Report No. 75-004-7752

FRANGIBLE BASE ACCIDENT EXPERIENCE IN NEW JERSEY

by

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prepared by

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November, 1974

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I. Summary and Conclusions

The results of an investigation into automobile accidents involving the impact of cast aluminum frangible base luminaire and traffic signal supports indicate that from 5% to 7% of accidents involving luminaires and from 4% to 17% of accidents involving traffic signals result in reported injuries. No reported fatalities have occurred in the recent past due to such impacts. For all fixed object accidents the corresponding figures are 44% resulting in reported injuries and just over 1% resulting in reported fatalities.

Therefore, it is concluded that any increased cost to decrease the momentum change of a vehicle impacting either a luminaire or traffic signal mounted on a cast aluminum frangible base does not appear to be warranted. The much higher percentage of reported injuries for all fixed object accidents indicates that any additional funding should be spent to alleviate the other problem areas.

II. Introduction

The AASHTO Committee on Structures is currently considering deleting cast aluminum frangible bases from the approved list of specifications for luminaire and traffic signal support structures. In approximately 18 months, FHWA criteria for such supports are expected to reflect the findings of the AASHTO committee. This action would dissuade the State of New Jersey from installing cast aluminum frangible bases on all new or replacement luminaire and traffic signal supports. The new criteria would specify bases which would cause smaller momentum changes in a vehicle when it impacts a support than is possible with a frangible base.

At the request of the Bureau of Electrical Operations, accident data has been compiled which reflects the severity of accidents involving the frangible bases used in New Jersey. The data was collected for accidents involving luminaires and traffic signals with several base types. The severity of injury was determined for reported accidents from police or driver reports. The Bureau of Electrical Operations files were the source of base-type data.

III. Study Procedure

Due to availability of data, the 12 month period from July 1, 1971 to June 30, 1972 was chosen as the study year. In the first phase of data collection, the total number of accidents involving luminaires and signals was determined. The Bureau of Electrical Operations' work orders for "Accidental Damages-Highway Lighting" and "Accidental Damages-Traffic Signals" were searched and tabulated. If there was damage to the base, as there was in 591 cases, the incident was defined as a "knockdown".

The second phase of data collection was an attempt to ascertain the severity of injury associated with each knockdown. This was possible in the 362 cases in which the work orders listed reported accidents. There were no reported accidents associated with the remaining 229 knockdowns.

Police or driver reports for reported accidents were obtained from two sources. The Department's electrical and maintenance claim files were the source of 237 reports and a search by the Bureau of Accident Records located another 100. There were 25 reports which could not be found.

When there is no injury, or property damage is less than $200, it is not required that an accident report be filed. But, if the driver or owner of the vehicle who caused the knockdown is known, the work order file would indicate a reported accident. In cases where no police or driver report was located and the estimate of damage listed on the work order was less than $200, the knockdown was classified as "Low Damage Estimate". Therefore, of the 25 reports which could not be located, three have been considered low damage estimates.

Varying amounts of data were available from the reports which were located. In the large majority of cases, accident severity could be determined. In less than 7% of the cases, the injury severity could not be related to base type because: a) the report was unclear about the injury, b) the base type could not be determined, or c) there were no occupants in the vehicle causing the knockdown.

Accident severity data was divided into two groups; knockdowns where injury did or did not occur. These two groups were further subdivided into categories of multiple impact accidents and single impact accidents. An accident was defined as multiple impact when the vehicle causing the knockdown also collided with other potential injury causing objects, such as another vehicle or barrier curb. An accident was defined as a single vehicle impact when the majority of the damage occurred as a result of the knockdown. In some cases, the defining as single or multiple impacts required judgment on the part of the data collector. This was due to collisions with other usually non-injury causing objects such as curbs or snow-fences. If an injury occurred and the definition was questionable, the collision was defined as multiple impact. The injury groups were divided into these two categories in order that injuries which occurred could be confidently attributed to the knockdown and not to a secondary impact.

