



FinnRa Engineering News No 6

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BREAK-AWAY LIGHTING COLUMNS, CURRENT PRACTICE IN FINLAND IN 1998

Accidents related to lighting columns

An average of six people died in crashes into rigid lighting columns in Finland in one year before the Finnish National Road Administration (Finnra) started to use brak-away lighting columns. The accident costs are shown in table 1.

Table 1: Accident Cost Caused By Collisions with Lighting Columns (FIM)

ADT (veh./day)	In One Year per Lighting Column	Present Value at a Discount Rate of 6 % in 20 years
-3000	567	6 900
3000-6000	1 483	18 031
6000-9000	2 085	25 345
9000-	2 288	27 812
Average	917	11 144

The result for ADT 6000-9000 veh/d includes 4.8 fatal accidents, 67 accidents resulting in injuries, and 100 accidents with material damage in 20 years per 1000 non-break-away lighting columns on the edge of the road. The sample contained 4920 columns, four years and only the cases where columns have increased the damages.

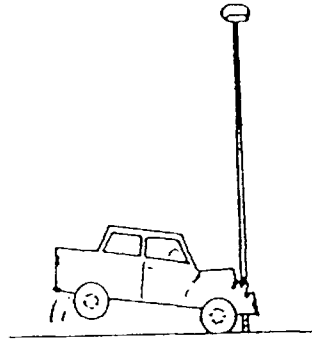
The following accident costs were used in the above calculations:

Fatal accident	7 550 000	FIM/killed
Accidents resulting in injuries	86 000	FIM/injured
Material damage	10 900	FIM/accident

1 FIM = 0.3 DEM = 1.1 FRF = 0.18 USD

The price of a break-away lighting column is normally 300 FIM higher than the price of a similar rigid column. Break-away columns reduce the accident costs related to lighting columns by 50...90 %, depending on the type of the column and the situation behind the column. It is cost-effective to use non-aggressive lighting columns on all roads, except roads with a very low traffic volume or low speed.

Rigid columns (unsafe at a crash)

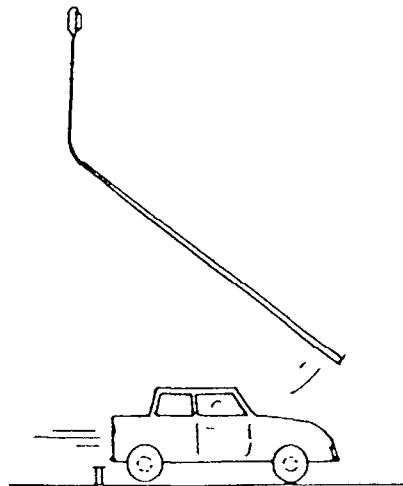


Rigid column

at a crash the car stops suddenly and the persons inside the car are very often injured
all the traditional wooden and metal columns are of this type

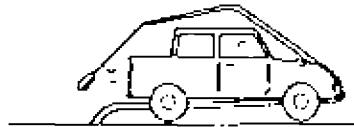
Break-away columns (safe at a crash)

1. Detachable columns



- columns may be made by modifying normal rigid metal or wood columns
- there is a weak section, slip-base or other detachment mechanism near ground level
- at a crash the column is loosened
- the car continues almost at the same speed (and may crash for instance into a tree)
- the falling column may hit the roof of the vehicle at a certain speed, for example 35...40 km/h (the situation is possible in tests, but no accidents have been reported)
- slip-bases do not always perform well on steep slopes, in soft soil or if the slip-base is situated too high.

2. Yielding, energy absorbing columns



at a crash the column becomes flat and bends under the car

if a column reduces the speed of a 900 kg vehicle from 100 km/h to 50 km/h or lower it is called highly energy absorbing
these energy absorbing columns prevent the car from crashing into a tree or other object behind the lighting column
energy absorbing columns must not be detached from their foundation

Figure 1: The functional properties of lighting columns.

Design standards

According to Finnish design standards new rigid columns may not be installed, when the ADT is greater than 3000 vehicles per day. In practice break-away lighting columns are used on roads with less traffic, too. On narrow roads with a very low traffic volume rigid wooden columns are usually used, but they should be placed behind the side ditch. Some 80 % of new lighting columns used by FinnRA are break-away. Behind guardrails or on roads with low speed (50km/h) rigid columns can, however, still be used. If there is a pedestrian way, rock wall or other hazard behind the column, energy absorbing lighting columns are recommended.

