# THE COST TO NEW ZEALAND OF PEDESTRIAN AND CYCLE INJURIES

A. W. BEASLEY
Orthopaedic Surgeon, WELLINGTON
(New Zealand)

## INTRODUCTION

New Zealand is a small country, remote from major centres of world population; with a population which has just reached three million, it is nevertheless highly motorised (Table 1); and although the scenery which represents its major tourist attraction is in itself a challenge to the roading engineer, the overall quality of roading is quite high if considered against a population density of approximately 12/km$^2$.

Motorways are limited to the environs of the major cities, but arterial and many secondary roads are good-quality two-lane structures, well marked and signposted. Streets in towns and cities are almost invariably sealed; at intersections there is widespread and increasing use of give-way and compulsory stop signs, and of traffic lights; while pedestrian crossings of zebra type, again often light-controlled, are in common use.

TABLE I

VEHICLE REGISTRATIONS 1973

| | per 1000 population |
|---|---|
| U.S.A. | 613.0 |
| NEW ZEALAND | 475.5 |
| AUSTRALIA | 427.1 |
| GREAT BRITAIN | 2[illegible]8.1 |

(derived from NZ Ministry of Transport figures)

New Zealand has been in the forefront of a number of legislative measures designed to promote road safety: in 1956 the wearing of safety helmets by motorcyclists travelling over 30 mph (50 km/h) was made compulsory, and this resulted in a substantial reduction in motorcycle fatalities, though without affecting the injury rate (Table II). In 1972 the wearing of seat belts by front seat occupants became compulsory; and in December 1973 the safety helmet requirement was extended to include all motorcycle users at all speeds, a law which (in conjunction with fuel conservation measures introduced at the same time) achieved a 40% reduction in motorcycle fatalities by comparison with the expected figure based on recent trends.

TABLE II MOTORCYCLE CASUALTIES

| Year | Killed | Injured | M/C + P/C Registered | Killed/ 10,000 m/c | Injured/ 10,000 m/c | Killed/ 1000 inj. |
|---|---|---|---|---|---|---|
| 1952 | 66 | 1,338 | 27,349 | 24.2 | 489 | 49.4 |
| 53 | 72 | 1,293 | 27,745 | 26.0 | 466 | 55.7 |
| 54 | 73 | 1,312 | 28,700 | 25.5 | 457 | 55.7 |
| 55 | 80 | 1,295 | 26,993 | 29.7 | 480 | 61.8 |
| 56 | 37 | 1,269 | 27,856 | 13.3 | 456 | 29.2 |
| 57 | 48 | 1,397 | 28,100 | 17.1 | 497 | 34.4 |
| 58 | 46 | 1,629 | 31,665 | 14.6 | 514 | 28.3 |
| 59 | 37 | 1,683 | 34,213 | 10.9 | 492 | 22.0 |
| 60 | 36 | 1,625 | 36,325 | 10.0 | 447 | 22.2 |

This account might lead to an expectation of an agreeably low casualty rate among the groups under consideration; unfortunately, with one notable exception, this is not the case. The exception is that for a generation control of pedestrian crossings used by school children has been entrusted to senior school pupils - though these may be as young as 10 years - who perform a set drill using hand-held signs; and in this period there has not been a fatality on patrolled crossings. In other respects, however, the record is less creditable.

GENERAL TRENDS

Ministry of Transport statistics indicate that in general, over the 25 years to 1973, while the vehicle rate per head of population rose from 0.20 to 0.48, accidents per head of population rose at a comparable rate, from 216 to 514 per 100,000 population. The ratio of accidents to vehicles was thus roughly constant, as was the ratio of accidents (and casualties) to petrol consumption. Only in 1974-75 did this situation show significant improvement in response to the factors described above.

Of these casualties, the proportion of pedestrians and pedal cyclists fell until 1970; then, when casualties among vehicle occupants fell in response to seat belt wearing, there was a brief upturn especially in the case of pedestrians, though the 1975 provisional figures suggest a return to the earlier trend. (Diagrams I and II)

In the case of motorcyclists, the relative decrease (a dramatic decrease in the case of fatalities from 1956 onwards) was as dramatically reversed with the advent of Japanese motorcycles to the New Zealand market from about 1970, and the age of vehicles involved in accidents (Table III) reflects the preponderance of these new motorcycles. Only in 1974 was a flattening of this

ominous upturn (at least in fatalities) to be detected, and this may be ascribed to the safety helmet legislation referred to above.

