

## Traffic Management

The goal for traffic management is to ensure safety and the smooth running of traffic. In 2007, the average daily traffic volume passing through toll stations is 1.56 million vehicles with a reduction compared to last year by 0.88%. Of these, the majority consist of small vehicles, which comes to 83.5%. In 2007, the Bureau worked on numerous projects in the hopes of improving the traffic efficiency. These include numerous improving measures and further details as outlined below.

### 1) Traffic Volume Over Years

(1) Statistics of Traffic Volume Passing Through Toll Stations From 2003 To 2007

(Unit: vehicle)

Year	Small Car	Bus / Heavy Truck	Tractor Trailer	Total	Yearly Growth Rate	Million Vehicles Kilometer
2003	435,632,839	54,137,373	34,954,139	524,724,351	7.99%	24,307.4
2004	467,876,262	57,254,601	38,037,516	563,168,379	7.33%	26,130.4
2005	479,143,420	56,480,534	38,185,268	573,809,222	1.89%	26,509.5
2006	480,594,647	55,241,451	38,877,139	574,713,237	0.16%	26,706.3
2007	475,502,719	54,347,929	39,791,876	569,642,524	-0.88%	25,950.0
Total	2,338,749,887	277,461,888	189,845,938	2,806,057,713	3.30%	127,787.5

(2) National Holidays Traffic Volume Statistics

The highest traffic volume in 2007 (also in national holidays of 2007) was in the Chinese New Year holiday on February 20th, 2007. 2.94 million vehicles passed through the tolls and the volume was above the design service flow rate by 75.08%

#### Comparison Table of Traffic Volume Passing through Toll Stations in National holidays of 2006 and 2007.

Holiday	Average Daily Traffic Volume in 2006 : 1,574,557				Average Daily Traffic Volume in 2007 : 1,560,664			
	Date (2006)	Week	Passing Traffic Volume	Over Designed Service Capacity by rate%	Date (2007)	Week	Passing Traffic Volume	Over Designed Service Capacity by rate%
New Year's Day	12.31	sat	1,751,754	4.27%	12.30	sat	2,117,038	26.01%
	★01.01	Sun	1,879,682	11.89%	12.31	Sun	1,993,046	18.63%
							1,914,265	13.94%

					*01.01	Mon		
Chinese New Year holidays	01.28	sat	1,927,825	14.75%	*0217	sat	2,069,888	23.21%
	01.29	Sun	2,138,803	27.31%	02.18	Sun	2,220,623	32.18%
	01.30	Mon	2,629,746	56.53%	02.19	Mon	2,673,693	59.15%
	●01.31	Tue	2,856,684	70.04%	●02.20	Tue	2,941,305	75.08%
	02.01	Wed	2,716,159	61.68%	02.21	Wed	2,879,970	71.43%
	02.02	Thu	2,376,438	41.45%	02.22	Thu	2,671,216	59.00%
	02.03	Fri	2,072,890	23.39%	02.23	Fri	2,258,887	34.46%
	02.04	sat	1,858,362	10.62%	02.24	sat	2,053,429	22.23%
02.05	Sun	1,707,987	1.67%	02.25	Sun	1,753,559	4.38%	
228 Memorial Day	★02.28	Tue	1,447,860	-13.82%	*02.28	Wed	1,459,257	-13.14%
Tomb Sweeping Festival					*04.05	Thu	2,528,089	50.48%
	★04.05	Wed	2,211,218	31.62%	04.06	Fri	2,031,035	20.89%
					04.07	sat	1,976,041	17.62%
					04.08	Sun	1,914,470	13.96%
Dragon Boat Festival					06.16	sat	2,188,036	30.24%
	★05.31	Wed	1,373,598	-18.24%	06.17	Sun	2,122,873	26.36%
					06.18	Mon	1,953,345	16.27%
					*06.19	Tue	1,765,437	5.09%
Moon Festival	10.06	Fri	2,334,775	38.97%	09.22	sat	2,216,076	31.91%
	10.07	sat	2,257,112	34.35%	09.23	Sun	2,227,590	32.59%
	★10.08	Sun	2,341,893	39.40%	09.24	Mon	2,075,383	23.53%
	10.09	Mon	2,075,554	23.54%	*09.25	Tue	1,910,881	13.74%
Double Ten National Day	★10.10	Tue	1,587,727	-5.49%	*10.10	Wed	1,337,963	-20.36%

