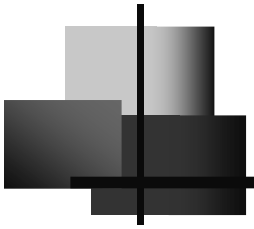


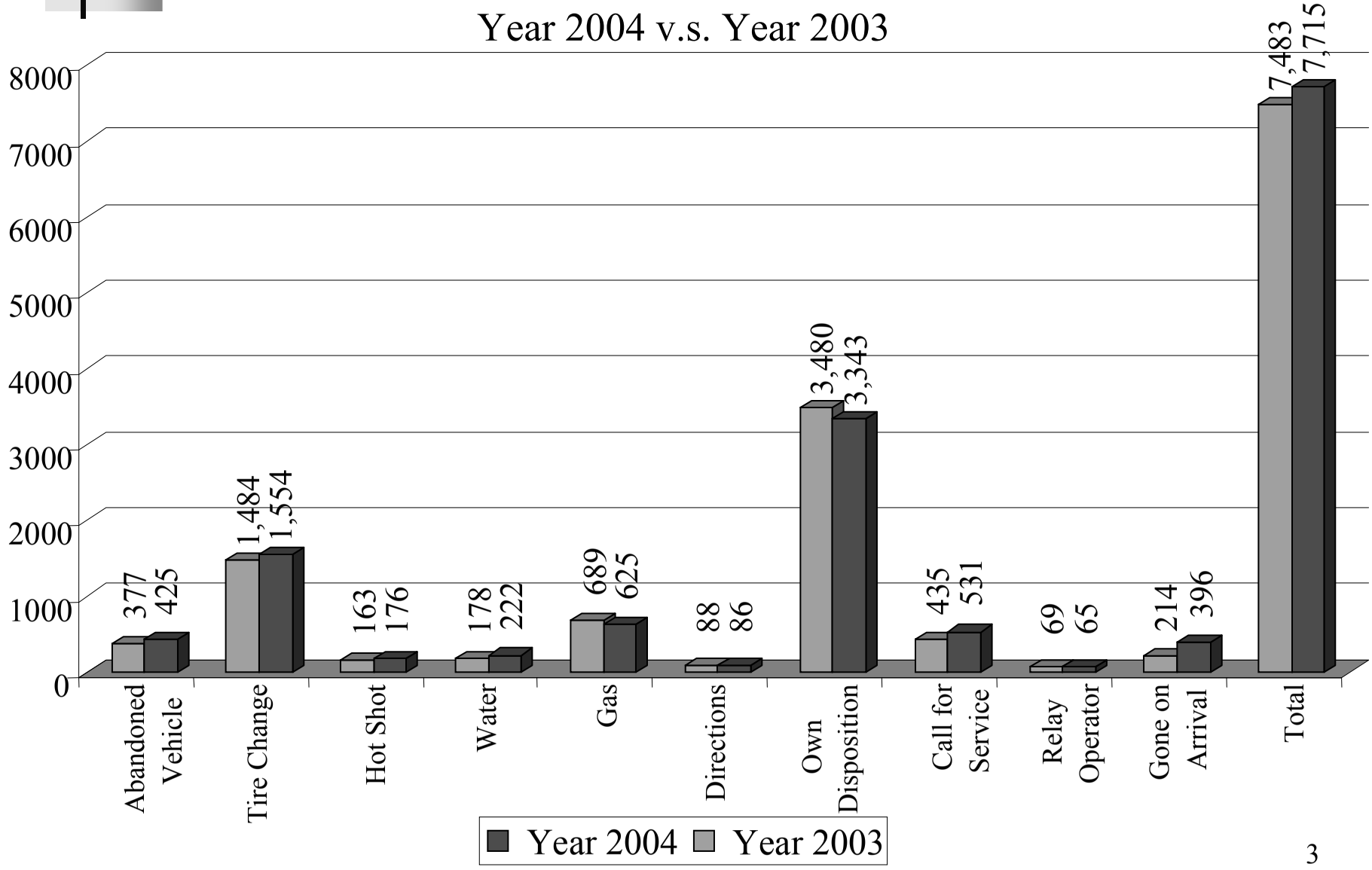
Module 5

Benefits due to Incident Management by CHART

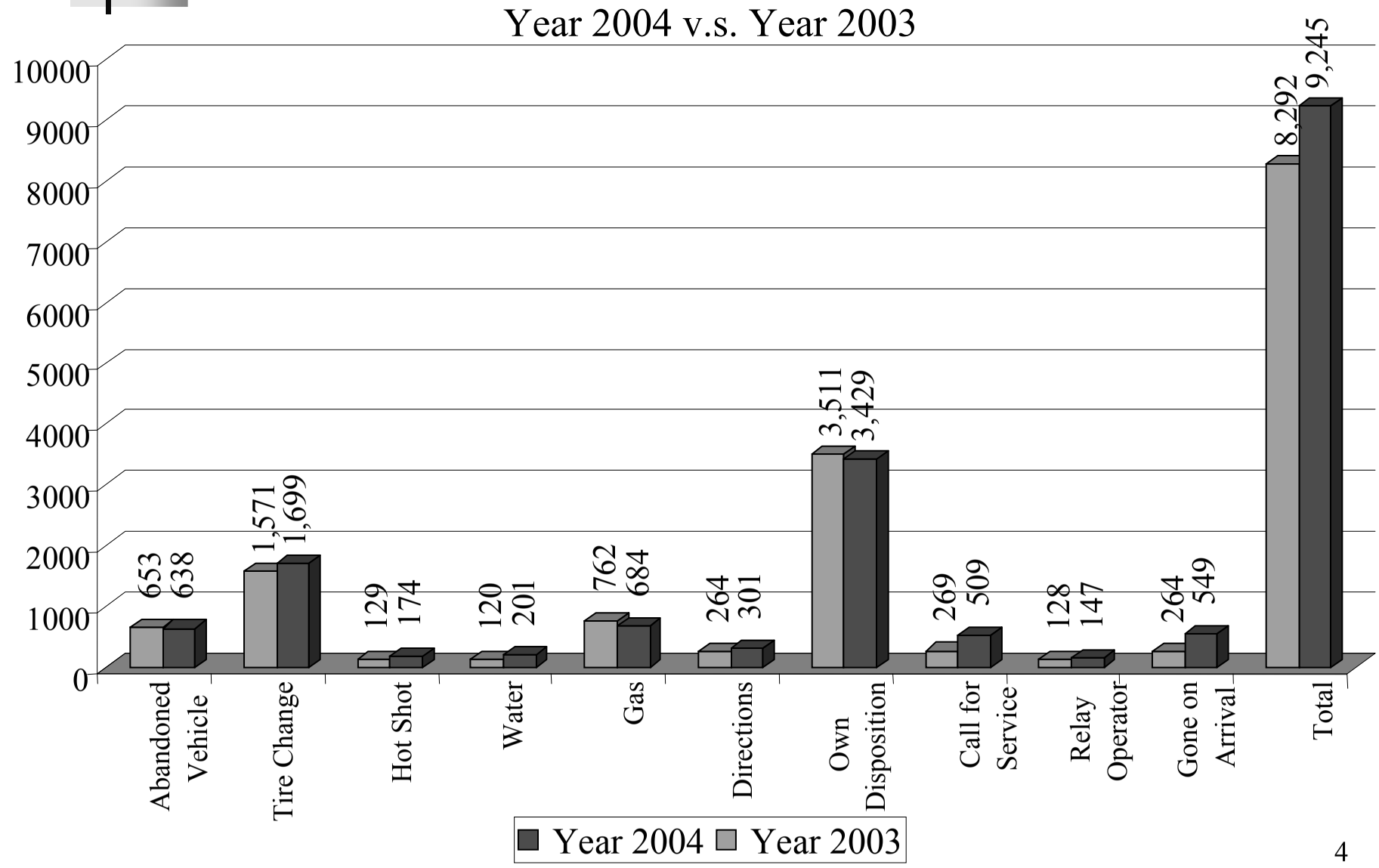
Contents

- Benefits due to Incident Management by CHART
  - Assistance to Drivers
  - Direct Benefits to Highway Users
  - Benefits due to efficient removals of stationary vehicles

