

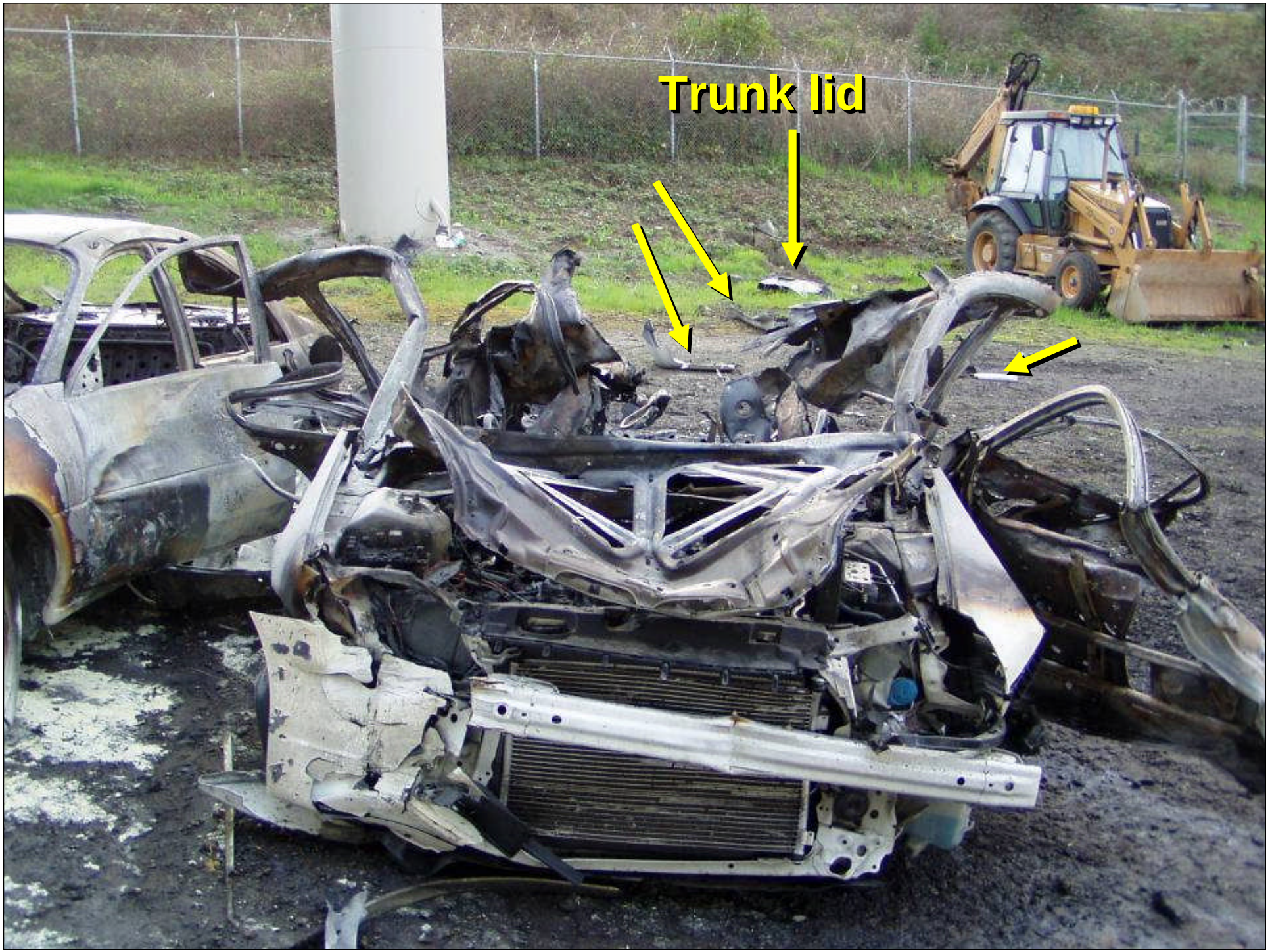



Rear of vehicle


Roof is blown completely
off vehicle and doors blown
open




Metal mounting
straps for CNG tank


Trunk lid


Tank initially landed here, about 100’ away
…then was moved down the hill for extinguishment.


