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# Air Resources Board

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## MEMORANDUM

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

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

**DATE:** April 16, 2002

**SUBJECT:** UPDATED ORVR PENETRATION CALCULATIONS

The ORVR penetration curve originally calculated in 1998 was updated using the VMT (vehicle miles traveled) data for vehicles of various ages calculated in connection with preparation of the 2002 100-car matrix. Other than substitution of the current age profile for VMT, the calculations were the same as in 1998.

The resulting estimated ORVR penetration is compared to the previous estimate in the following Table 1:

**TABLE 1**

Year*	ORVR Percent	
	1998 Estimate	2002 Estimate
1998	0.43	0.48
1999	3.00	3.19
2000	7.32	7.88
2001	12.70	13.27
2002	19.00	19.11
2003	25.91	25.11
2004	32.61	31.79
2005	38.90	37.66
2006	44.86	43.04
2007	50.54	47.84
2008	56.03	52.11
2009	61.26	56.15
2010	66.28	60.10

*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

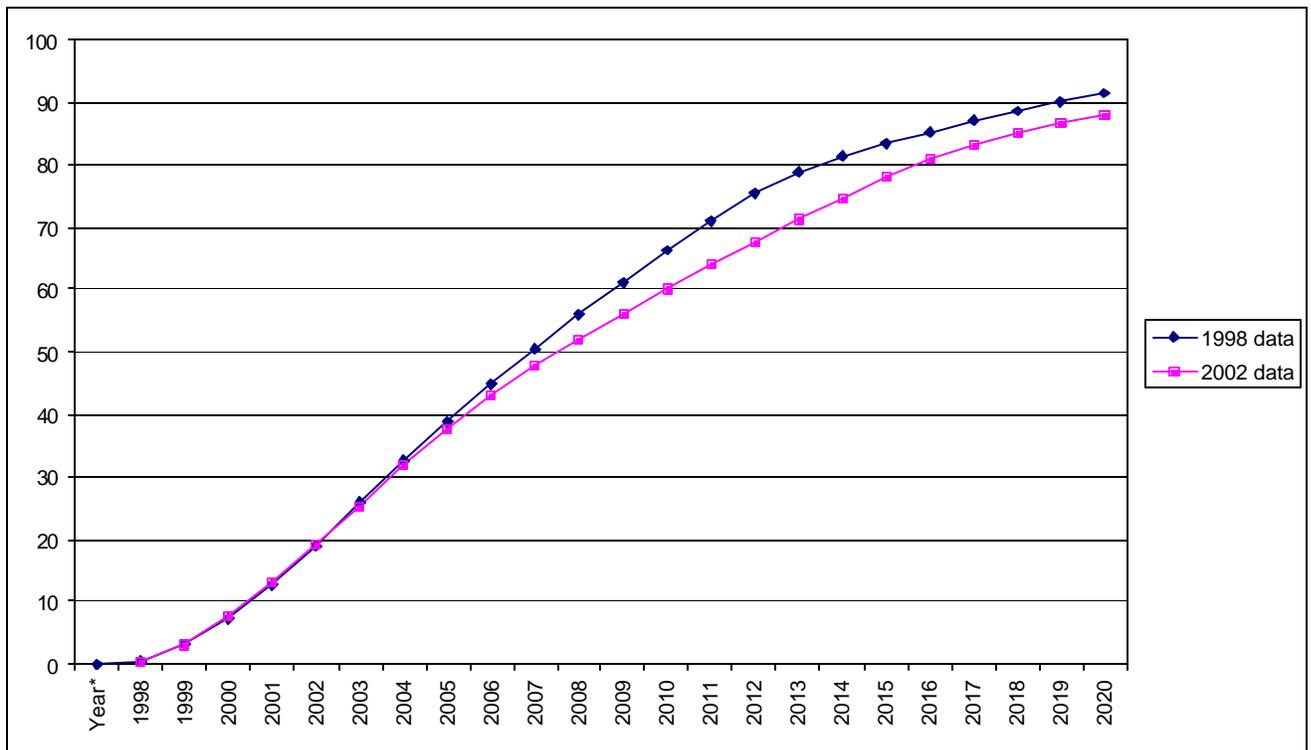
**Table 1 (Continued)**

Year*	ORVR Percent	
	1998 Estimate	2002 Estimate
2011	71.04	63.97
2012	75.28	67.73
2013	78.63	71.30
2014	81.23	74.72
2015	83.40	77.91
2016	85.30	80.81
2017	87.05	83.27
2018	88.67	85.25
2019	90.12	86.87
2020	91.34	88.18

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

The ORVR penetration calculated previously in 1998 and currently in 2002 is compared 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 and now in 2002) 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 between 1998 and 2002 are entirely responsible for differences in ORVR penetration calculated in the previous and the current estimate.
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>	

The following table reflects the VMT values used for trucks and vehicles in the calculations in 1998 and 2002. 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 and 2002 Calculations**

<b>Miles Traveled/Day</b>				
<b>Vehicle Age</b>	<b>1998 Autos</b>	<b>1998 Trucks</b>	<b>2002 Autos</b>	<b>2002 Trucks</b>
0	13503947	6838062	21390619	9800564
1	67927646	34147570	99826754	45911224
2	61693916	30464226	98889623	49361396
3	67788806	32373179	81747605	41205276
4	59583172	27578466	73856028	35798436
5	56772294	24608990	71071919	34572505
6	45332168	17828140	58738063	26254672
7	49923190	16702786	66263738	27679789
8	47578704	19224822	53377480	24112539
9	50917003	22176728	49462405	22597624
10	51926978	22929163	42930346	17480262
11	42990215	16121225	47900871	19141825
12	40145406	13874302	46565320	16205467
13	34288693	12143121	50058308	18535438
14	29273139	11869264	46569553	16707553
15	18106876	8018804	43826113	16695427
16	15302030	6714440	41489209	17960545
17	13539682	5443958	35552311	12732999
18	12676966	4474220	30397540	11688958
19	15238870	4774642	18707092	6061516
20	13553333	4491775	15622392	5394757
21	11488148	4287270	13710065	4723297
22	8360950	4361997	12779788	4430326
23	5795769	3153203	16176096	6478066
24	7118299	3613300	14566170	6166153
25	7500490	4272136	12569475	5162695

<b>Miles Traveled/Day</b>				
<b>Vehicle Age</b>	<b>1998 Autos</b>	<b>1998 Trucks</b>	<b>2002 Autos</b>	<b>2002 Trucks</b>
26	6272032	2151655	9446923	5176595
27	4627699	1587558	6592844	3995432
28	4353183	1493384	8170575	5064714
29	4224097	1449100	8958670	4834442
30	3326091	1141034	7494128	4013280
31	2922842	1002697	5567861	2363952
32	2679663	919273	5279941	1943312
33	2793202	958223	5093905	1703719
34	1842046	631924	4083431	1118633
35	1297235	445024	3708889	915066
36	905035	310477	3469523	920671
37	563906	193451	3596267	1448527
38	580469	199133	2352701	947636
39	533939	183171	1644437	662357
40	370570	127126	1143151	460446
41	630327	216237	668243	269159
42	602973	206853	727129	292878
43	548575	188192	683057	275126
44	281125	96442	482503	194346
45	284605	97635	844759	340257
46	194269	66645	810902	326620
47	232962	79919	737005	296855