



**Terry Tamminen**  
Agency Secretary

# Air Resources Board

---

**Alan C. Lloyd, Ph.D.**  
**Chairman**

1001 I Street • P.O. Box 2815  
Sacramento, California 95812 • [www.arb.ca.gov](http://www.arb.ca.gov)



**Arnold Schwarzenegger**  
Governor

**TO:** George Lew, Chief  
Engineering and Certification Branch  
Monitoring and Laboratory Division

**FROM:** Joe Guerrero, Manager  
Engineering Evaluation Section  
Monitoring and Laboratory Division

**DATE:** November 9, 2004

**SUBJECT:** UPDATED ORVR PENETRATION CALCULATIONS

---

The ORVR penetration curves originally calculated in 1998 and previously updated in 2002 were updated using the VMT (vehicle miles traveled) data for vehicles of various ages calculated in connection with preparation of the 2004 200-car matrix. Other than substitution of the current age profile for VMT, the calculations were the same as in previous years.

The resulting estimated ORVR penetration is compared to the previous estimates in the following table:

*The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption.  
For a list of simple ways you can reduce demand and cut your energy costs, see our Website: <http://www.arb.ca.gov>.*

---

California Environmental Protection Agency

*Printed on Recycled Paper*

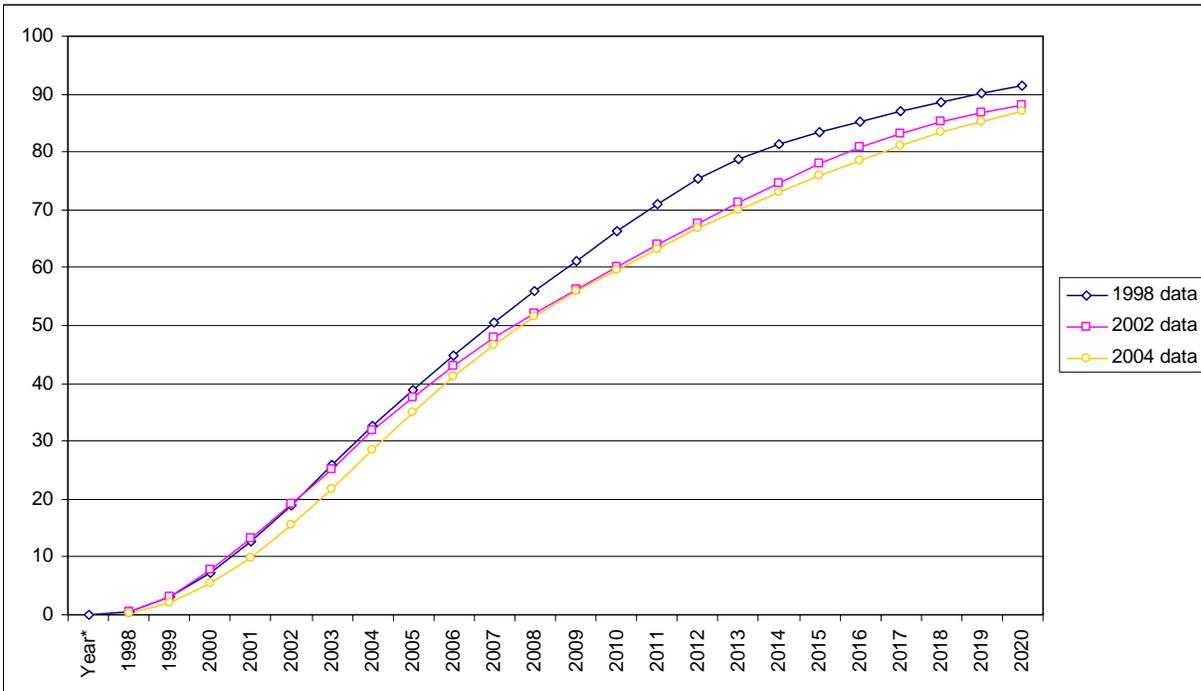
**TABLE 1**  
**Estimated ORVR Vehicle Penetration For 1998, 2002 and 2004**

Year*	ORVR Percent		
	1998	2002	2004
1998	0.43	0.48	0.30
1999	3.00	3.19	2.18
2000	7.32	7.88	5.54
2001	12.70	13.27	9.90
2002	19.00	19.11	15.46
2003	25.91	25.11	21.86
2004	32.61	31.79	28.51
2005	38.90	37.66	35.03
2006	44.86	43.04	41.07
2007	50.54	47.84	46.57
2008	56.03	52.11	51.50
2009	61.26	56.15	55.86
2010	66.28	60.10	59.70
2011	71.04	63.97	63.29
2012	75.28	67.73	66.73
2013	78.63	71.30	69.97
2014	81.23	74.72	72.99
2015	83.40	77.91	75.80
2016	85.30	80.81	78.50
2017	87.05	83.27	81.02
2018	88.67	85.25	83.31
2019	90.12	86.87	85.32
2020	91.34	88.18	87.03

\* Estimated percentages are effective January 1 of the indicated year.

The ORVR penetrations calculated in 1998, 2002, and 2004 are illustrated in the following graph.

**FIGURE 1. Percent ORVR Penetration**



A number of assumptions affect the reliability of the values in Table 1. These include the following:

1. Introduction of ORVR vehicles into the market is assumed to follow the phase-in schedule given in Table 2. Earlier introduction of ORVR vehicles is not prohibited by regulations and could accelerate ORVR penetration.
2. The age profile (vehicle miles traveled as a function of model year) for vehicles is assumed to be correct at the time the estimate was made (first in 1998, 2002, and now in 2004) and is further assumed to be applicable to future years in which ORVR percentages are estimated. This ignores any possible future changes in buying and driving habits and also ignores the effect of programs intended to take older vehicles off the road and encourage use of electric and alternate-fuel vehicles. Notably, the difference in age profile is entirely responsible for

differences in ORVR penetration calculated in the previous and the current estimates.