The support structures involved in the knockdowns were composed of different combinations of bases and poles. Two of the types, the TB-2 and HHB bases, were not an integral part of the pole. They were both cast aluminum frangible bases, but they differ in that the HHB has a smaller bolt circle and its use is limited to installations in center barrier curbs and, occasionally, for replacement of damaged non-frangible bases. The other most commonly knocked-down type was the pedestal. This is installed with the base and pole as integral parts of the structure. A pedestal was also referred to as a four-lug pedestal, four-hole pedestal, and a four-hole pedestal standard.

In some cases, the base type was given as just "base", the Bureau of Electrical Operations stated that it can be assumed that this is either a TB-2 or HHB base. In center barriers, HHB bases are used exclusively, therefore, a center barrier location is considered to be an HHB base, otherwise a TB-2 is assumed. Also, there were references to base and pole combinations called "SP648V" and "pedestal standard" for which the Bureau of Electrical Operations has not located specifications. There were no knockdowns where the base type was determined to be non-frangible. The most frequently used base types are shown in Figure 1 and the number of knockdowns for luminaires and signals tabulated by base type is shown in Table 1.

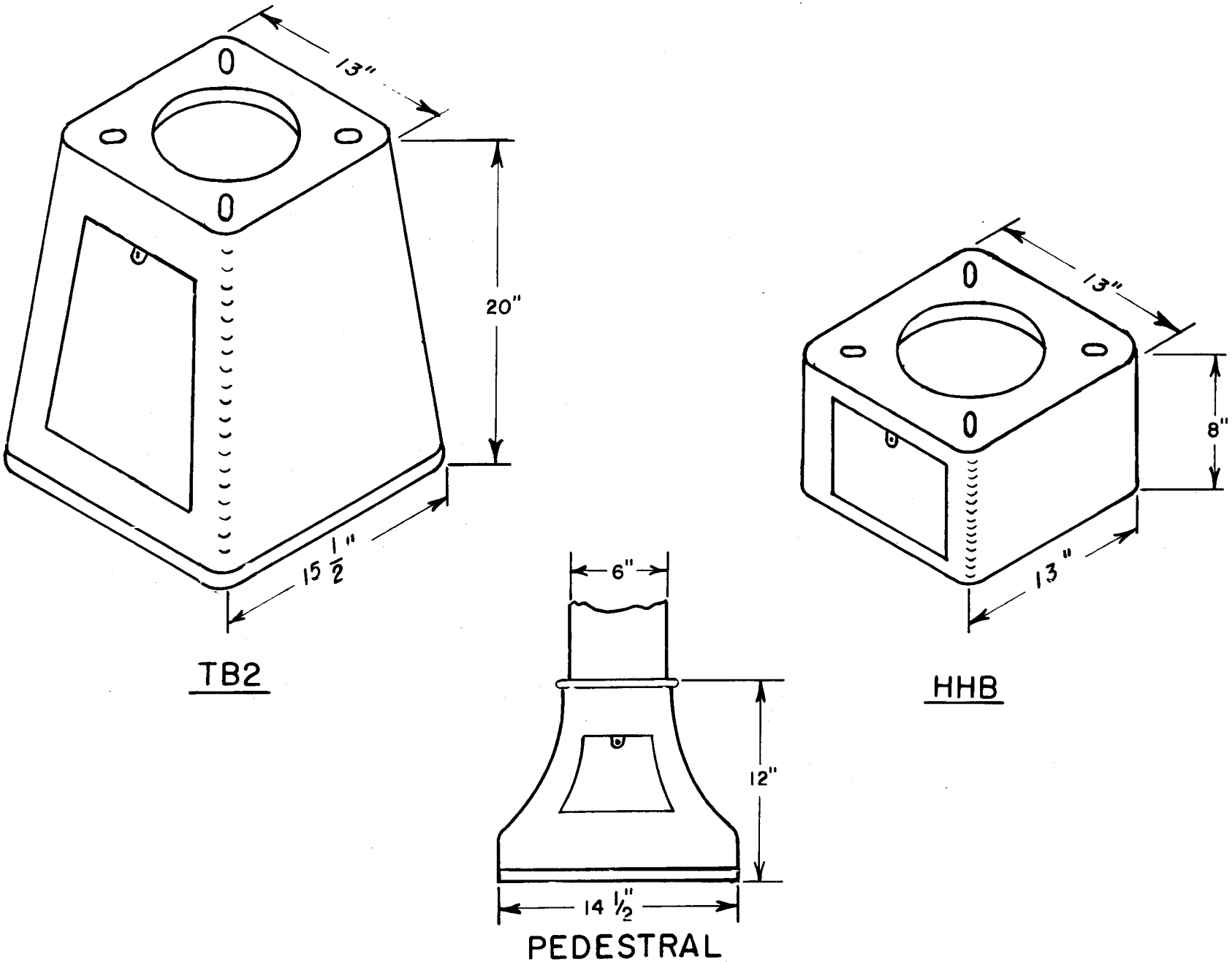

FIGURE 1: Scale Sketches Of Bases Most Frequently Knocked Down

LUMINAIRES	
TB-2 Base	133
HHB Base	7
Pedestal	1
Others or Not Known	5
	146

SIGNALS	
TB-2 Base	222
HHB Base	58
Pedestal	130
Others or Not Known	35
	445

TABLE 1: NUMBER OF KNOCKDOWNS BY BASE TYPE

IV. DISCUSSION AND RESULTS

The tabulation of data is in Tables 2, 3, 4, and 5. Table 2 presents totals for all knockdowns, while Tables 3, 4, and 5 show the breakdown for each of the 3 most commonly knocked-down base types. The difference between Table 2 and the sum of the other three tables is due to the "other" category which is not listed separately.

An example of the progression through the data flow chart is as follows for luminaire data in Table 2. Of the total of 146 knockdowns, 58 knockdowns, or 40%, were matched with reported accidents and 88 knockdowns, or 60%, were not associated with reported accidents. Of the total luminaire knockdowns, 8 knockdowns, or 6%, had insufficient data for further analysis.