TABLE III THE AGE OF THE VARIOUS TYPES OF MOTOR VEHICLES INVOLVED IN ACCIDENTS

| CLASSIFICATION OF VEHICLE | AGE OF VEHICLE | | | | | | | | | | | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Under 1 year | 1 and under 2 years | 2 and under 3 years | 3 and under 4 years | 4 and under 5 years | 5 and under 10 years | 10 and under 15 years | 15 and under 20 years | 20 and under 25 years | 25 years and over | Not stated | |
| Cars | 652 | 1,271 | 968 | 825 | 776 | 3,744 | 3,511 | 2,144 | 801 | 119 | 404 | 15,215 |
| Rental Cars | 30 | 59 | 20 | 7 | - | 10 | 2 | - | - | - | 1 | 129 |
| Taxis | 7 | 31 | 18 | 16 | 20 | 69 | 13 | - | - | - | 3 | 177 |
| Vans | 51 | 164 | 127 | 136 | 142 | 393 | 247 | 147 | 48 | 11 | 29 | 1,435 |
| Trucks | 49 | 76 | 80 | 85 | 85 | 303 | 169 | 89 | 43 | 46 | 50 | 1,075 |
| Articulated trucks | 8 | 19 | 17 | 18 | 15 | 27 | 10 | - | - | - | 5 | 119 |
| Buses | 4 | 5 | 16 | 11 | 13 | 54 | 44 | 51 | 25 | 5 | 31 | 259 |
| Motor Cycles | 632 | 1,129 | 665 | 403 | 223 | 235 | 81 | 33 | 29 | 4 | 33 | 3,467 |
| Power Cycles | 47 | 91 | 71 | 59 | 45 | 53 | 20 | 1 | 1 | 1 | 1 | 390 |
| Others | 5 | 5 | 5 | 6 | 9 | 12 | 10 | 4 | 2 | 1 | 62 | 121 |
| TOTALS | 1,485 | 2,850 | 1,987 | 1,566 | 1,328 | 4,840 | 4,107 | 2,469 | 949 | 187 | 619 | 22,387 |

## REGIONAL VARIATIONS (Table IV)

To some extent these are readily explicable - the high casualty rates for pedestrians in Auckland and Wellington (the two major centres of population) and in Manukau and Papatoetoe (dormitory suburbs of Auckland) are not surprising; and the particularly high rate in Porirua (Wellington's dormitory suburb) may be accounted for on the basis of the high Polynesian population found there, including many recent arrivals from the small Pacific Island communities.

TABLE IV PEDESTRIAN, PEDAL CYCLE, AND MOTOR CYCLE ACCIDENTS IN THE LARGER CENTRES FOR THE CALENDAR YEAR 1974

| CITY | NUMBER OF ACCIDENTS INVOLVING | | |
|---|---|---|---|
| | Pedestrians | Pedal Cyclists | Motor or Power Cyclists |
| Auckland | 250 | 44 | 270 |
| Wellington | 198 | 13 | 215 |
| Christchurch | 184 | 159 | 446 |
| Dunedin | 77 | 19 | 122 |
| Lower Hutt | 36 | 21 | 56 |
| Palmerston North | 28 | 37 | 94 |
| Wanganui | 6 | 17 | 29 |
| Invercargill | 32 | 16 | 42 |
| Hamilton | 66 | 38 | 141 |
| New Plymouth | 27 | 9 | 64 |
| Timaru | 23 | 11 | 20 |

Continued overleaf

TABLE IV Continued

| | | | |
|---|---|---|---|
| Napier | 37 | 25 | 64 |
| Gisborne | 28 | 16 | 37 |
| Hastings | 12 | 17 | 43 |
| Nelson | 18 | 19 | 31 |
| Tokapuna | 34 | 10 | 43 |
| Rotorua | 31 | 13 | 38 |
| Tauranga | 19 | 17 | 51 |
| Hamilton | 92 | 33 | 90 |
| Whangarei | 34 | 13 | 26 |
| Porirua | 31 | 6 | 24 |
| Upper Hutt | 16 | 13 | 29 |
| Papatoetoe | 24 | 10 | 19 |

Other regional figures, however, are surprising. Christchurch is noted for its high density of bicycles, yet the pedal cyclist casualties there are in proportion to those for the remainder of the country; while Wanganui whose cyclist casualty rate is the highest in the country, is a provincial city of modest size and no overt traffic abnormalities.

The notable feature of motorcycle accidents is that they show relatively little variation over the whole country.