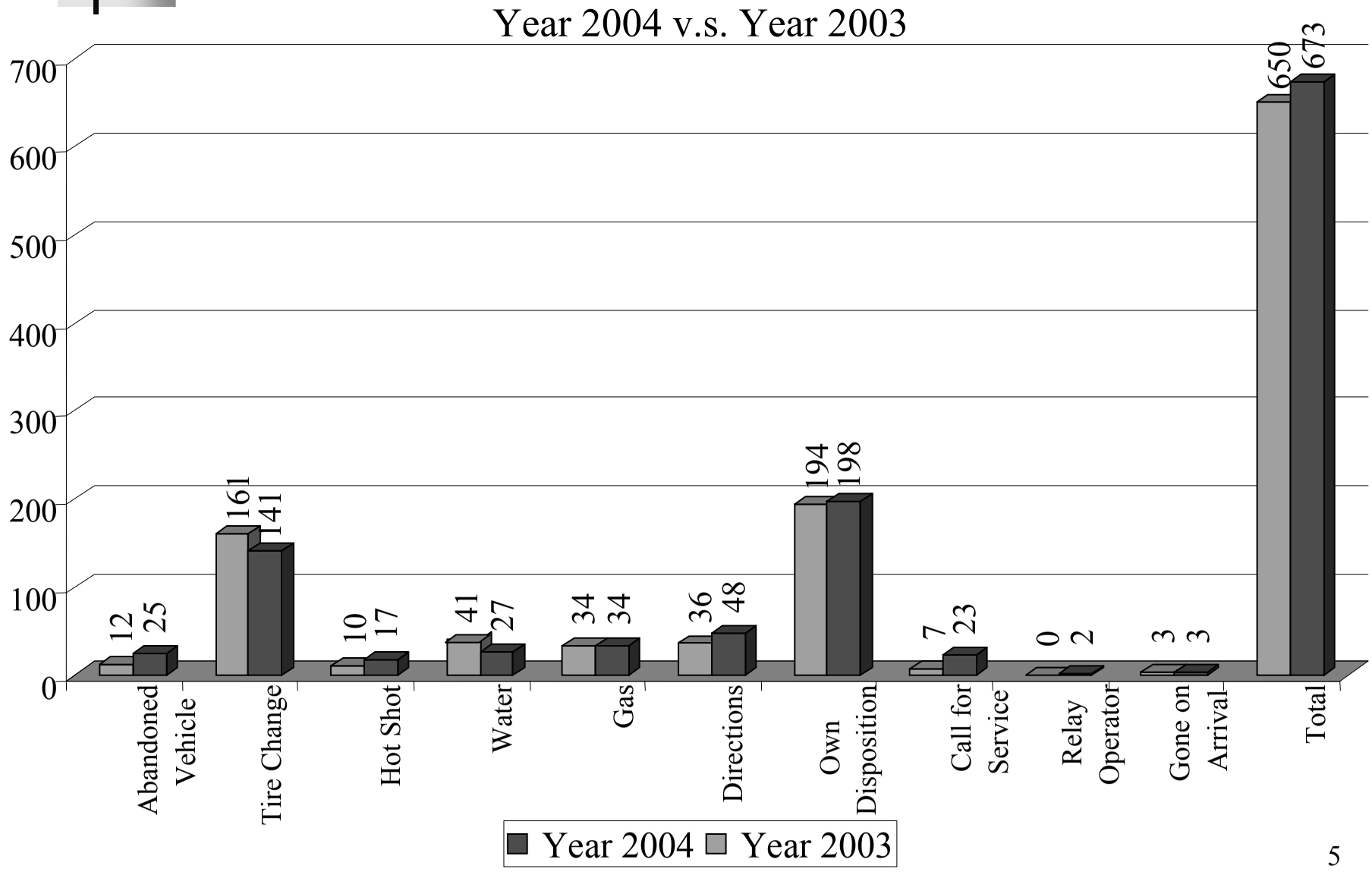
Nature of Driver Assistance by TOC-3



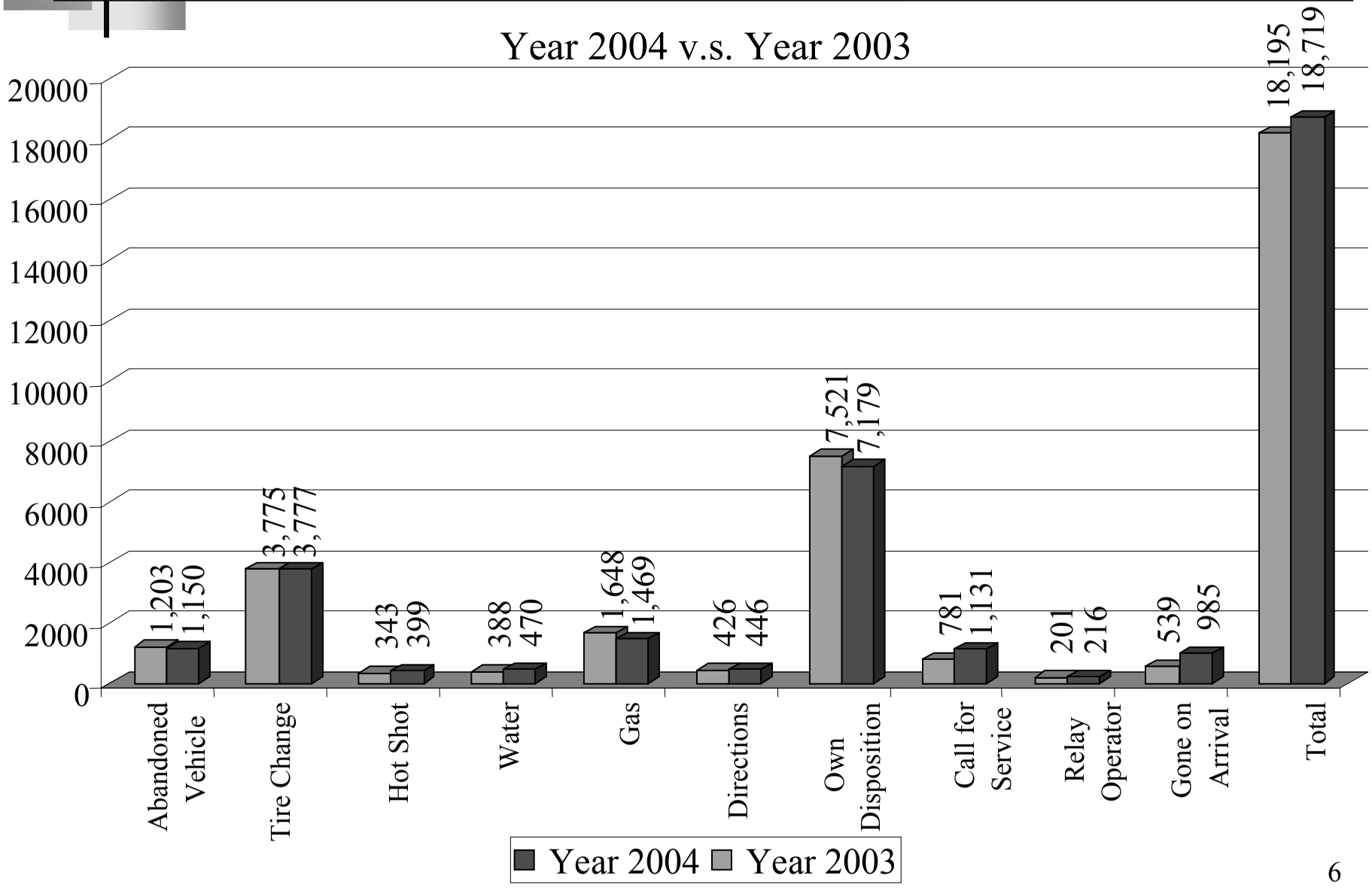
Nature of Driver Assistance by TOC-4



Nature of Driver Assistance by TOC-5



Nature of Driver Assistance (Total)



Direct Benefits to Highway Users

- Computation of Additional Delay and Fuel Consumption due to Incidents was based on:
  - Incident duration
  - Traffic volume
  - Total number of lanes
  - Lane(s) blocked

Direct Benefits to Highway Users (cont.)