The present rigid lighting columns causing danger on roads with heavy traffic are planned to be modified to break-away between years 1995 and 2005. About half of the work has already been done. Methods for modifying modern lighting columns, both wood poles and steel columns, are not expensive. It is not necessary to repair all aluminium columns. On roads where road lighting is old fashioned and column spacing is short, the old columns shall be replaced with new safe ones. The replacement costs will be gained back as savings from accident and energy costs within 4...6 years, if ADT exceeds 6000 vehicles per day.

Cables

Ground cables should not be screwed directly on the wall of detachable lighting columns.

Lighting columns are often used with overhead cables. Normal cable fixings are used, except with yielding columns. On yielding columns the fixing hook glides upwards along the column when crashed. Break-away columns may be made to stand the load from the overhead cables as well as rigid columns.

Manufacturers: Products

The following impact tested break-away lighting columns are available in the Finnish market; manufacturer (dealer): product

1. Steel columns with a slip-base

The columns are normal steel columns with a slip base.

Stahlsund Oy, Finland, fax 358-9-222 7010: Steel columns with a slip-base. Widely used in Finland.

Tehomet Oy, Finland fax 358-15-431981: Steel columns with a slip-base. Widely used in Finland.

Örsta Stålinindustri as, Norway, fax 47-70-68742: Steel columns with a slip-base. Widely used in Norway.

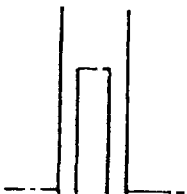
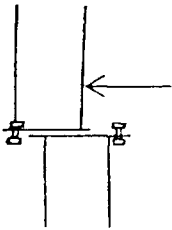
Petitjean SA, France (Onninen Oy, Finland, fax 358-9-875 5400): Steel columns with a slip-base. Not used in Finland.

2. Wood poles

Break-away wood poles are made of massive wood or lamellas or they are provided with a slip-base.

Vierumäen Teollisuus Oy Finland, fax 358-3-7187555: Safepole, a normal wood pole made hollow at the lower end. In a crash the pole breaks at the ground level. Widely used in Finland with overhead cables.

Metsäliitto SW Oy Finland, fax 358-10-4659503: Luxiroad, a normal wood pole made hollow at the impact level. New product. Equal to Junttila method for modifying existing wood poles.



Martinsons Ab Sweden (Lappset Group Oy, Finland, fax 358-16-320 9100) The Comwood gluelam column is a coneshaped pipe glued out of 12 wood lamellas. Used in Finland.

Tehomet Oy, Finland fax 358-15-431981: Slip-base set for wood poles. Widely used in Finland.

3. Modifying existing columns

Finnish National Road Administration/Htl fax 358-20444 2395: Sawing method for modifying existing wood poles to break-away poles. Widely used in Finland.

Maanrakennus Junttila, adress Junttilantie 6, 87100 Kajaani, Finland: Method for modifying existing wood poles to break-away. Widely used in Finland.

Tehomet Oy, Finland fax 358-15-431981: A slip-base set for modifying existing steel and wood poles. Widely used in Finland.

Sähkö-Jokinen Ky, Finland, fax 358-2-5481112: Slip-base set for modifying existing wood poles to break-away.

4. Yielding or energy absorbing columns

Vialumine Oy, Finland, fax 358-9-595006 (SLO Oy, Finland fax 358-102832020): The Vialumine column is made of an angular aluminium pipe reinforced with hot dip galvanized steel bars. The diameter of OMK columns is 140 mm. OIK columns with a thinner wall but a diameter 180 mm may be used with an overhead cable, as well. A specified rigid concrete foundation is used with 140 mm columns. 180 mm columns are often used with a special foundation, which may be pressed in the ground without digging. Widely used in Finland.

Sähkö-Jokinen Oy, Finland, fax 358-2 548 1112. KAPU, an energy absorbing yielding column made of steel lamellas. It is used with a specified rigid concrete foundation. Widely used in Finland.