Note :

1. Designed Service Flow Rate is 1.68 million PCU
2. \*Holiday ● Highest Traffic Volume Day of This Year.
3. Data source: Provide by all toll stations. 供



## 2) Traffic Accident Analysis

There were 101 A1 type traffic accidents on the freeway in 2007, with 112 fatalities and 86 injury. The accident rates was 0.0039 case per million vehicle kilometers (MVK), with 0.0043 fatality per MVK and 0.0033 injury per MVK. Compared to 2006, accident rates dropped by 8%, fatality rates dropped by 16.1% and injury rates dropped by 23.7%. In term of the analysis of accident causes, 24 cases of improper driving (23.8%), 19 cases of intoxicated driving (18.8%), and 7 cases of defective tire and wheel coming off vehicles (6.9%) are 3 major causes of accidents in 2007 which consist of 49.5%. In term of vehicle types involved in

accidents, heavy trucks and tractor trailers have a higher rate of accidents.

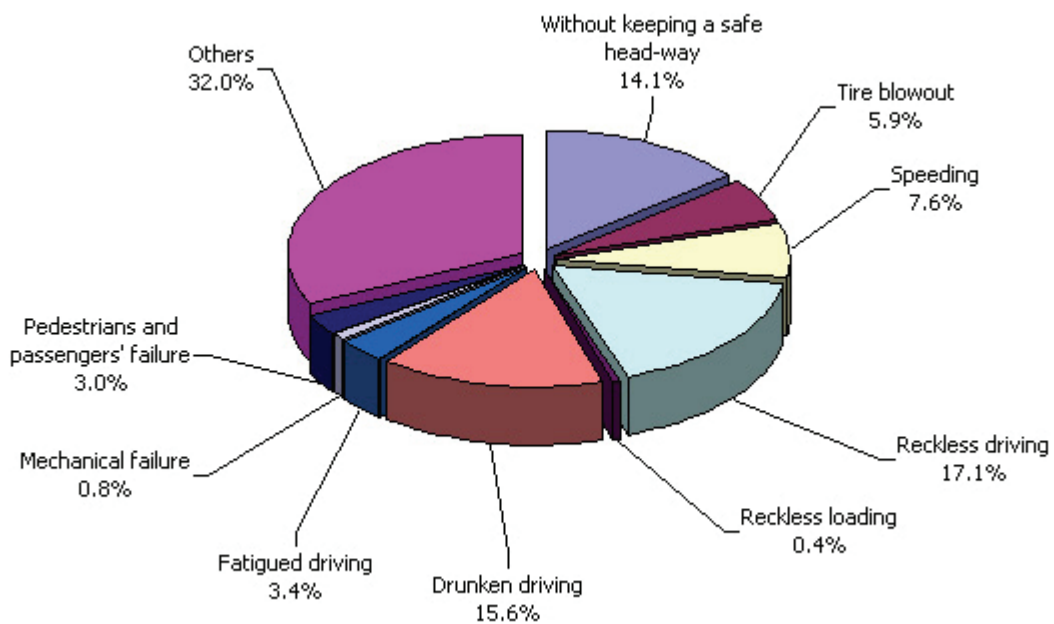
(1)Accident Statistics in 2003-2007

Year	Million Vehicles Km (MVK)	Number of Accidents (case)	Accident Rate (case/MVK)	Death (Person)	Death rate (Person/MVK)	Injury (Person)	Injury rate (Person/MVK)
2003	23,872.7	89	0.0037	107	0.0045	80	0.0034
2004	25,678.6	107	0.0042	124	0.0058	133	0.0052
2005	26,050.9	117	0.0045	129	0.0050	154	0.0059
2006	26,235.3	111	0.0042	135	0.0051	114	0.0043
2007	25,950.0	101	0.0039	112	0.0043	86	0.0033
Total	127,787.5	525	0.0041	607	0.0048	567	0.0044