TABLE V TYPES OF ROAD USERS KILLED AND INJURED

| Year | Drivers of Motor Vehicles | Passengers in Motor Vehicles | Motor Cyclists & Pillion Riders | Bicyclists | Pedestrians | Power Cyclists | Other Road Users | Totals |
|---|---|---|---|---|---|---|---|---|
| 1949 | | 2,941 (99) | 792 (45) | 893 (26) | 861 (44) | - | 68 (4) | 5,535 (218) |
| 1950 | 1,282 (46) | 2,263 (55) | 1,021 (47) | 939 (24) | 974 (57) | - | 67 (3) | 6,546 (232) |
| 1951 | 1,447 (60) | 2,478 (79) | 1,164 (47) | 1,065 (32) | 986 (70) | - | 68 (4) | 7,230 (292) |
| 1952 | 1,639 (49) | 2,544 (62) | 1,366 (61) | 1,108 (31) | 966 (64) | 38 (5) | 59 (-) | 7,720 (272) |
| 1953 | 1,701 (58) | 2,758 (72) | 1,314 (71) | 1,028 (26) | 1,095 (83) | 51 (1) | 52 (2) | 7,999 (313) |
| 195 | 1,811 (72) | 2,790 (90) | 1,312 (72) | 1,092 (37) | 1,106 (87) | 73 (1) | 51 (1) | 8,235 (360) |
| 1955 | 2,222 (78) | 3,228 (67) | 1,308 (76) | 1,228 (26) | 1,195 (81) | 67 (4) | 61 (1) | 9,309 (333) |
| 1956 | 2,360 (87) | 3,704 (99) | 1,229 (36) | 1,195 (19) | 1,259 (86) | 77 (1) | 63 (1) | 10,087 (329) |
| 1957 | 3,056 (92) | 4,201 (103) | 1,325 (48) | 1,345 (41) | 1,341 (90) | 120 (-) | 49 (2) | 11,437 (784) |
| 1958 | 3,093 (101) | 4,252 (104) | 1,512 (41) | 1,367 (39) | 1,361 (89) | 163 (5) | 39 (1) | 11,787 (479) |
| 1959 | 3,169 (93) | 4,406 (99) | 1,525 (37) | 1,318 (27) | 1,406 (93) | 185 (-) | 43 (-) | 12,065 (349) |
| 1960 | 3,570 (92) | 4,808 (123) | 1,475 (32) | 1,311 (30) | 1,439 (92) | 186 (4) | 28 (1) | 12,817 (374) |
| 1961 | 3,782 (103) | 4,870 (113) | 1,483 (38) | 1,386 (32) | 1,442 (101) | 189 (5) | 57 (1) | 13,809 (393) |
| 1962 | 4,162 (124) | 5,195 (108) | 1,602 (44) | 1,432 (31) | 1,535 (88) | 193 (2) | 55 (1) | 14,174 (598) |
| 1963 | 4,592 (115) | 5,519 (110) | 1,563 (38) | 1,347 (27) | 1,612 (95) | 192 (6) | 46 (3) | 14,871 (394) |
| 1964 | 5,314 (148) | 6,320 (116) | 1,796 (36) | 1,341 (26) | 1,621 (97) | 260 (4) | 44 (1) | 16,696 (428) |
| 1965 | 5,751 (181) | 6,710 (170) | 1,865 (42) | 1,322 (33) | 1,710 (123) | 244 (6) | 50 (4) | 17,652 (559) |
| 1966 | 6,340 (196) | 7,282 (162) | 1,935 (37) | 1,234 (29) | 1,723 (114) | 179 (5) | 50 (1) | 18,743 (543) |
| 1967 | 6,142 (198) | 7,000 (188) | 1,828 (42) | 1,157 (25) | 1,675 (109) | 136 (4) | 41 (1) | 17,979 (570) |
| 1968 | 6,456 (174) | 7,807 (179) | 1,708 (27) | 1,107 (24) | 1,774 (116) | 127 (1) | 41 (-) | 18,220 (522) |
| 1969 | 6,770 (204) | 7,653 (179) | 1,771 (34) | 1,078 (33) | 1,814 (118) | 174 (2) | 40 (-) | 19,296 (570) |
| 1970 | 7,970 (269) | 8,333 (211) | 1,819 (37) | 1,069 (28) | 1,887 (101) | 301 (6) | 57 (3) | 21,446 (655) |
| 1971 | 7,811 (253) | 8,375 (227) | 2,580 (49) | 1,112 (29) | 1,974 (113) | 383 (3) | 49 (3) | 22,284 (677) |
| 1972 | 7,584 (260) | 8,372 (225) | 3,378 (75) | 1,051 (22) | 2,119 (125) | 467 (4) | 57 (2) | 23,028 (713) |
| 1973 | 7,955 (273) | 8,486 (250) | 3,884 (126) | 1,048 (30) | 2,337 (157) | 470 (4) | 48 (3) | 24,228 (843) |
| 1974 | 7,044 (225) | 7,086 (190) | *3,837 (106) | 995 (26) | 2,149 (125) | 362 (1) | 32 (3) | 21,505 (676) |
| 1975 | 6,399(230) | 6,098(170) | *3,390(93) | 744(18) | 1,841(112) | 266(3) | 36(2) | 19104(628) |

*Includes 26 power cycle pillion riders
Figures in brackets denote number killed and are included in adjacent totals

MORTALITY INDEX FOR PEDESTRIANS, CYCLISTS AND MOTORCYCLISTS

| | | | |
|---|---|---|---|
| 1960-64 | .062 | .021 | .023 |
| 1965-69 | .067 | .024 | .020 |
| 1970-74 | .059 | .026 | .025 |

## THE "MORTALITY INDEX"

Comparison of numbers killed and injured in the three categories (Table V) permits an index of the lethal potential of injury to pedestrians as compared with cyclists or motorcyclists. This potential is surprisingly high - a pedestrian has about one chance in 16 that his injuries will be fatal, whereas a cyclist or motorcyclist has about one chance in 40 - and the index is surprisingly constant over the past three 5-year periods, apart from a sharp rise in the motorcycle index for 1973-74.