Evidence indicates it may have ricocheted off the underside of a freeway overpass (next picture).


90’


Rear bumper frame 90'+ away


Bumper shrapnel
(note burn marks on
ground)


Roof section about 75’ away


This may be your only warning of a CNG – fueled vehicle. Typically located on the trunk lid or bumper.
WASHINGTON
39819D
EVERGREEN STATE
CNG


Composite tank is carbon-fiber / fiberglass
wrapped for strength – similar to our SCBA tanks.

Port of Seattle

August 07, 2003

Airport Taxis, Shuttles Convert to Natural Gas

New contract requires fleet conversions to improve air quality

The Port of Seattle Commission today authorized the renewal of contracts with two major providers of ground transportation at Seattle-Tacoma International Airport. The contracts, with the *Seattle Tacoma International Taxi Association (STITA) and Shuttle Express*, will require the two organizations to make major investments to convert their fleets to clean-burning natural gas.

Under its new contract, STITA will be required to convert its entire *160-cab fleet* to natural gas in the next three years. By converting more quickly, STITA will earn the right to extend the contract from five to seven years.

Historical Information

- Several NHTSA (National Highway Traffic Safety Administration) investigations
  - Example: January 27, 2003; Ford Crown Victoria on fire with flame impingement on CNG tank. The tank failed catastrophically prior to Pressure Relief Device (PRD) functioning.
  - Vehicle recall with dealers installing additional insulation behind back seat.
  - Number of vehicles still needing repair???

Code of Federal Regulations

- CFR 49, Part 571
  - Standard 304
    Compressed Natural Gas Fuel Container Integrity

    Flame Test Standard:
    Flame impingement generating 1550-1650° F. at the surface for the length of the cylinder for 20 minutes or until fuel is completely vented through PRV.

CNG Properties

- Compressed to 3,600 psi in fuel cylinder
- CNG rated at 117 octane fuel
- BTU per # = 22,800 (gasoline = 18,900)
- *Not* a liquid when compressed (it becomes a very close dense gas)
- *Not* the same as Liquified Natural Gas – LNG (cryogenic: -260° to become liquified)
- Lighter than air when released (.6 air)