(2)Accident Causes Analysis in 2003-2007

Year	Tail Gating	Defective Tire	Speeding	Improper Driving	Improper Loading	Intoxicated Driving	Fatigue	Mechanical Defect	Pedestrian Violation	Other reasons
2003	14	8	6	15	0	9	2	0	2	33
2004	19	7	9	12	0	10	5	0	2	43
2005	20	5	11	23	0	22	3	2	7	24
2006	16	4	8	16	2	22	4	2	5	32
2007	5	7	6	24	0	19	4	0	0	36
Total	74	31	40	90	2	82	18	4	16	168

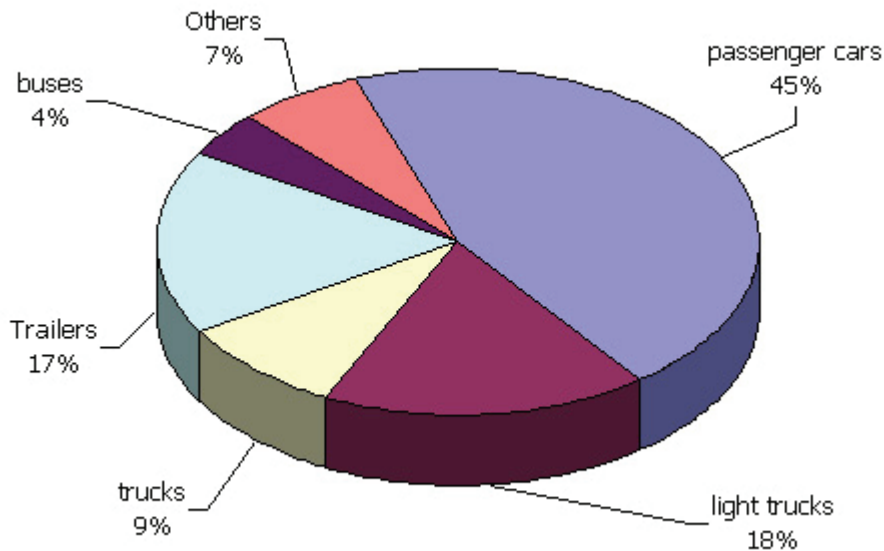
(3)Diagram of Accident Causes Analysis in 2003



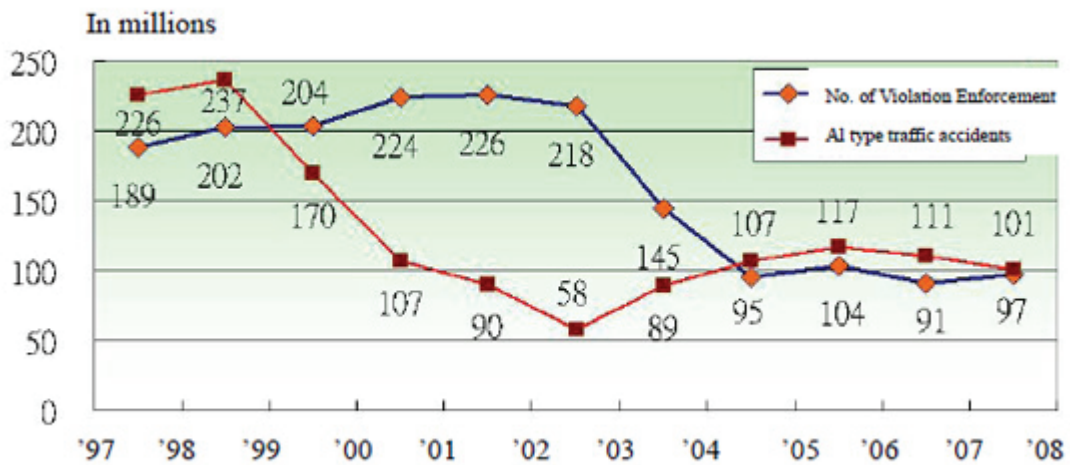
(4) Vehicle Types Involved In Accident Statistics in 2003-2007