- Excessive Delay due to a Non-Recurrent Incident:

$$\Delta Delay = e^{-10.19} * (Traffic\ Volume)^{2.8} * \left(\frac{No.\ of\ Lane\ Blocked}{Total\ No.\ of\ Lanes}\right)^{1.4} * (Incident\ Duration)^{1.78}$$

- Additional Fuel Consumptions

$$\Delta Fuel = e^{-10.77} * (Traffic\ Volume)^{2.27} * \left(\frac{No.\ of\ Lane\ Blocked}{Total\ No.\ of\ Lanes}\right)^{0.9} * (Incident\ Duration)^{1.69}$$

  - *Calibration is based on Actual Incident Scenarios Simulated with CORSIM*

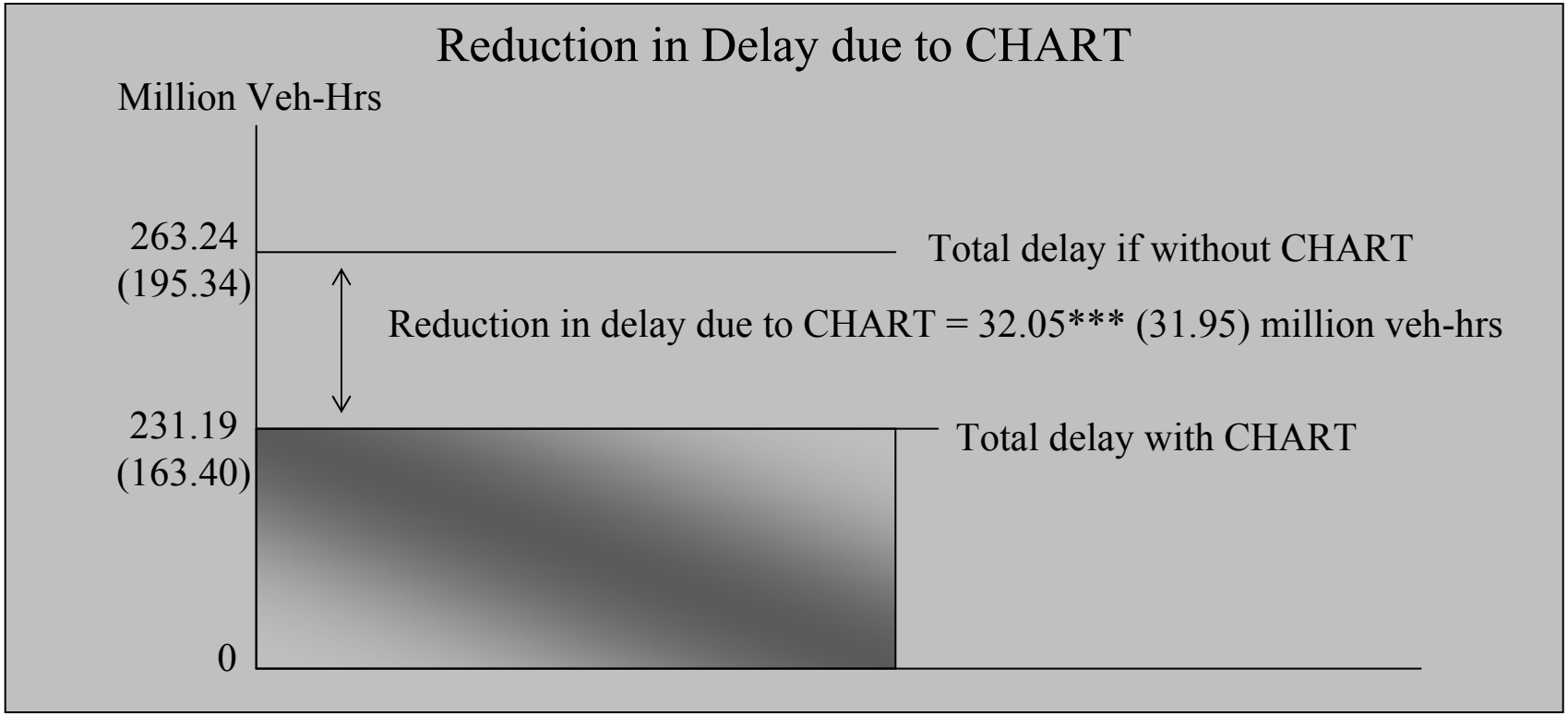
Direct Benefits to Highway Users (cont.)