CNG Properties

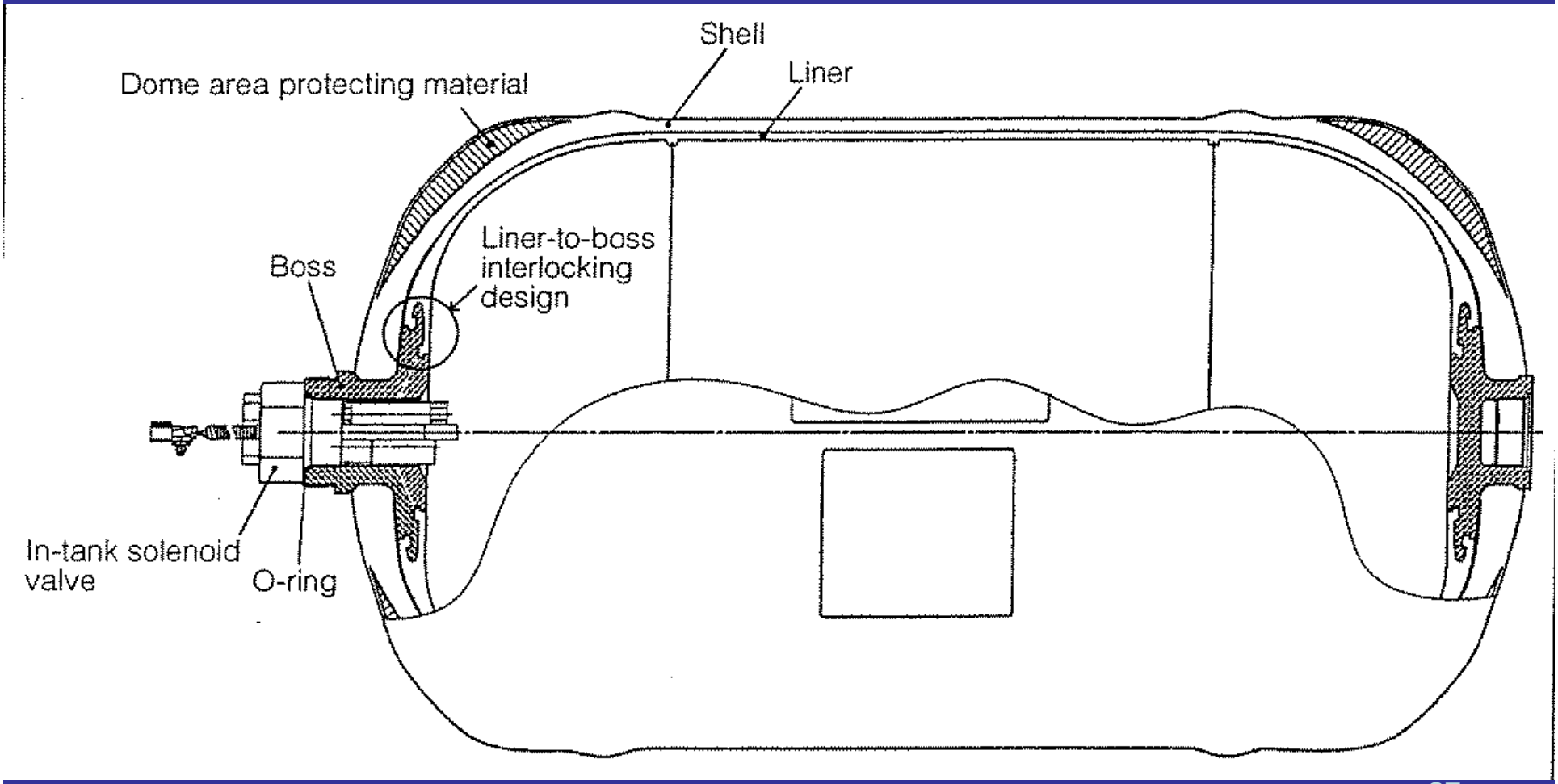
- LEL / UEL = 4 – 16% (gasoline = 1.3 – 7.6)
- 1 cubic foot of CNG = 245 cu.ft. of natural gas at sea level (uncompressed)
- 1 cubic foot of CNG weighs 13#
- 5.66# = 1 Gasoline Gallon Equivalent (GGE)
- Honda Civic tank = 8 GGE
- *Note: 1 gallon of gasoline properly vaporized has the explosive equivalency of 83 pounds of dynamite (CDC).*