)TE: Percentages with respect to Luminaire or signal knockdowns

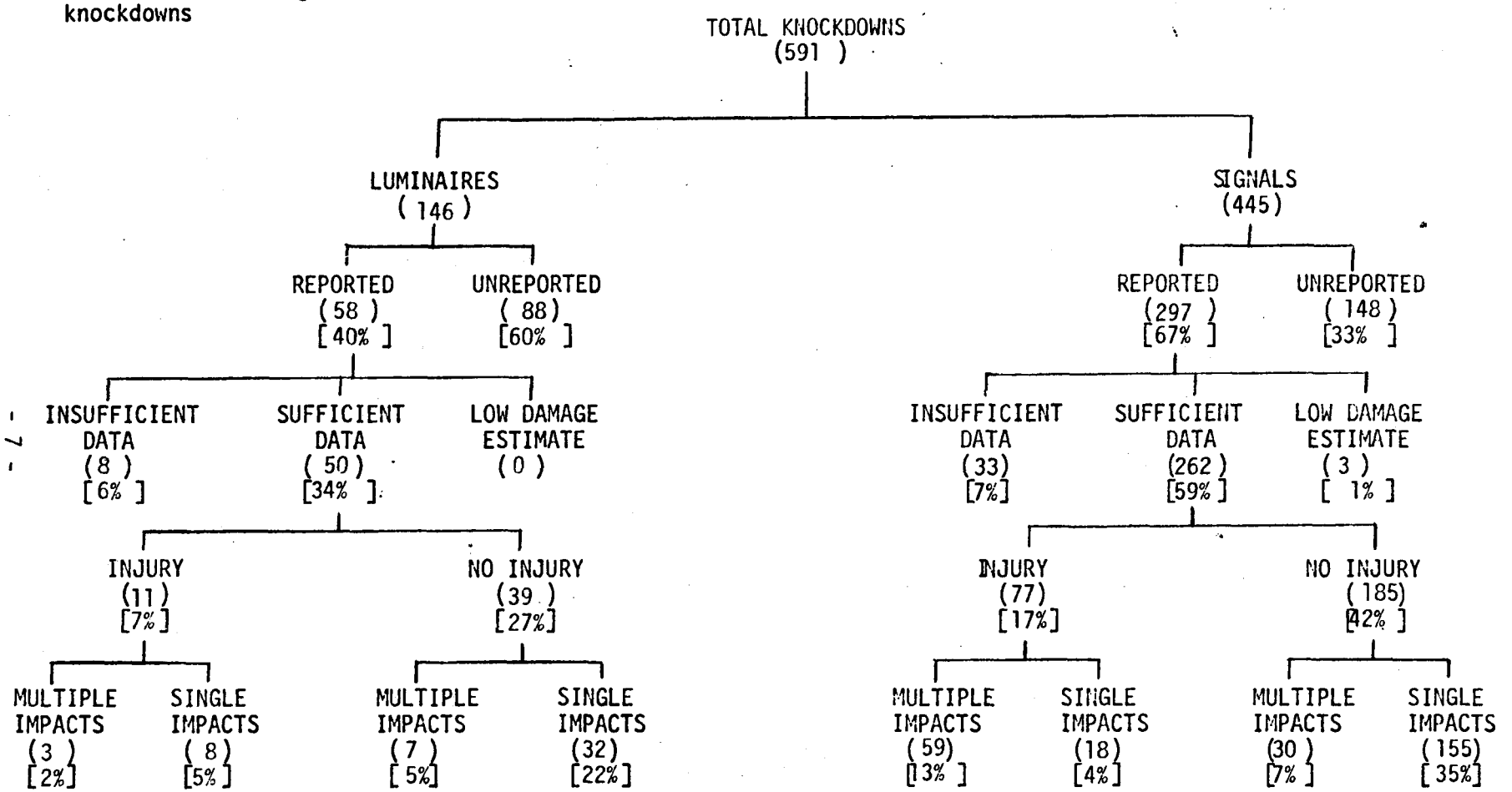

TABLE 2: ACCIDENT DATA FOR ALL BASE TYPES

OTE: Percentages with respect to Luminaire or signal knockdowns

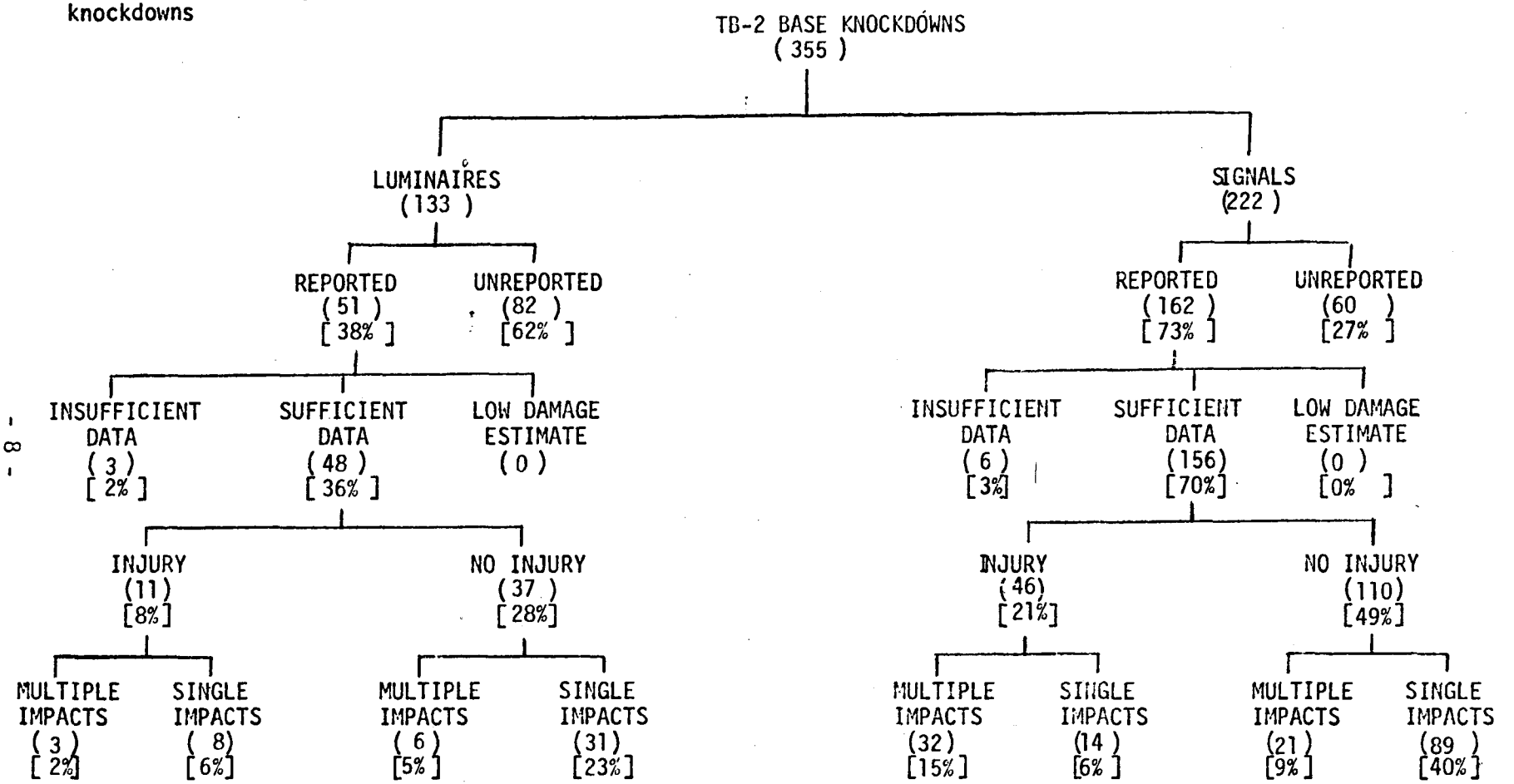

TABLE 3: ACCIDENT DATA FOR TB-2 BASE

OTE: Percentages with respect to Luminaire or signal knockdowns

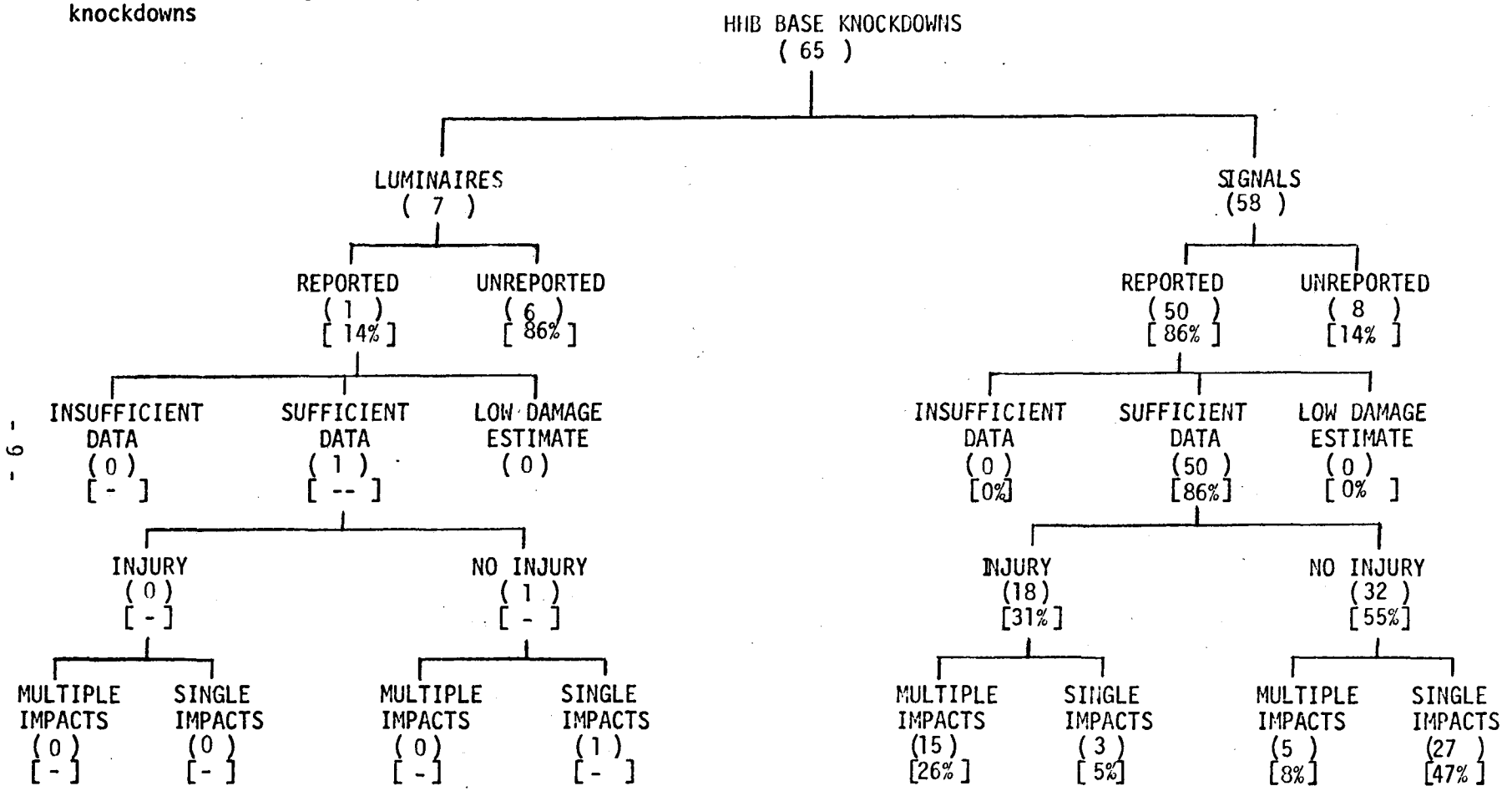

TABLE 4: ACCIDENT DATA FOR HHB BASE

OTE: Percentages with respect to Luminaire or signal knockdowns