## TIME OF DAY AND WEEK

The figures here show not-unexpected peaks for pedestrian accidents (Table VI) at the beginning and end of the working day and at lunchtime, with an additional late evening peak corresponding to the hour after hotel closing. It is interesting to note that Wednesday, Thursday and Friday show a preponderance of the mid-afternoon casualties, at a time when children are leaving school, and that the Friday figures reflect the tradition of late-night Friday shopping in this country.

TABLE VI

PEDESTRIAN ACCIDENTS BY TIME OF DAY BY DAY OF WEEK

| DAYS OF THE WEEK | TIMES OF THE DAY | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midnight - 1 a.m. | 1 - 2 am | 2 - 3 am | 3 - 4 am | 4 - 5 am | 5 - 6 am | 6 - 7 am | 7 - 8 am | 8 - 9 am | 9 - 10 am | 10 - 11 am | 11 - 12 noon | 12 - 1 pm | 1 - 2 pm | 2 - 3 pm | 3 - 4 pm | 4 - 5 pm | 5 - 6 pm | 6 - 7 pm | 7 - 8 pm | 8 - 9 pm | 9 - 10 pm | 10 - 11 pm | 11 - Midnight |
| Monday | 1 | 1 | - | - | 1 | - | 2 | 15 | 26 | 3 | 10 | 11 | 16 | 11 | 7 | 26 | 34 | 29 | 20 | 11 | 13 | 3 | 4 | 3 |
| Tuesday | - | 1 | 1 | - | - | - | - | 7 | 17 | 6 | 7 | 6 | 18 | 12 | 15 | 38 | 32 | 27 | 12 | 19 | 11 | 8 | 13 | 4 |
| Wednesday | 3 | - | - | 1 | - | 1 | 2 | 12 | 23 | 14 | 9 | 5 | 20 | 13 | 15 | 50 | 39 | 31 | 9 | 28 | 14 | 9 | 21 | 1 |
| Thursday | 1 | - | - | - | - | 1 | 1 | 9 | 27 | 10 | 6 | 5 | 19 | 13 | 9 | 41 | 32 | 24 | 27 | 25 | 9 | 5 | 19 | 10 |
| Friday | 1 | 2 | - | - | 1 | - | - | 10 | 28 | 9 | 13 | 12 | 21 | 19 | 19 | 53 | 52 | 32 | 35 | 37 | 31 | 31 | 40 | 14 |
| Saturday | 4 | - | - | 1 | - | - | 2 | 1 | 2 | 5 | 18 | 16 | 18 | 15 | 21 | 16 | 33 | 23 | 18 | 20 | 18 | 19 | 34 | 16 |
| Sunday | 11 | 15 | - | 1 | 2 | - | - | 1 | 1 | 3 | 5 | 9 | 16 | 16 | 23 | 7 | 17 | 14 | 11 | 12 | 4 | 1 | 4 | - |
| Totals | 21 | 19 | - | 3 | 4 | 2 | 7 | 55 | 124 | 50 | 68 | 64 | 128 | 99 | 109 | 231 | 239 | 180 | 132 | 152 | 100 | 76 | 135 | 48 |
| Percentages | 1.6 | 1.5 | 0.4 | 0.2 | 0.3 | 0.1 | 0.3 | 2.7 | 6.0 | 2.4 | 3.3 | 3.1 | 6.2 | 4.8 | 5.3 | 11.2 | 11.6 | 8.7 | 6.4 | 7.4 | 4.9 | 3.7 | 6.6 | 2.3 |

Bicycle casualties (Table VII) show morning and afternoon-to-evening peaks throughout the week; the motorcycle morning peak (Table VIII) is slightly earlier, and the evening peak slightly later, with a prolongation into the late evening on Friday, and a Saturday afternoon peak not shared by the other categories of road user. Whether this reflects increased usage after Saturday afternoon sport, or increased usage as a Saturday afternoon sport, is uncertain.