Cylinder Properties

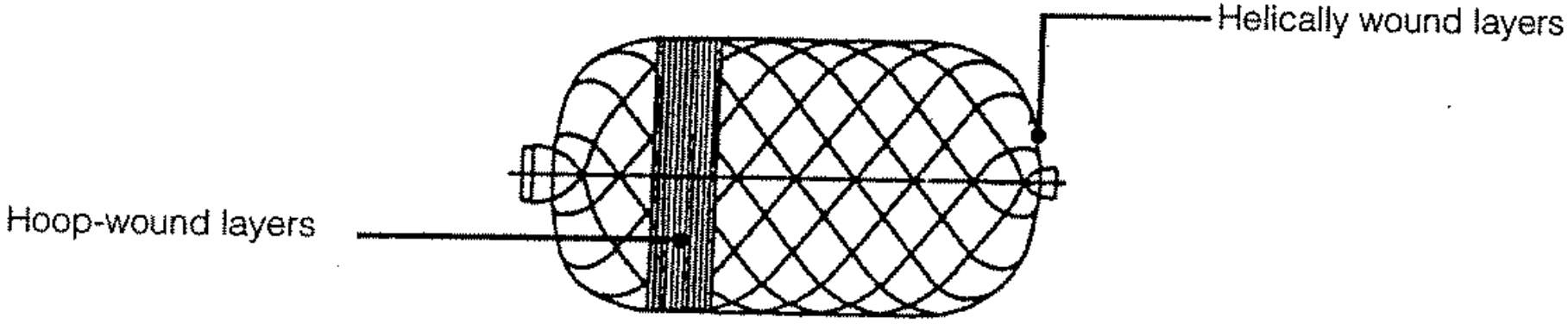
- Four Cylinder Types:
  - Type 1: all metal (steel or aluminum)
  - Type 2: hoop wrapped steel or aluminum
  - Type 3: fully wrapped steel or aluminum
  - Type 4: all-composite (non-metallic)*

*Early model Honda Civic uses Type 4; later models use Type 3

Honda Civic Tank Design



Honda Civic Tank Design



Filament Winding Pattern

Note: The pressure relief device (PRD) activates similar to a fusible link – it fails versus resealing like a spring-assisted pressure reducing valve (PRV). The gas is vented out the vent tube until the tank is empty. Discharge time depends on fuel level.

Ongoing Investigation

The tank was wrapped and secured at the FD Commissary for subsequent investigation by engineers from the various component manufacturers.

Ongoing Investigation

- Stakeholders have demonstrated a serious commitment to determining the cause and developing corrective recommendations
  - Honda Motor Company sent four engineers from Japan and the U.S.
  - The tank manufacturer sent an engineer from their Nebraska facility
  - The valve manufacturer sent an engineer from their Ontario, Canada facility

Ongoing Investigation

After an initial site investigation, the tank was shipped to Honda Motor Company for scientific analysis. Results are pending.

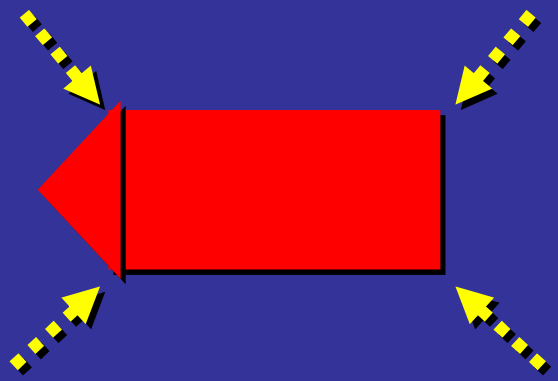
***SEE Slide 2 for new information*

Ongoing Investigation

- Additional inquires have been received from:
  - U.S. Department of Transportation
  - National Highway Traffic Safety Administration
  - State of Washington Department of Transportation
- A “Firefighter Near Miss” has been posted on-line
- *SEE Slide 2 for updated information*

Lessons Learned / Best Practices

- Approach from 45° angle to vehicle ends
- Be aware of CNG vehicles
  - Cabs, city vehicles, shuttles
- Look for CNG placards



- Watch for other hazards, i.e. bumper struts; hood and tailgate struts; airbags; burning fuel runoff; hazardous vehicle contents; exploding tires; other traffic
- Consider cooling streams from a distance

Best Practices – Honda Civic

The Best Way to Stop CNG Flow and Turn Off the Engine: KEYS

Turn off the ignition switch, and remove the key.

Turning off the ignition switch automatically shuts off the flow of CNG from the fuel tank. It also turns off power to the airbags and the seat belt tensioners within 3 minutes.

Best Practices – Honda Civic

The Second-Best Way to Stop CNG Flow and Turn Off the Engine: ELECTRICAL

Remove the main fuse, and disconnect the battery negative cable.