Year	Passenger Car	Light Truck	Heavy Truck	Tractor Trailer	Bus	Other	Total
2003	45	17	10	11	2	4	89
2004	45	14	10	24	9	5	107
2005	54	16	9	23	4	11	117
2006	51	22	13	14	3	8	111
2007	42	23	7	18	4	7	101
Total	237	92	49	90	22	35	525

(5) Diagram of Vehicle Types Involved In Accident in 2003-2007



(6) Accident and Violation Enforcement Analysis in 1997-2007



### 3) Long Holiday Traffic Relieving Measures

In order to relieve traffic flow during the consecutive holidays, the Bureau has stipulated and implemented traffic relieving measures based on different nature of holidays, and therefore, during major holidays such as Tomb Sweeping Festival, Dragon Boat Festival, and the Moon Festival, the traffic on freeways can be more smoothly.

2007 Traffic Relieving Measure Operated in Each Holiday :

Traffic Relieving Measure	Chinese New Year Holiday	Tomb Sweeping Festival	Dragon Boat Festival	Moon Festival
Toll-free period	◎	◎	◎	◎
Ramp Metering Control at Entry	◎	◎	◎	◎
High Occupancy Vehicle Exclusive Use	◎	◎	—	—
Entrance-ramp Closure	◎	—	—	—
Opening of road shoulder	◎	◎	◎	◎

Note : ◎ operated actions °



### 4) Improvement to freeway bottleneck sections

(1) Opening of road shoulders and adding auxiliary lanes

To improve congested sections during peak traffic hours, the Bureau implemented the following in 2007:

- a. Those sections on Freeway No.1, such as Pingjhen system to Youth Southbound, Freeway No. 1 Yangmei to Youth Northbound, and Freeway No. 1 Jhubei to Hsinchu A (exit of Gongdao 5th Road and Guangfu Road) Southbound, allow small vehicles to drive on the road shoulders during peak hours.
- b. Freeway No. 3 Dasi to Puding tunnel exit northbound section and freeway No.1 Wudu to Sijhih toll station southbound section have both added auxiliary lanes.



Freeway No. 3 Dasi to Puding tunnel exit northbound section with added auxiliary lanes (3 lanes to 4 lanes).



No.1 Wudu to Sijih toll station southbound section with added auxiliary lanes (2lanes to 3 lanes).

## (2) Freeway No. 1 Dingjin System Interchange Northbound Section improvements.

Due to high traffic volumes on the northbound exit during peak hours, this section is often congested to influence traffic on the mainline. Therefore, on June 1, 2007 two outside lanes leading up to the interchange are redirected as exit lanes, the lanes are clearly marked to indicate exit and through lanes. The initiative has effectively improved order at the interchange as well as improved driving speed.



### (3) Traffic Improving for Hsuehshan Tunnel of Freeway No.5

In order to maintain traffic safety, there are numerous restrictions on the Hsuehshan Tunnel such as lane changes, longer tail gatings, and speed limit (below 70km/hr). Added to the "blackhole effect" in front of the tunnels, these limits restrict vehicle movements. When toll stations allow too much traffic to pass on into the Hsuehshan Tunnel, congestion invariably occurs which piles up from the tunnel entrance all the way back to the toll station and results in the failing of relieving of traffic flow.

To address this problem, on January 27, 2007, Toucheng toll station northbound mainline was reduced to 2 lanes only and the Toucheng interchange on-ramp and accelerating lane are reduced to one lane, which limiting traffic entering the tunnel to maintain traffic movement, order and safety.