- Emission Reduction Information
  - The parameters provided by MDOT*
    - HC: 13.073 grams per hour of delay
    - CO: 146.831 grams per hour of delay
    - NO: 6.261 grams per hour of delay
  - The emissions cost data proposed in the literature (Patrick, 1998)
    - $6,700 per ton for HC
    - $6,360 per ton for CO
    - $12,875 per ton for NO

Note: * The parameters are provided by MDOT in Year 2000

Direct Benefits to Highway Users (cont.)

Duration = Cleared Time – Received time



Note: * The analysis has excluded the outlier data (i.e., mean ± 2 standard deviation)

** Including delays due to rubber-necking effects incurred by shoulder-lane incidents

*** The number in each parenthesis shows the data from Year 2003

Direct Benefits to Highway Users (cont.)

- For Trucks Only -

Reduction due to CHART		I-495/ I-95	I-95	I-270	I-695	I-70	I-83	MD-295	US-50	US-1	Total
Truck (%)		13.83 (10.7)	13.83 (10.7)	8.00 (8.7)	9.94 (10.9)	21.08 (17.9)	13.29 (7.2)	3.58 (1.2)	8.76 (10.9)	6.25 (4.4)	
Delay (million veh-hrs)		0.530 (0.41)	0.430 (0.25)	0.032 (0.03)	0.816 (1.07)	0.110 (0.03)	0.192 (0.09)	0.044 (0.03)	0.076 (0.09)	0.006 (0.003)	2.236 (2.01)
Fuel consumption (million gallons)		0.089 (0.07)	0.073 (0.04)	0.005 (0.01)	0.138 (0.18)	0.019 (0.01)	0.032 (0.02)	0.007 (0.004)	0.013 (0.02)	0.001 (0.001)	0.377 (0.34)
Emissions (tons)	HC	6.93 (5.41)	5.62 (3.21)	0.42 (0.44)	10.67 (13.97)	1.44 (0.45)	2.51 (1.22)	0.57 (0.34)	0.99 (1.18)	0.08 (0.04)	29.23 (26.3)
	CO	77.83 (60.8)	63.11 (36.0)	4.71 (4.99)	119.88 (157)	16.14 (5.04)	28.18 (13.7)	6.43 (3.86)	11.10 (13.2)	0.95 (0.50)	328.32 (295)
	NO	3.32 (2.59)	2.69 (1.54)	0.20 (0.21)	5.11 (6.69)	0.69 (0.21)	1.20 (0.59)	0.27 (0.16)	0.47 (0.56)	0.04 (0.02)	14.00 (12.6)

Note: The number in each parenthesis shows the result in Year 2003

Direct Benefits to Highway Users (cont.)

- For Trucks Only -

Reduction due to CHART		Amount	Unit rate	In dollar (million)
Delay (million veh-hrs)	Truck	2.236	$19.58/hour (truck driver's cost)	43.78 (39.34)
			$45.40/hour (cargo's cost)	101.52 (91.21)
Fuel consumption (million gallons)		0.377	$1/gal.	0.377 (0.339)
Emissions (tons)	HC	29.23	$6,700/ton	2.464 (2.21)
	CO	328.32	$6,360/ton	
	NO	14.00	$12,875/ton	
Total				$ **148.14** (133.10)

Note: 1. The truck driver's cost and cargo's cost are computed based on the information shown later in the references

2. The number in each parenthesis shows the result in Year 2003.

Direct Benefits to Highway Users (cont.)