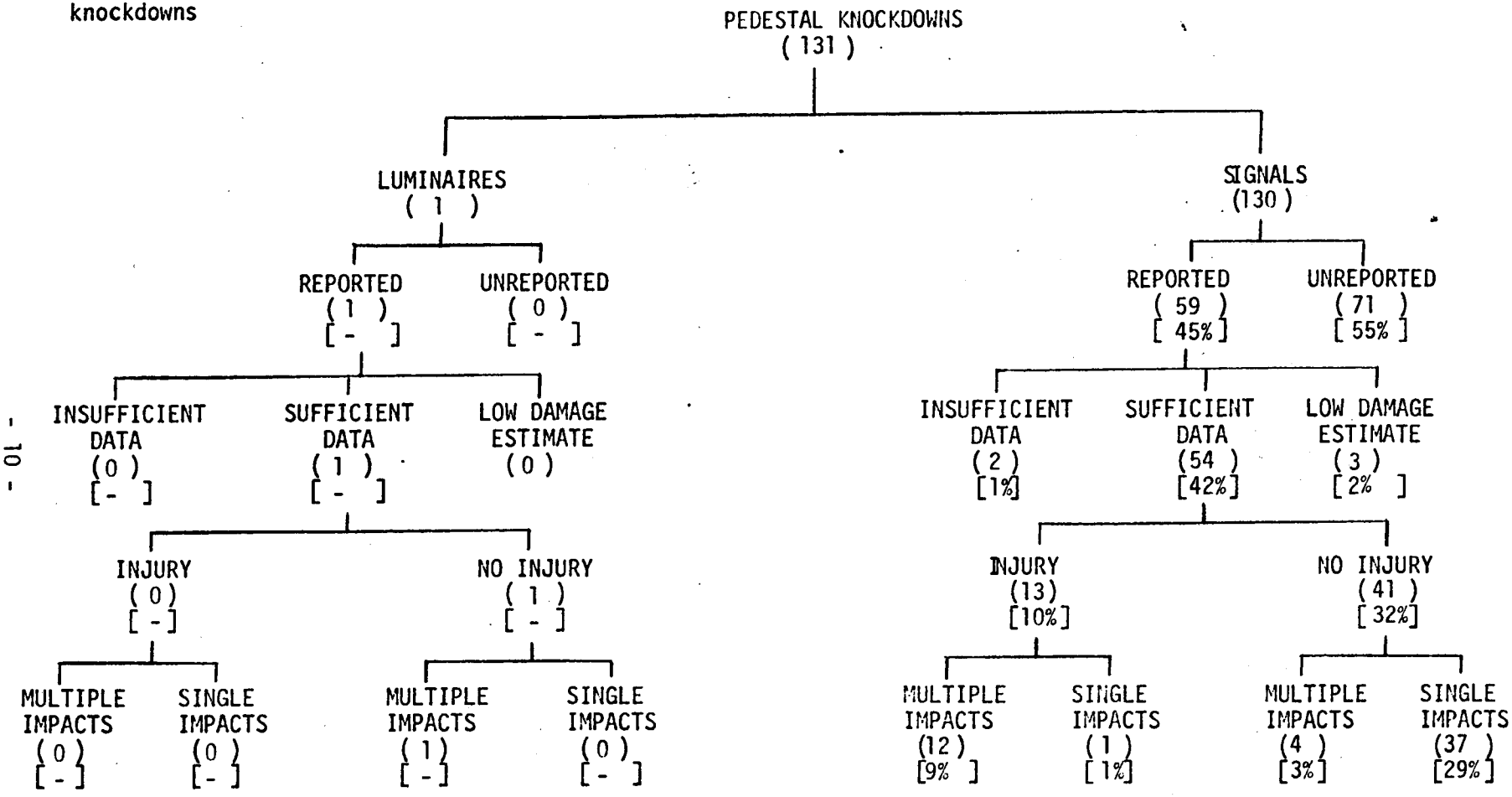

TABLE 5: ACCIDENT DATA FOR PEDESTAL BASE

This group included reported accidents where the accident report could not be located, and knockdowns where injury severity could not be related to base type.

For 50 of the reported accident knockdowns, or 34% of the luminaire total, there was sufficient data to continue the analysis. As can be seen in the table, the sufficient data group was divided into knockdowns with or without injury and further subdivided into single and multiple impact accidents. It should be emphasized that the percentages shown in the table are with respect to the number of corresponding luminaire or signal knockdowns, and not total knockdowns.

Data was also collected for injury severity. It was determined that injury could be attributed to the knockdown only in the case of single vehicle, single object impacts. Injury could not necessarily be attributed to the knockdown itself where there were multiple impacts, since the injury may have been caused by the impact with the other objects. For the case of single vehicle, single object impacts, the injury severity data is given in Table 6. The Total Injury Accidents column of the Table is the number of single vehicle, single object impacts where injury occurred. The "Most Serious Injury Code" is that used in New Jersey accident reports for the most seriously injured occupant of the vehicle which caused the knockdown.