## TABLE VII

DAYS OF THE WEEK AND TIMES OF THE DAY THAT PEDAL CYCLIST ACCIDENTS OCCURRED

| DAYS OF THE WEEK | TIMES OF THE DAY | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midn't - 1 am | 1 - 2 am | 2 - 3 am | 3 - 4 am | 4 - 5 am | 5 - 6 am | 6 - 7 am | 7 - 8 am | 8 - 9 am | 9 - 10 am | 10 - 11 am | 11 - 12 noon | 12 - 1 pm | 1 - 2 pm | 2 - 3 pm | 3 - 4 pm | 4 - 5 pm | 5 - 6 pm | 6 - 7 pm | 7 - 8 pm | 8 - 9 pm | 9 - 10 pm | 10 - 11 pm | 11 - Midn't |
| Monday | 1 | - | - | - | - | 1 | 2 | 12 | 28 | 3 | 4 | 8 | 5 | 1 | 2 | 25 | 25 | 23 | 8 | 6 | 1 | 1 | - | - |
| Tuesday | 1 | - | - | - | 1 | - | 2 | 13 | 33 | 4 | 4 | 1 | 10 | 6 | 4 | 19 | 18 | 15 | 9 | 5 | 4 | 1 | 2 | 1 |
| Wednesday | 1 | - | - | - | - | - | 5 | 11 | 28 | 4 | 1 | 2 | 7 | 4 | 6 | 16 | 34 | 24 | 5 | 2 | 5 | 2 | 1 | 1 |
| Thursday | 1 | - | - | - | - | 1 | 1 | 12 | 30 | 2 | 8 | 5 | 4 | 3 | 5 | 31 | 29 | 16 | 14 | 5 | 6 | 2 | 2 | - |
| Friday | 1 | - | - | - | - | - | 1 | 7 | 30 | 4 | 5 | 3 | 7 | 2 | 3 | 21 | 32 | 25 | 7 | 10 | 1 | 2 | 1 | 1 |
| Saturday | 1 | - | - | - | - | - | 2 | 1 | 2 | 7 | 12 | 15 | 8 | 8 | 17 | 7 | 15 | 12 | 3 | 4 | 3 | 1 | 2 | 2 |
| Sunday | 2 | - | - | - | - | - | - | - | - | 2 | 5 | 9 | 2 | 5 | 6 | 6 | 10 | 4 | 7 | 1 | - | - | - | - |
| Totals | 4 | - | - | - | 1 | 2 | 12 | 56 | 151 | 26 | 39 | 43 | 43 | 29 | 43 | 125 | 163 | 119 | 53 | 33 | 20 | [illegible] | 8 | [illegible] |
| Percentages | 0.4 | - | - | - | 0.1 | 0.2 | 1.2 | 5.7 | 15.4 | 2.6 | 4.0 | 4.4 | 4.4 | 3.0 | 4.4 | 12.7 | 16.6 | 12.1 | 5.4 | 3.4 | 2.0 | .8 | 0.8 | 0.5 |

MOTOR CYCLE AND POWER CYCLE ACCIDENTS BY TIME OF DAY BY DAY OF WEEK

## TABLE VIII

| DAYS OF THE WEEK | TIMES OF THE DAY | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Midnight - 1 a.m. | 1 - 2 am | 2 - 3 am | 3 - 4 am | 4 - 5 am | 5 - 6 am | 6 - 7 am | 7 - 8 am | 8 - 9 am | 9 - 10 am | 10 - 11 am | 11 - 12 noon | 12 - 1 pm | 1 - 2 pm | 2 - 3 pm | 3 - 4 pm | 4 - 5 pm | 5 - 6 pm | 6 - 7 pm | 7 - 8 pm | 8 - 9 pm | 9 - 10 pm | 10 - 11 pm | 11 - Midnight |
| Monday | 2 | 1 | 1 | - | - | 1 | 3 | 33 | 33 | 10 | 15 | 20 | 29 | 18 | 18 | 27 | 54 | 61 | 35 | 35 | 17 | 16 | 14 | 8 |
| Tuesday | 7 | 2 | - | 2 | - | 1 | 5 | 43 | 33 | 12 | 10 | 15 | 31 | 17 | 16 | 31 | 43 | 53 | 30 | 36 | 22 | 10 | 14 | 12 |
| Wednesday | 4 | 3 | 2 | 1 | - | - | 5 | 47 | 29 | 6 | 20 | 13 | 30 | 16 | 19 | 29 | 44 | 70 | 39 | 35 | 26 | 23 | 29 | 16 |
| Thursday | 2 | 1 | - | - | - | - | 7 | 38 | 49 | 16 | 14 | 13 | 33 | 22 | 13 | 32 | 58 | 58 | 37 | 45 | 29 | 25 | 41 | 18 |
| Friday | 7 | 4 | 3 | 1 | 1 | 1 | 6 | 51 | 39 | 13 | 12 | 12 | 34 | 21 | 23 | 38 | 74 | 69 | 65 | 68 | 48 | 42 | 55 | 23 |
| Saturday | 19 | 16 | 6 | 6 | 2 | - | 4 | 11 | 8 | 16 | 19 | 42 | 38 | 47 | 47 | 42 | 69 | 45 | 44 | 38 | 31 | 19 | 35 | 28 |
| Sunday | 23 | 16 | 11 | 5 | - | - | 1 | 5 | 4 | 6 | 11 | 28 | 29 | 33 | 39 | 39 | 43 | 40 | 28 | 33 | 16 | 10 | 13 | 6 |
| Totals | 64 | 43 | 23 | 15 | 3 | 3 | 31 | 228 | 195 | 79 | 101 | 143 | 224 | 174 | 175 | 238 | 385 | 396 | 278 | 290 | 189 | 145 | 205 | 111 |
| Percentages | 1.7 | 1.2 | 0.6 | 0.4 | 0.1 | 0.1 | 0.8 | 6.1 | 5.2 | 2.1 | 2.7 | 3.8 | 6.0 | 4.7 | 4.7 | 6.4 | 10.3 | 10.6 | 7.4 | 7.8 | 5.1 | 3.9 | 5.4 | 3.0 |