Sähkö-Jokinen Oy, Finland, fax 358-2 548 1112. TURVA, a yielding column made of steel lamellas. It is used with a specified rigid concrete foundation. It is a modification from column KAPU, but it has a lower capacity for absorbing energy than KAPU has. Widely used in Finland.

Tehomet Oy, Finland, fax 358-15-431981: RELE, Where the lower part is a lattice construction with a thin steel cover and the upper part is like rigid steel column. The column looks like a normal rigid lighting column. It is used with a specified rigid concrete or steel foundation. Widely used in Finland.

Stahlsund, Finland, fax 358-0-222 7010: The yielding column made by Stahlsund is an angular steel pipe with thin steel walls reinforced with steel bars welded on the inner side of the wall. It is used with a specified rigid foundation. It has come into market in 1997.

Varmförzinkning Ab Sweden, fax 46-371-31972 (Silux Oy, Finland, fax 358-9-8021890): The ESV-column is an angular steel pipe with thin steel walls reinforced with steel bars welded on the inner side of the wall. A special yielding foundation is used with the columns. Widely used in Sweden.

Approvals in Finland Before the full adoption of the EN 12767 the Finnish National Road Administration has approved break-away lighting columns to be used in the following situations and performance classes:
Product, approved heights and impact test parameters: column height, impact speed, safety level and exit speed (EN 12767).

Energy absorbing columns Approved in Finland in safety level 2 or 3 as (highly) energy absorbing columns (exit speed ≤ 50 km/h), when speed limit is not higher than 120 km/h:

Vialumine OMK 140 mm	12 m	12 m (100,3,49)
Vialumine OIK 180 mm	12 m	
" with overhead cables	10-12	12 m (70,3,0)
SJ-KAPU	10-12	10 m (100,3,35)
Tehomet, RELE	10-12 m	12 m (100,3,0)
Stahlsund	12 m	10 and 12 m (100,2,0)*

* These energy absorbing columns with THIV 28 km/h belong to safety level 2 (with THIV 28..32 km/h). Ones in safety level 3 (THIV ≤ 27) may be preferred.

Approved in Finland in safety level 2 or 3 as (highly) energy absorbing columns, when speed limit is not higher than 80 km/h:

Vialumine OMK 140 mm	10-12	12 m (100,3,49)
Vialumine OIK 180 mm	10-12	
" with overhead cables	10-12	12 m (70,3,0)
SJ-KAPU	10-12	10 m (100,3,35)
" with overhead cables	10-12	
Tehomet RELE	10-12	12 m (100,3,0)
Stahlsund	10-12	10 and 12 m (100,2,0)
ESV	10 m	
" with overhead cables	10 m	

Non-energy absorbing columns Approved in Finland in safety levels 1-3 (THIV ≤ 27) as non energy absorbing columns, when speed limit is not higher than 120 km/h:

Vialumine 140	10 m	12 m (100,3,49)
Vialumine 180	10 m	
SJ-TURVA	10-12	(KAPU)
Stahlsund slip-base	10-12	12 m (35)
Tehomet slip-base	10-12	12 m (35)
Petitjean slip-base	10-12	12 m (35)
Comwood wood pole	10-12	12 m (35)
Vierumäen t. Safepole	10-12	12 m (35)
Metsäliitto Luxiroad	10-12	12 m (35)

The approval of yielding columns is based on two full scale impact tests with a 900 kg car. Test speeds are: highest column 35 km/h and smallest or highest column with 100 km/h or 70 km/h. The prEN 12767 requires one high speed test more: both the smallest and highest column shall be tested at 100 km/h or 70 km/h. Before the full adoption of EN 12767 the result of the missing test has been predicted from the results of other tests.

The approval of non-yielding columns is based on one test: highest column 35 km/h. The prEN 12767 requires one high speed test more.

Finra does not use to approve columns higher than 12 m or lower than 10 m.

Previous numbers:

1. Break-away lighting columns, current practice in Finland in 1993.
2. Foundations of luminare supports. The effect of backfill on the strains in foundations.
3. The need of space for snow remover from carriageways in Finland.
4. Acoustic performance of simple board and plywood fences.
5. Break-away lighting columns, current practice in Finland in 1996.

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