## 5) Traffic Engineering Projects

### (1) Amendments of Fundamental Principles of Temporary Traffic Control

To improve labor safety during maintenance of freeway equipment, the “Devices of Temporary Traffic Control” was amended to identify measures, nature of constructions, its classification and facilities installation, as well as safety regarding entering and exiting work sites.

### (2) Sign Improvements

To establish a clear, complete sign system to provide road users with clear, precise and easily identifiable road information, continuous patrols and checking up is also necessary to improve the indication of indirect lines or the guide signs which are prone to be confounded for system interchanges connecting freeways and other confusing signs.





Complicated exit lanes (2 exit lanes) - Freeway No. 1 Hsinchu Northbound exit.





Indirect line sign (pictorial) - Freeway No. 1 Taichung system Northbound exit.



Indirect line sign (text) – Freeway No. 1 Airport System Interchange Northbound exit.

(3) Heavy motorcycles over 500c.c are allowed to be ridden on

Freeway No.3A, and Provincial Highway No.2F Northbound section. In accordance to amendments of article 92 section 2 of Road Traffic Management and Penalty Act on January 29, 2007. Heavy motorcycles over 500c.c can enter Freeway No.3A and Provincial Highway No.2F Northbound section since November 1, 2007. Sections open and prohibit to heavy motorcycles are clearly signed to notify road users.

Regulatory 23.1		Exclusive use of vehicle with 4 or over 4 wheels and heavy motorcycle with cylinder total air displacement over 550 cm <sup>3</sup>
Prohibitory 2.1		Prohibits heavy motorcycle with cylinder total air displacement over 550 cm <sup>3</sup> entry



Opened section – Freeway No. 3A Shenkeng end (set up Regulatory 23.1 sign)



Prohibit section connecting Opened section - Freeway No. 1 Sijhih-Wugu elevated road Huanbei interchange entrance (set up Prohibitory 2.1 sign)

#### (4) Additional signs on Freeway No.5

- a. Trial fluorescent signs

In consideration of power outages, the Hsuehshan Tunnel emergency exit signs use fluorescent lighting which do not need a power source. 10 sites were selected for installation of emergency exit number signs, emergency exit door opening instructions and emergency exit directions.



Emergency exit number and safety door opening instruction signs.



Emergency exit direction signs.

- b. Additional direction signs of “to Yilan” and “to Taipei”  
To assist exiting during emergencies, the tunnels are installed with “to Yilan” and “to Taipei” signs.



Direction signs at the pedestrian or vehicle cross connection - Freeway No. 5 Northbound



Direction signs at the pedestrian or vehicle cross connection - Freeway No. 5 Southbound



Sign installed in pilot tunnel.

## 6) Traffic control equipment installation

14 locations between Sibling Interchange to Douliu were installed with ramp metering signal from January 26th, 2007 to final acceptance in August 27th, 2007.

## 7) Others

(1) Freeway No.5 Small vehicle occupancy rate survey.

To understand traffic flow, distribution property, occupancy of small vehicles during work day, weekend, and holiday period in the Hsuehshan Tunnel. the Bureau carry out the survey “Freeway No. 5 small vehicle occupancy rate survey” . Their findings were:

- a. The occupancy rate for vehicles with over three persons during holidays and consecutive holidays reached over 40%. During consecutive holidays, the rate reached over 55%.
- b. The occupancy rate for vehicles with one person and two persons during workday account for 40% and 40%, respectively.
- c. The occupancy rate for vehicles with two persons during weekend and long holidays accounts for 30-35%, which is

(2) Opening of Hsuehshan Tunnel to buses.

Freeway No. 5 Shihding to Toucheng section (including Hsuehshan Tunnel) was opened to buses on November 15th 2007.