- For Total Vehicles -

Reduction due to CHART		Amount	Unit rate	In dollar (million)
Delay (million veh-hrs)	Truck	2.236	$19.58/hour (truck driver's cost)	43.78 (39.34)
			$45.40/hour (cargo's cost)	101.52 (91.21)
	Car *	23.709	$14.34/hour (car driver's cost)	339.99 (355.79)
Fuel consumption (million gallons)		5.410	$1/gal.	5.410 (5.39)
Emissions (tons)	HC	418.99	$6,700/ton	35.32 (35.21)
	CO	4,706	$6,360/ton	
	NO	200.67	$12,875/ton	
Total				$ **526.02** (526.94)

Note: 1. The number in each parenthesis shows the result in Year 2003.

2. Delay Reduction for Cars is computed without using adjusted PCE for trucks.

Direct Benefits to Highway Users (cont.)

- References for Truck's Time Value
  - Truck Driver's Time Value
    - The US Dept. of Transportation recommends using $18.10 as the wage rate for truck drivers (year 2000).
    - Some urban toll and congestion studies indicate that heavy-duty truck drivers value their time closer to $20-25 per hour.
    - The Bureau of Labor Statistics found that the US average hourly wage for heavy truck drivers as of year 2000 was $15.78.
    - FHWA's Highway Economic Requirements System (HERS, a benefit/cost system for highways) adopts a value of $21.95/hour for truck drivers.

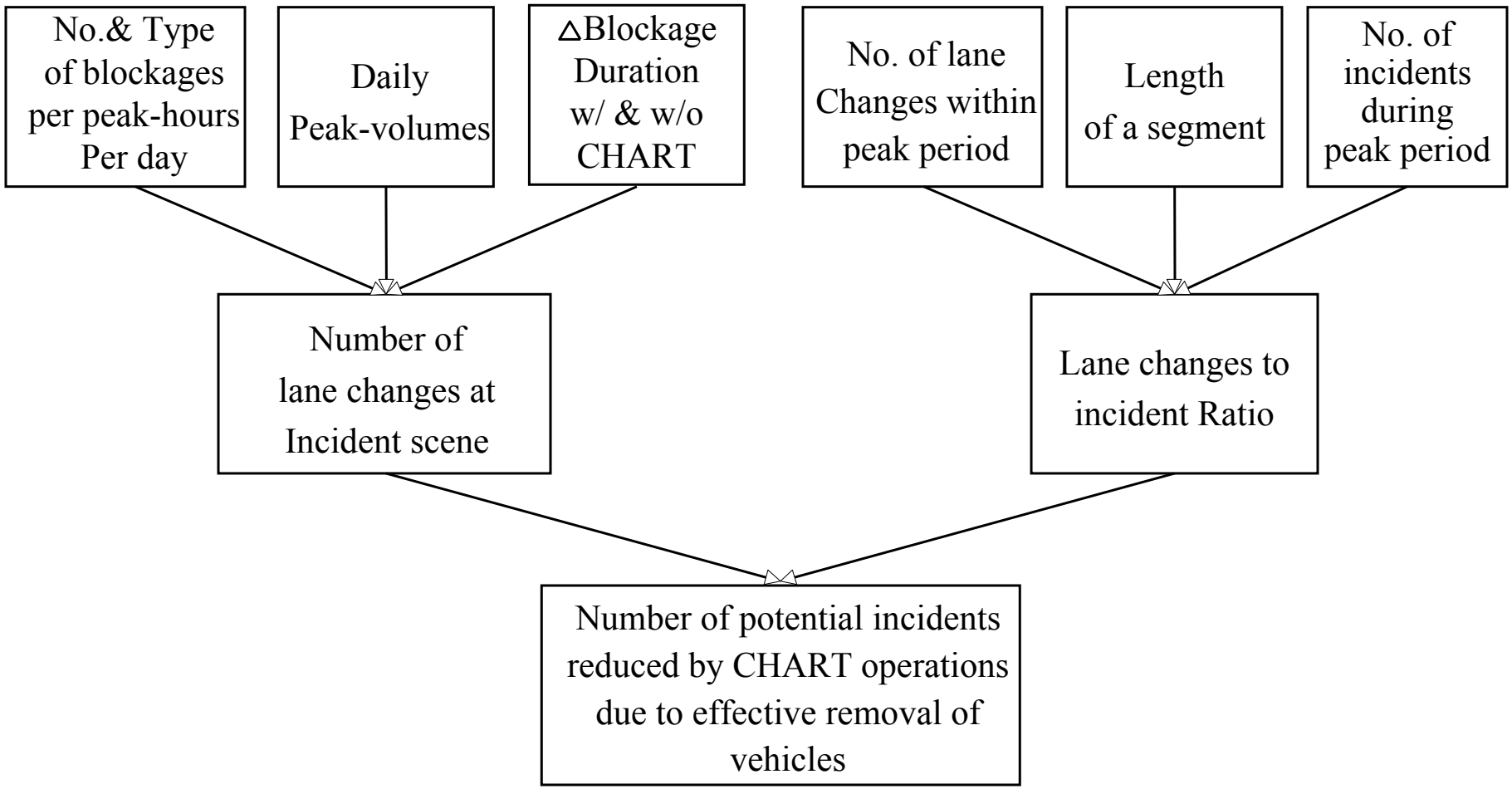
Direct Benefits to Highway Users (cont.)