## AGE OF CASUALTIES

It is not surprising to find pedestrian casualties (Table IX) involving those at the extremes of life, but it must be a cause for concern that the "mortality index" for children under 5 years exceeded 0.08 and that for pedestrians over 70 years reached 0.15 for the three years reviewed.

Similarly, while the peak for cycle accidents (Table X) was

not unexpectedly in the 10-14 age group, the figures (particularly for fatal accidents) in the 5-9 age group are disturbingly high.

TABLE IX

AGES OF PERSONS KILLED AND INJURED DURING THE THREE CALENDAR YEARS 1972, 1973, 1974

PEDESTRIANS

| AGE GROUPS | KILLED | | | INJURED | | |
|---|---|---|---|---|---|---|
| | 1972 | 1973 | 1974 | 1972 | 1973 | 1974 |
| Under 5 years | 20 | 20 | 20 | 222 | 264 | 238 |
| 5 - 9 years | 11 | 21 | 21 | 407 | 432 | 414 |
| 10 - 14 years | 3 | 8 | 8 | 203 | 233 | 239 |
| 15 - 19 years | 3 | 12 | 4 | 221 | 265 | 232 |
| 20 - 24 years | 1 | 9 | 4 | 145 | 169 | 137 |
| 25 - 29 years | 4 | 3 | 2 | 76 | 85 | 80 |
| 30 - 34 years | 4 | 3 | 1 | 65 | 60 | 56 |
| 35 - 39 years | 3 | 6 | 6 | 51 | 54 | 59 |
| 40 - 44 years | 1 | 3 | 4 | 50 | 71 | 72 |
| 45 - 49 years | 5 | 3 | 5 | 87 | 72 | 55 |
| 50 - 54 years | 5 | 4 | 5 | 72 | 85 | 85 |
| 55 - 59 years | 10 | 8 | 7 | 60 | 74 | 66 |
| 60 - 64 years | 7 | 15 | 9 | 81 | 76 | 75 |
| 65 - 69 years | 12 | 12 | 4 | 74 | 61 | 57 |
| 70 years and over | 25 | 25 | 25 | 156 | 168 | 141 |
| Unknown age | - | 1 | - | 24 | 13 | 18 |
| TOTALS | 125 | 157 | 125 | 1,994 | 2,180 | 2,024 |

TABLE X

AGES OF PERSONS KILLED AND INJURED DURING THE THREE CALENDAR YEARS 1972, 1973, 1974

PEDAL CYCLISTS

| AGE GROUPS | KILLED | | | INJURED | | |
|---|---|---|---|---|---|---|
| | 1972 | 1973 | 1974 | 1972 | 1973 | 1974 |
| Under 5 years | - | - | - | 2 | - | 2 |
| 5 - 9 years | 4 | 5 | 7 | 160 | 183 | 193 |
| 10 - 14 years | 8 | 7 | 7 | 469 | 501 | 426 |
| 15 - 19 years | 2 | 5 | 3 | 143 | 113 | 140 |
| 20 - 24 years | 1 | 1 | - | 36 | 40 | 39 |
| 25 - 29 years | - | - | 1 | 23 | 19 | 20 |
| 30 - 34 years | - | - | 1 | 15 | 8 | 14 |
| 35 - 39 years | - | 2 | - | 21 | 14 | 17 |
| 40 - 44 years | 1 | 1 | - | 29 | 16 | 23 |
| 45 - 49 years | - | 1 | - | 13 | 12 | 9 |
| 50 - 54 years | - | 3 | 1 | 25 | 18 | 19 |
| 55 - 59 years | 3 | 2 | 1 | 25 | 20 | 18 |
| 60 - 64 years | 2 | 1 | 1 | 23 | 30 | 8 |
| 65 - 69 years | 1 | - | 1 | 19 | 17 | 15 |
| 70 years and over | - | 2 | 3 | 19 | 22 | 21 |
| Unknown age | - | - | - | 7 | 5 | 5 |
| TOTALS | 22 | 30 | 26 | 1,029 | 1,018 | 969 |

Motor cycle casualties show the expected preponderance (Table XI) in the 15-19 age group. The sociology of motor cycle usage at this age is a subject in itself, and need not be enlarged on here.