After the first stage opening of the Hsuehshan Tunnel to small vehicles on June 16th, 2006, the Bureau worked actively to allow the tunnel opening for buses by November 15th, 2007. The following works are outlined below:

- a. Setup Hsuehshan Tunnel bus access preparation team, whom decides relevant schedule and key objectives.
- b. Amend “Attentions of traffic safeness in Hsuehshan Tunnel on Freeway No.5” . This added attentions for bus drivers.
- c. Amend “Emergency Response Plan for Hsuehshan Tunnel on Freeway No.5” to accommodate for buses.
- d. Review traffic engineering facilities and add relevant equipment.
- e. Review emergency exit signs, as well as trial florescent lighting equipment.
- f. Review control station operations, outline control plans and the integration of enforcement officers, and environmental agency for random inspections.
- g. Strengthen fire fighting capacity.
- h. Conduct rescue exercise of bus accident scenario.
- i. Promotional works

The opening of Hsuehshan Tunnel to buses will not only cut down travel time between Taipei and Yi-lan, the tunnel also will encourage tourism in Eastern Taiwan region.

### (3) Survey on Cargos Carried by Light Trucks Passed Hsuehshan Tunnel

After opening of the Hsuehshan Tunnel to small vehicles, there have been light trucks and vans traveling through the tunnel. To understand cargo type and the numbers of passing vehicle, the Bureau instigated "Hsuehshan Tunnel Vehicle Type Survey" , "Light Truck Cargo Content Survey" and evaluate the fire scenario and scale under the possible cargo by the above survey.

Research of Hsuehshan Tunnel vehicle types showed there are not many light trucks and vans traveling through the tunnel. On workdays the daily average is about 1000 vehicles (7-9%) while weekend cargo has reduced to 500 units per day on average (below 3%). Vans usually constitute 6% of the total traffic (Approx. 800/day on average) and drops to below 3% on weekends and holidays. The trend shows van use is higher in weekends where as light trucks are more numerous in the workdays. This may be due to vans are used to carry passengers and light trucks are less used in the weekends.

Survey of light trucks shows 26% did not even carry a load while agricultural and seafood products constitute 20% of all cargoes. Metal products constitute 13%, wood and plastic each constitutes of 7% and paper products constitute 5%. 11% are mainly parcel services and 10 % are categorized as others. On the other hand, vans do not carry cargoes and carry passengers together constitute 85%.

According to the survey, it was found out that the amount and ratio of light trucks passing through the tunnel were both low (10% below during weekdays and 3% during holidays), and the flammable goods (woods, plastic, and paper) they delivered only accounted for below 20%. Therefore, when a light truck with flammable goods has an accident, the chance of getting a fire is relatively low. Furthermore, most light truck didn't carry full load of goods, even if there was fire, the heat releasing rate should be below 30 MW and is within the control range of the manage agency.

### (4) Freeway No.5 speed restriction adjustment

There are numerous tunnel sections from Nangang system to Toucheng section. Initial design took into account that our citizens were not yet familiar with long tunnel and design standard and traffic safety, so the driving speed was limited to below 70 km/hr. After one year of use and road users getting used to the Hsuehshan Tunnel, the public suggested to increasing the speed limit and after due review with the Ministry of Transportation and Communications, the speed limit between Nangang and Toucheng sections (with the exception of the Hsuehshan Tunnel) were increased to 80 Km/Hr in October 1st, 2007.



Freeway No. 5 Speed Limit Sign Changed

#### (5) Traffic Safety Promotions

##### a. Hsuehshan Tunnel Bus Safe Driving Promotions

In order to enhance the traffic safety in the tunnel after the opening of Hsuehshan Tunnel to the buses on November 15th, 2007, the Bureau initiated advertising campaigns on posters, television, radio, brochures and on the internet regarding regulation changes and tunnel driving safety and relevant emergency responses.

The campaign consists of 12 items and all works was completed by November 23rd, 2007. These includes promotional banners, road lamp hanging flags, posters, brochures, short films, television and radio air time, news channel marquee as well as Bureau websites.