3. Trucks in the Medium Duty Truck category and heavier are ignored. Medium Duty Trucks are believed to be only about 5% of the population and their mandated schedule for ORVR begins in 2004. This assumption may result in a slight acceleration of the estimated ORVR penetration compared to real values.
4. The difference in fuel economy (miles per gallon) between trucks and autos is ignored. Higher fuel consumption in trucks (which have later scheduled ORVR phase-in) will make the percentage of gasoline consumed by ORVR-equipped vehicles lag the estimated ORVR percentage penetration calculated in terms of vehicle miles traveled.

The following table reflects the ORVR adoption schedule used in calculations.

**TABLE 2 - Mandated Phase-In Schedule for ORVR  
on Autos and Light Duty Trucks**

1998 model year	40% of Autos must have ORVR
1999 model year	80% of Autos must have ORVR
2000 model year and thereafter	100% of Autos must have ORVR
2001 model year	40% of Light Duty Trucks* must have ORVR
2002 model year	80% of Light Duty Trucks* must have ORVR
2003 model year and thereafter	100% of Light Duty Trucks* must have ORVR
<i>* Light Duty Trucks have GVW up to 6000 pounds and include most pickup trucks.</i>	

**In 2004 a revised, higher weight cutoff for trucks was used for the first time in calculating the 200-car matrix. The ORVR percentages for light trucks were applied to all trucks in the new category but the correctness of this has not been verified. The percentage of the heavier trucks is small, so the effect on overall ORVR penetration is assumed negligible.**

The following table reflects the VMT values used for trucks and vehicles in the calculations in previous years. Examination of the tables will reveal that VMT is not a smooth function of vehicle age but rather the miles traveled by vehicles of any particular vintage are strongly affected by the past history of consumer buying habits which vary substantially from year to year.

**TABLE 3**  
**VMT by Vehicle Age in 1998, 2002 and 2004**

Miles Traveled/Day						
Vehicle Age	1998 Autos	1998 Trucks	2002 Autos	2002 Trucks	2004 Autos	2004 Trucks
0	13503947	6838062	21390619	9800564	18008400	12646033
1	67927646	34147570	99826754	45911224	93917952	63307996
2	61693916	30464226	98889623	49361396	97685015	67607945
3	67788806	32373179	81747605	41205276	102842074	75161075
4	59583172	27578466	73856028	35798436	103852994	77580697
5	56772294	24608990	71071919	34572505	89410250	64438159
6	45332168	17828140	58738063	26254672	80641003	56117692
7	49923190	16702786	66263738	27679789	77075441	51178332
8	47578704	19224822	53377480	24112539	63019449	38863953
9	50917003	22176728	49462405	22597624	66981244	39735309
10	51926978	22929163	42930346	17480262	56543956	36174131
11	42990215	16121225	47900871	19141825	51781890	31928284
12	40145406	13874302	46565320	16205467	44446612	24434229
13	34288693	12143121	50058308	18535438	48577446	25188497
14	29273139	11869264	46569553	16707553	46420489	22840943
15	18106876	8018804	43826113	16695427	48315493	26544493
16	15302030	6714440	41489209	17960545	42991187	23813117
17	13539682	5443958	35552311	12732999	40231258	22846471
18	12676966	4474220	30397540	11688958	37275687	27492324
19	15238870	4774642	18707092	6061516	31142747	20811449
20	13553333	4491775	15622392	5394757	26640400	17928091
21	11488148	4287270	13710065	4723297	15787439	9779473
22	8360950	4361997	12779788	4430326	13008492	8827906
23	5795769	3153203	16176096	6478066	11312509	8590702
24	7118299	3613300	14566170	6166153	10424031	8663095
25	7500490	4272136	12569475	5162695	13117431	13166707
26	6272032	2151655	9446923	5176595	11667655	12325134
27	4627699	1587558	6592844	3995432	9959354	13225727
28	4353183	1493384	8170575	5064714	7411601	10100524
29	4224097	1449100	8958670	4834442	5092624	7935018
30	3326091	1141034	7494128	4013280	6278408	7681964

**TABLE 3 (Continued)**

Miles Traveled/Day						
<b>Vehicle Age</b>	<b>1998 Autos</b>	<b>1998 Trucks</b>	<b>2002 Autos</b>	<b>2002 Trucks</b>	<b>2004 Autos</b>	<b>2004 Trucks</b>
31	2922842	1002697	5567861	2363952	6864804	8542260
32	2679663	919273	5279941	1943312	5673964	7392316
33	2793202	958223	5093905	1703719	4162694	4528645
34	1842046	631924	4083431	1118633	3887091	3879839
35	1297235	445024	3708889	915066	3686655	3096513
36	905035	310477	3469523	920671	2910310	2091362
37	563906	193451	3596267	1448527	2612262	3155768
38	580469	199133	2352701	947636	2382721	2878469
39	533939	183171	1644437	662357	2387918	2884747
40	370570	127126	1143151	460446	2717174	3282508
41	630327	216237	668243	269159	1029064	1243171
42	602973	206853	727129	292878	694484	838978
43	548575	188192	683057	275126	414173	500345
44	281125	96442	482503	194346	412547	498381
45	284605	97635	844759	340257	375748	453925
46	194269	66645	810902	326620	255254	308362
47	232962	79919	737005	296855	429028	518291