TABLE XI

AGES OF PERSONS KILLED AND INJURED DURING THE THREE CALENDAR YEARS 1972, 1973, 1974

MOTOR CYCLISTS

| AGE GROUPS | KILLED | | | INJURED | | |
|---|---|---|---|---|---|---|
| | 1972 | 1973 | 1974 | 1972 | 1973 | 1974 |
| Under 15 years | - | - | - | 8 | 13 | 18 |
| 15 - 19 years | 54 | 56 | 51 | 1,711 | 1,928 | 1,957 |
| 20 - 24 years | 20 | 20 | 23 | 613 | 723 | 742 |
| 25 - 29 years | 3 | 7 | 6 | 117 | 138 | 148 |
| 30 - 34 years | - | 6 | 3 | 45 | 43 | 53 |
| 35 - 39 years | 3 | - | 3 | 32 | 27 | 34 |
| 40 - 44 years | - | - | - | 17 | 25 | 26 |
| 45 - 49 years | - | 1 | - | 11 | 16 | 24 |
| 50 - 54 years | 1 | | | 8 | 14 | 10 |
| 55 - 59 years | | | | 13 | 7 | 11 |
| 60 - 64 years | - | - | | 5 | 10 | 4 |
| 65 - 69 years | - | - | - | 2 | 2 | 5 |
| 70 - 74 years | | | - | 4 | 3 | 2 |
| 75 years and over | - | | - | 6 | 5 | 6 |
| TOTALS | 87 | 97 | 87 | 2,593 | 2,954 | 3,045 |

## PATTERN OF INJURY

To assess in more detail the injuries suffered by these categories of road user, a survey has been made of those casualties admitted in 1975 to the orthopaedic wards of Wellington Hospital. This is the base hospital of the capital city, and draws its admissions from the city and inner suburbs, from the satellite city of Porirua, and from outer suburbs towards the West Coast; it serves a population of some 240,000.

The survey excludes casualties not requiring inpatient care, and those admitted to the other surgical wards. This selection was influenced by the calssification of medical records within this hospital, and excluded such spectacular admissions as the 21-year-old motorcyclist who (preoccupied with making an obscene gesture to a passing traffic officer) rode his vehicle into the side of a taxi, suffering head and internal injuries to which he succumbed two weeks later, but also fractures of every major limb bone except the femur which still bore an intramedullary rod introduced in the treatment of a previous motorcycle injury (his third) some months before.

For the purposes of this survey, pedestrians have been taken to include

a. persons walking and struck by a vehicle

b. persons falling while descending from a stationary vehicle, and

c. one person who tripped over a parking meter!

but not to include one who tripped over a chain in a driveway.

Cyclists have been those injured while riding a two-or three-wheel pedal cycle; and motor cyclists have included pillion riders.

The resultant series consists of 120 cases, in categories of road user as follows:

| | | |
|---|---|---|
| pedestrians | 38 | (32%) |
| cyclists | 12 | (10%) |
| motor cyclists | 70 | (58%) |

## AGE AND SEX DISTRIBUTION

The age distribution (Table XII) corresponds well enough with that shown in the national figures in tables IX - XI.

In all categories, there was a preponderance of males (Table XIII): this is less surprising, perhaps, in the case of motor-cyclists than in other categories.

TABLE XII WELLINGTON HOSPITAL : AGES OF ORTHOPAEDIC ADMISSIONS 1975

| | PEDESTRIANS | CYCLISTS | MOTORCYCLISTS |
|---|---|---|---|
| Under 5 years | 3 | 2 | - |
| 5 - 9 | 6 | - | - |
| 10 - 14 | 2 | 4 | 1 |
| 15 - 19 | 5 | - | 33 |
| 20 - 24 | 2 | 1 | 2 |
| 25 - 29 | 2 | - | 4 |
| 30 - 34 | 3 | - | 3 |
| 35 - 39 | - | - | - |
| 40 - 44 | 4 | - | 1 |
| 45 - 49 | - | - | 2 |
| 50 - 54 | 1 | - | 1 |
| 55 - 59 | 1 | - | - |
| 60 - 64 | 2 | - | - |
| 65 - 69 | - | - | - |
| 70 years and over | 3 | - | - |

TABLE XIII WELLINGTON HOSPITAL : SEX OF ORTHOPAEDIC ADMISSIONS 1975

| | PEDESTRIANS | CYCLISTS | MOTORCYCLISTS |
|---|---|---|---|
| Male | 30 | 8 | 1 |
| Female | 8 | 4 | 1 |

## SEVERITY OF INJURIES

Pedestrians spent substantially longer in hospital, average 34.89 days as compared with 23.67 days in the case of cyclists and 26.63 days in the case of motorcyclists. They also required more surgical procedures (range 0-4, average 1.45) than cyclists (0-2, average 1.00) and motorcyclists (0-4, average 1.31).