This method should be used if the ignition switch is in the ON (II) position, you cannot reach the key or the CNG manual shutoff valve, but you can reach under the hood.

Best Practices – Honda Civic

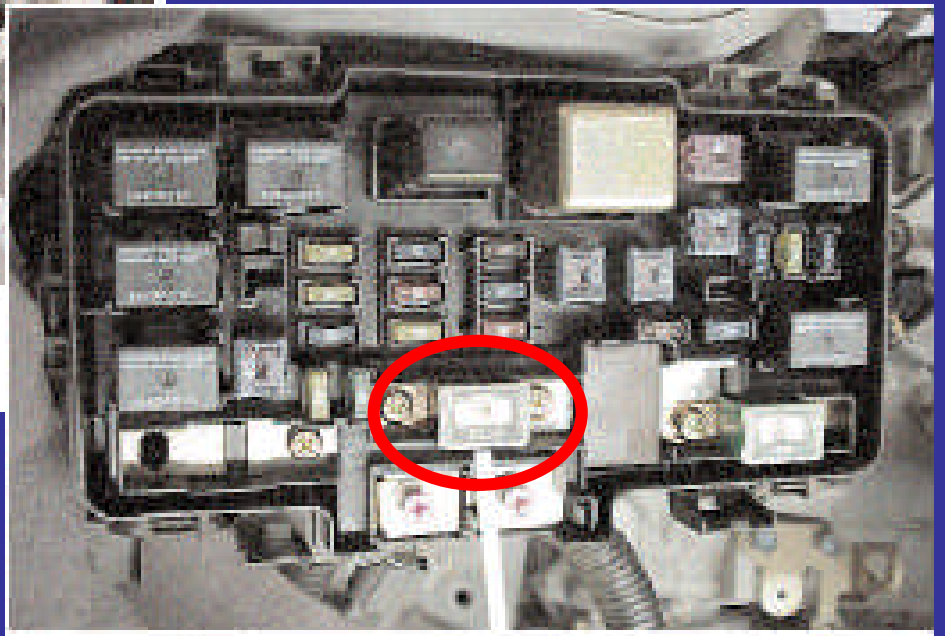
The Second-Best Way, continued:

Removing the main fuse shuts off the flow of CNG from the fuel tank and turns off the engine. Disconnecting the battery negative cable cuts power to the airbags and the seat belt tensioners within 3 minutes. It also prevents the engine from being restarted.

Best Practices – Honda Civic

Under-Hood Fuse Box

Battery



Main Fuse

Best Practices – Honda Civic

Least-Desirable Way for Stopping CNG Flow and Turning Off the Engine: GAS

Turn off the CNG manual shutoff valve.

This method does not disable the airbags or the seat belt tensioners. It should be used only if the engine is running, you cannot reach the key, and you cannot reach under the hood.