The final analsyis indicates that between 8 and 11 reported injury accidents resulted from 146 knockdowns of luminaires which is a range from 5% to 7%. For signals the numbers are from 18 to 77 reported injury

LUMINAIRES

Base Type	Total Injury Accidents	Number of knockdowns with "Most Serious Injury" Code (2)	(3)	(4)	(I)
TB-2	8	2	2	1	3
All Others	0	0	0	0	0
Total	8	2	2	1	3

SIGNALS

TB-2	14	2	3	6	3
HHB	3	0	1	2	0
Pedestal	1	0	0	1	0
Total	18	2	4	9	3

INJURY CODE KEY

1 - Killed
2 - Incapacitation: Bleeding wound, distorted memory, carried from scene
3 - Non-incapacitating: other visible bruises, abrasions, swelling, limping
4 - Possible: no visible injury, momentary unconsciousness, complaint of pain
I - Injury: no details given

TABLE 6: ACCIDENT SEVERITY FOR SINGLE VEHICLE, SINGLE OBJECT IMPACTS

accidents for 445 knockdowns which is a range from 4% to 17%. The ranges given above are based on the assumption that some percentage of multiple impact accidents result in injury which is caused by the impact with the luminaire or signal support, but, since it is an unknown quantity, only the ranges are given. The Bureau of Electrical Operations has stated that they know of no fatality related to impacting of luminaire supports or traffic signal supports. For the year of 1971, the Bureau of Accident Records lists a total of 28,899 fixed object accidents of which 12,781 or 44%, resulted in injury and 324, or just over 1% resulted in a fatality. For 1972, the corresponding percentages are the same.

In the only other similar type study located, Lazenby[1] calculated that for a cast aluminum frangible base used in Texas, similar to the TB-2, 12 out of 58 (21%) accidents involving highway lighting installations resulted in injury, and there were no reported fatalities. Accidents involving other fixed object collisions, contact between two or more cars either before or after the accident, and "hit-and-run" ("unreported") accidents were not included in his analysis. If the same exclusions are made in the data for New Jersey the TB-2 base types would be 8 out of 40 or 20% comparing closely to Lazenby's results.

[1]LAZENBY, J.G., Progress Report on the Design Concept and Field Performance of Breakaway Devices for Illumination Poles in Texas, Bureau of Public Roads, February, 1967

APPENDIX

There are several designs which are expected to meet the new specifications for luminaire bases. These are the Texas Slip-Base, the Hapco frangible coupling, and the Safety Shear frangible coupling designs. At the present time, the Texas Slip-Bases and Hapco Couplings have been shown to meet the previous standards and have been installed in field locations. The Safety Shear is expected to meet the new specifications and be marketed within a year.

A cost comparison of the three New Jersey bases of this report and the three bases expected to meet the new standards are shown in Table 1A. All costs shown in this table assume that installation time (man-hours) and any damages to the pole and light head are constant. Initial installation cost is the price of installing the base at a location where there was no luminaire previously. Cost to convert from existing frangible base is the cost of replacing the existing TB2, HHB, or Pedestal base with one that meets the new standards. Replacement cost due to impact is the cost of repairing the existing base following a knockdown. It should be emphasized that cost of the Slip Base and either of the frangible coupling designs are only estimates. The Slip-Base and Hapco frangible coupling are presently included in construction projects, but the Safety Shear has not been used to date.

	Texas Slip-Base	Hapco Coupling	Safety Shear	TB-2	HHB	Pedestal
Initial Installation Cost	100*	35-50*	12-20*	35	30	50
Cost to convert from existing frangible base	100-200*	40*	20*	--	--	--
Replacement cost due to impact	5-10*	5-6*	12*	35	30	50

* Estimated

TABLE A1: DOLLAR COSTS OF BASES