The older pedestrian admissions contributed to, but did not entirely account for, this disparity.

The incidence of multiple fractures was barely higher in the case of motorcyclists (Table XIV)and from the nature of their injuries or their clinical records, it can be predicted that 8 pedestrians and 11 motorcyclists will suffer significant permanent disability. Moreover, at the time of the survey (5 months after the end of the period concerned, and thus 5-17 months after the time of Injury) one pedestrian and 12 motorcyclists had their treatment incomplete, in addition to 6 motorcyclists who had been transferred to other hospitals and whose situation as regards completion of treatment was thus uncertain.

TABLE XIV **WELLINGTON HOSPITAL : SEVERITY OF INJURY**
**ORTHOPAEDIC ADMISSIONS 1975**

| | PEDESTRIANS | CYCLISTS | MOTORCYCLISTS |
|---|---|---|---|
| Number of patients | 36 | 12 | 76 |
| Injuries included fracture | 35 | 10 | 67 |
| Multiple fractures | 8 | - | 11 |
| Permanent disability likely | 8 | - | 11 |

DISTRIBUTION OF INJURIES

As would be anticipated in an orthopaedic survey, limb injuries were in the majority (Table XV), and cyclists showed a higher incidence of upper limb injuries than the other two categories; more surprising, perhaps, is the closely parallel pattern in these other groups, with only a small increase in the frequency of lower trunk injuries in pedestrians to distinguish them - this feature may readily be ascribed to the second impact against bonnet or mudguard.

TABLE XV **WELLINGTON HOSPITAL : DISTRIBUTION OF INJURIES**
**ORTHOPAEDIC ADMISSIONS 1975**

| | PEDESTRIANS | CYCLISTS | MOTORCYCLISTS |
|---|---|---|---|
| Head | 1 (2) | 1 (8) | 5 (7) |
| Upper limb | 10 (19) | 4 (33) | 20 (27) |
| Trunk (above diaphragm) | 1 (2) | 1 (8) | 3 (3) |
| Trunk (below diaphragm) | 6 (12) | - | 7 (7) |
| Hip & thigh | 10 (19) | 3 (25) | 19 (26) |
| Knee, leg, foot | 23 (45) | 3 (25) | 45 (44) |

(Percentage distribution in brackets)

OTHER FACTORS

In three pedestrians, alcohol was referred to in the case notes - the actual level of alcohol influence was probably higher; in none of the cyclists and in only one of the motorcyclists do the case notes record the presence of alcohol.

The disturbing feature in the motorcyclists' records is the frequency of previous motorcycle trauma - 5 had previous admissions, 3 of these with lower limb fractures and two with head injuries; moreover 4 of the previous admissions were in 1974, and one of these patients (after occupying a bed for 111 days in 1975) was re-admitted in January 1976 with a further fracture of the same femur. It seems in this series (and from past experience) that the

compulsion to ride a motorcycle can be proof against the lessons of experience.

## THE COST

The 120 patients in this series were in hospital for 3474 patient-days, and thus occupied 9.5 orthopaedic beds (13.5% of a 70 bed unit) for the year. They contributed significantly to a a situation in which the unit is filled to about 80% of its capacity by trauma, so that elective orthopaedic surgery is ill-provided for.

They cost at a per diem rate of $NZ65 for inpatient care, some $225,810 for the treatment received. Assuming them to have been drawn from roughly 8% of the population, the cost to the country of inpatient orthopaedic care would approximate $2.82 million. The cost of inpatient care in other surgical wards plus outpatient care could reasonably be expected to double this, to give a figure of some $5-6 million as the direct cost of medical treatment.

Further direct costs can be conjectured if one considers that these casualties were in hospital for an average of 29 days and probably thereafter incapacitated for a comparable period; earnings-related compensation amounting to 80% of average income is payable for this period.

Finally there is the provision under the Accident Compensation legislation in New Zealand, for lump sum payments for permanent disability, and for compensation of the dependents of those dying after accidents (in 1974, in our three categories, a total of 257 persons).

Such costs could be assessed; what cannot so readily be priced is the destruction of property and the loss of production which these accidents have entailed; and what cannot be given a price at all is the misery and the maiming with which the surgeon is confronted.

## SUMMARY

Ministry of Transport statistics in 1974, and the orthopaedic admissions to Wellington Hospital in 1975, have been studied to give an indication of the significance of pedestrian, cycle and motorcycle accidents to New Zealand. Notable findings include the high mortality index and prolonged inpatient time of pedestrian casualties, the high risk to children as pedestrians or cyclists, and the major and recurring nature of motorcycle casualties.

## REFERENCES

Singh C, Robson J.H. and Toomath J.B.: Traffic Research Report No 8; Ministry of Transport, Wellington, New Zealand (1975)

Motor Accidents in New Zealand: Statistical Statement (1974)

Henry, G.: Personal Communication (1976)