Civic CNG Shutoff Valve

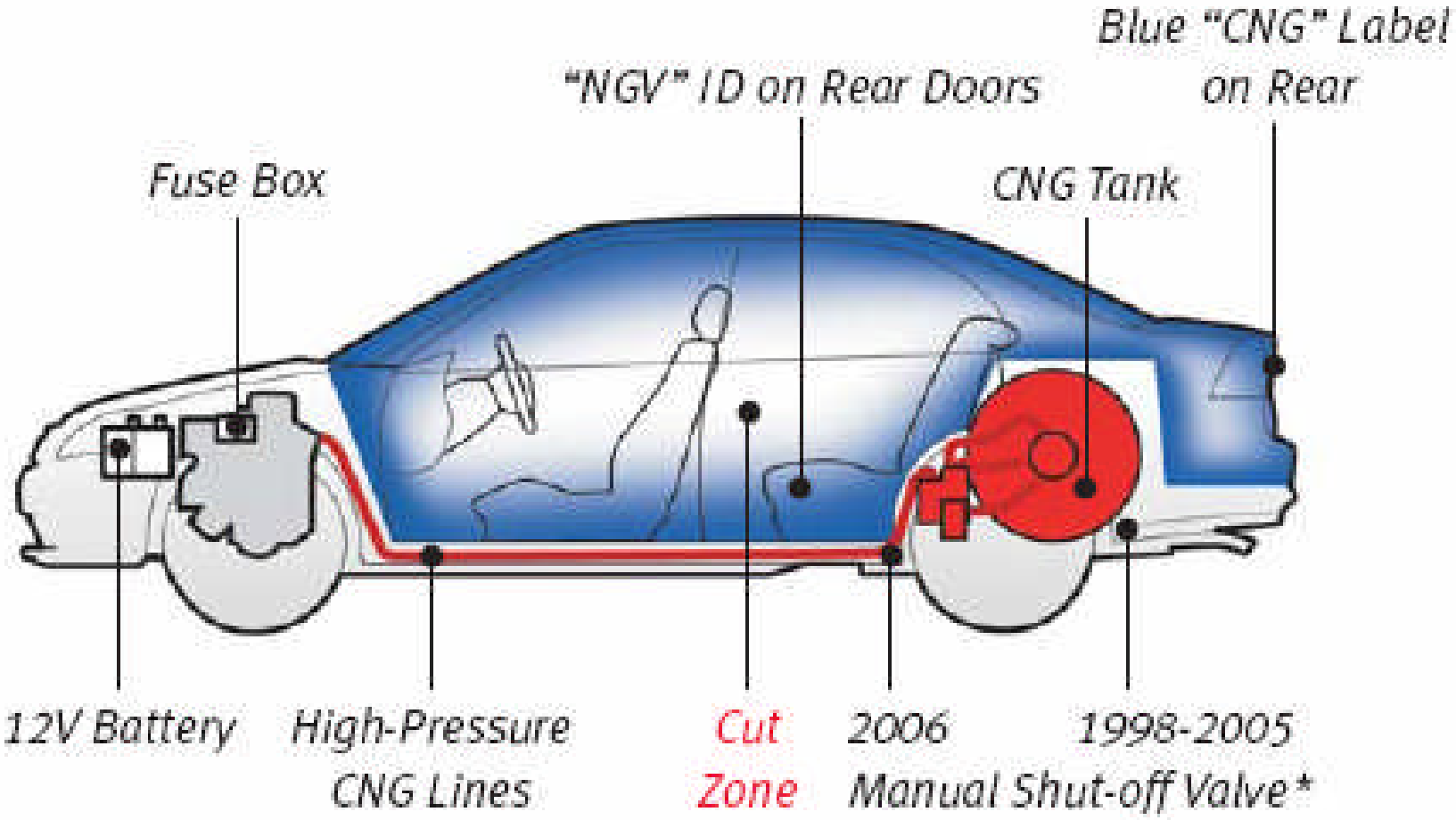
CNG Manual Shutoff Valve

The Civic GX has a CNG manual shutoff valve to stop the flow of CNG from the fuel tank. The red handle of the valve is on the bottom of the car, near The left rear tire and the splash guard.