Promotional Banners and Road Lamp Hanging Flags



Promotional Brochures and Posters



Promotional Short Film

b. Service Area Promotions

i. Promotion Facilities in Service Area

To ensure improvements to the service areas promotions, reviews and various equipment upgrade are necessary to enhance the efficiency of

these promotions. Facilities include: 1. Lively large promotional billboards, 2. Add alternate routes in the touring route map, 3. A4 sized acrylic poster clip in rest rooms, 4. Promotional brochures, 5. 9 additional LED Display Boards to further enhance advertising in the service areas.



A4 Sized Acrylic Poster Clip



LED Display Boards



Large Promotional Billboards

## ii. Freeway Information Kiosk

To raise freeway safety awareness, each service area has a freeway information kiosk which follows 5 key idea, that of See, Listen, Find, Collect, and Ask. To provide users with better freeway information, currently there are 4 such kiosks in Guansi, Siluo, Gukeng and Dongshan service areas. From its successes, the Guansi station will become the standard for all future stations to follow. The Freeway Information Kiosks will be combined with the service area service desk to improve the overall service quality of the service areas.



Guansi Freeway Information Kiosk



Gukeng Freeway Information Kiosk



Dongshang Freeway Information Kiosk

#### (6) Freeway Lane adjustment Operations

To maintain traffic order near urban areas in 2007, the Bureau implemented multiple lane adjustment measures. For example, Freeway No.1 Yuanshan-Sanchong and Dingjin-Wujia System trial measure to allow large vehicles to travel on the inner lanes and for vehicles carrying dangerous goods to surpass other vehicles near off ramps using neighboring outer lanes.

To improve traffic order in metropolitan Taipei and Kaohsiung on Freeway No.1, the Dingjin system-Wujia system in Kaohsiung began trial measure allowing large vehicle to travel on the inner lanes on July 9th, 2007. Yuanshan-Sanchong section of metropolitan Taipei was followed in September 2007. Currently the results have been positive and the Bureau will review whether to keep this change permanent.

According to the Regulation Governing Road Traffic Safety, vehicles carrying dangerous goods must travel on the outer lanes and may not change lanes on the freeway. However, when a vehicle with dangerous goods travels through interchanges, it may interlace with vehicles exiting from or entering into the interchanges; thus affect the traffic safeness. To address this issue, a trial measure was set from October 1st, 2007 to March 32nd, 2008. The measure is to “allow vehicles carrying dangerous goods to drive on inner lane to surpass other vehicles when passing freeway interchanges”. This trails zone consists of 1 kilometres before the exit off ramp ( “right lane” sign) and 400M after the interchange ( “speed limit” sign).

#### (7) Ministry of Transportation and Communications (MOTC) 2006 Year-end Inspection Awards the Freeway Bureau the No.1.

From June 26th, 2007 to the 29th, the MOTC inspected various projects of the

Bureau. The context includes business inspection, field inspection, and combined discussion. The result showed the Freeway Bureau having the first rank.

#### (8) 2007 Nation-wide Highway Traffic Safety Affairs Seminar

The Bureau was honored to be assigned the task of holding the annual seminar in 2007.

There were 43 units and groups participating the seminar, with 261 persons attended.



The first day (September 5th) began with Deputy Minister You of the Ministry of Transportation and Communications to address and open the seminar. The first speech was delivered by Professor Jhang Hsin-Li of National Chiao Tung University on “New Thought and Directions for Transport Safety Education” . Then Chief Wu Mu-Fu of the Toll Service Division delivered “Freeway Electronic Toll Collection (ETC) movement” . After that, a discussion was held by Executive Secretary Lin Yin-He and Deputy Directorate General Ou Huei-Jheng.



Freeway No.5's Pinglin Traffic Control Center and the Hsuehshan Tunnel Museum. On the second day all participants visited the Fulong Visitor Center of Northeast and Yilan Coast National Scenic Area as well as the Fourth Nuclear Plant of Longmen Engineering Division of Tai Power Company. Thanks to the efforts of people in the Bureau, we have successfully brought the 2007 National Roads Works Safety Seminar to a satisfactory conclusion. Not only did the members give good responses, they also learnt more in the field of transportation safety.