- References for Truck's Time Value
  - Cargo's Time Value
    - A 1997 study by the Texas Transportation Institute uses a truck time value of $45/hour, representing $25/hour on top of the standard USDOT value of driver time alone.
    - A study by Levinson (2003) found a value of $49.42/hour for commercial vehicle operators in Minnesota.
    - A study by DeJong (2000) found the value ranging from $36-48/hour. A similar range of values was found by Waters (1995).

Direct Benefits to Highway Users (cont.)

		Total by Chart		Washington Region		Baltimore Region	
		Year 2004	Year 2003	Year 2004	Year 2003	Year 2004	Year 2003
Annual Delay Reduction	hours	32,050,143	31,945,820	14,368,130	14,761,838	17,682,012	17,183,983
Daily Delay Reduction	hours	123,270	122,869	55,262	56,776	68,008	66,092
Emission Reduction							
HC Reduction	ton/day	1.612	1.606	0.722	0.742	0.889	0.864
	$/day	10,797	10,762	4,840	4,973	5,957	5,789
CO Reduction	ton/day	18.100	18.041	8.114	8.337	9.986	9.704
	$/day	115,115	114,740	51,606	53,020	63,509	61,720
NO Reduction	ton/day	0.772	0.769	0.346	0.355	0.426	0.414
	$/day	9,937	9,904	4,455	4,577	5,482	5,328
Total	$/day	135,849	135,407	60,901	62,570	74,948	72,837

Benefits due to Efficient Removals of Stationary Vehicles



Benefits due to Efficient Removals of Stationary Vehicles (cont.)

- Number of potential incidents reduced by CHART operations due to efficient removals of disabled vehicles

Road Name		I-495/ I-95	I-95	I-270	I-695	I-70	I-83	MD-295	US-50	Total
Mileage		41	63	32	44	13	34	30	42	
Number of Potential Incident Reduction	Year 2004	112	81	16	104	20	20	14	17	384
	Year 2003	171	92	20	147	9	39	7	25	510
	Year 2002	107	105	10	71	12	10	5	23	343
	Year 2001	174	79	13	65	2	10	**7**	20	370
	Year 2000	297	12	14	47	8	7	N/A	N/A	385

*The analysis has excluded the outlier data (i.e., mean ± 2 standard deviations)