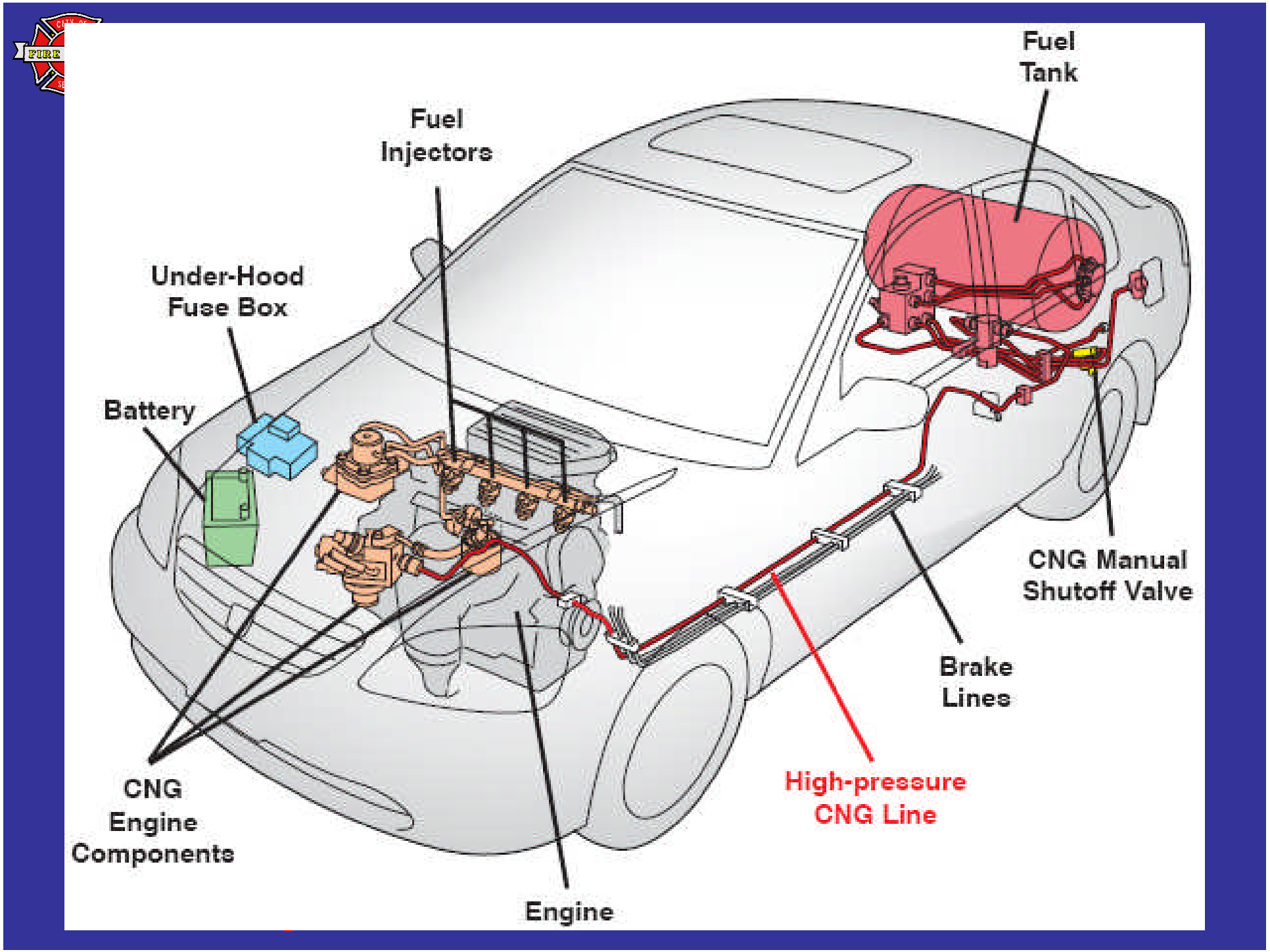
CNG Manual Shutoff Valve

Pressure Relief Outlet

Civic GX (1998-2006)

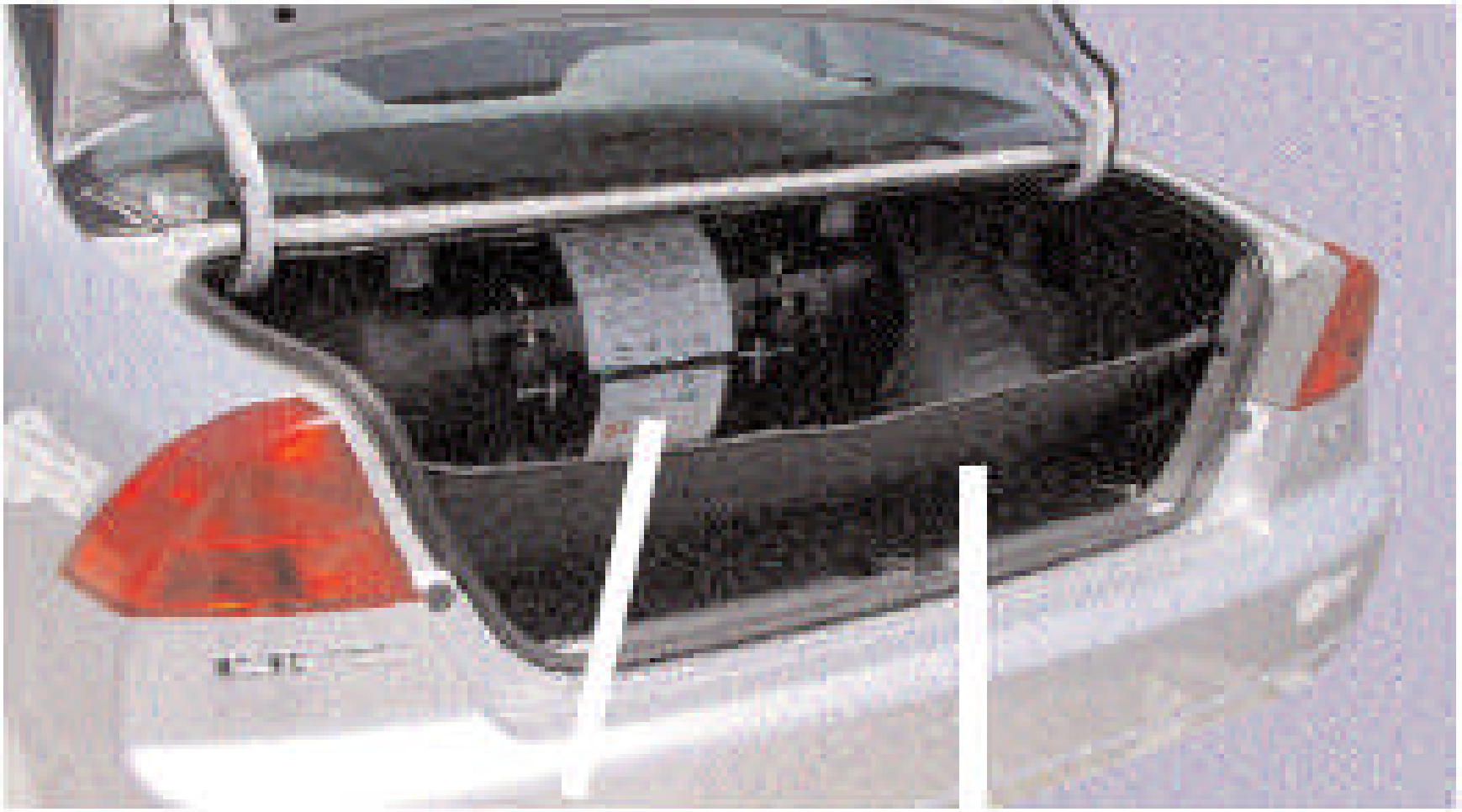


*On driver's side. Turn one-quarter turn clockwise to shut off CNG.


Fuel Tank
Fuel Injectors
Under-Hood Fuse Box
Battery
CNG Manual Shutoff Valve
Brake Lines
High-pressure CNG Line
CNG Engine Components
Engine

Seattle Fire Department


1
CNG


Fuel Tank
Removable
Divider

SAFETY SUMMARY

- Determine vehicle type during size-up
- Use 45° approach angle
- Watch for additional hazards
- Consider cooling streams from a distance
- If CNG vehicle, remember best practices:
  - **#1 – KEYS**
  - **#2 – ELECTRICAL**
  - **#3 – GAS**

NOTICE:

For questions regarding the content of this presentation or the incident referenced herein, please contact:

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