

## Simplified Life-Cycle Cost, LCC.

This document illustrates a simple, yet fairly comprehensive, LCC of median road median barriers divided into three common technologies.

Blue Systems' core idea throughout all of our product range is to create the best product possible using as little material as possible. This idea ensures a high effective, low cost and low environmental impact end product.

Typical repair ratios are: cable barriers 5 to steel beam barriers 1 whilst a typical steel beam repair activity imply the need of twice the time as well as twice the amount of workers and heavy machineries compared to a typical cable barrier repair activity. Concrete barriers are typically not in need of any repairs except for in extraordinary incidents.

In this simple LCC we have decided to value all included barriers equally safe.

In Sweden, the governmental Swedish Transport Administration invest tax-payer's money into road safety installations. Furthermore 50% of material costs from barrier repairs is charged the Swedish Transport Administration, remaining repair costs is covered by road users through car insurance policies.

Paragraphs not included in LCC above but should reasonably be included in LCC for Transport Administration or the society as a whole:

- Expected barrier life time. Damages on cable barriers from both collisions and plows etc. are continuously repaired resulting in cable barriers looking more or less brand new still after 23 years on Swedish roads. On beam barriers however, plow damages as well as smaller collision injuries are neglected and not repaired - resulting in the need of replacing the whole system prematurely.
- Environmental aspects from different barrier technologies. Cable barriers weighs on average less than other technologies, implying the need of less resources to produce the product as well as less work transporting goods.
- Societal cost of congestions due to repair work. Cable barrier repairs can almost always be planned and carried out at a time of day when it interferes with the flow of traffic to a minimum. Beam barrier repairs must usually be performed as soon as possible, and often during the times of day when traffic flow is disturbed greatly.
- Societal cost of deaths, seriously and slightly injured in barrier accidents. Barriers are installed to protect against something more dangerous and all barriers should be considered safer to crash into than what they protect against. Crash violence for vehicle's occupants are however proved lower in collision with cable barriers than other types of barriers.
- Societal cost of deaths, seriously and slightly injured in accidents where there was still no barrier installed due to lack of investment funds. A vehicle restraint system with low investment cost enables large quantities of protective barriers to be installed quickly - thus potentially saving more lives.
- Societal benefits of lives saved from death, serious and slight injuries in barrier accidents. Barriers are installed to protect against something more dangerous and all barriers should be considered safer to crash into than what they protect against. Crash violence for vehicle's occupants are however proved lower in collision with cable barriers than other types of barriers.
- And more...

### Life-cycle cost per 10 km of median H1-W5 barrier over 30 years:

Investment/installation	Cable (4RC-96)	Steel beam	Concrete
Acquiring of materials	158,1 k€ / 10 km	442,0 k€ / 10 km	1 081,1 k€ / 10 km
Installation cost	54,1 k€ / 10 km	75,8 k€ / 10 km	43,3 k€ / 10 km
<i>Subtotal</i>	<i>212,2 k€ / 10 km</i>	<i>517,8 k€ / 10 km</i>	<i>1 124,3 k€ / 10 km</i>
Service and maintenance	Cable (4RC-96)	Steel beam	Concrete
Repair actions per year	18,5 repair actions / year & 10 km	3,7 repair actions / year & 10 km	0 / year & 10 km
Acquiring of materials	227,5 € / repair	1 296,5 € / repair	-
Roadblock and repair cost	574,1 € / repair	1 831,4 € / repair	-
<i>Subtotal</i>	<i>14 830 € / year &amp; 10 km</i>	<i>11 573 € / year &amp; 10 km</i>	-
Total LCC Swedish Transport Administration			
<b>LCC 10 years</b>	<b>233 k€ / 10 km</b>	<b>542 k€ / 10 km</b>	<b>1 124 k€ / 10 km</b>
<b>LCC 20 years</b>	<b>254 k€ / 10 km</b>	<b>566 k€ / 10 km</b>	<b>1 124 k€ / 10 km</b>
<b>LCC 30 years</b>	<b>275 k€ / 10 km</b>	<b>590 k€ / 10 km</b>	<b>1 124 k€ / 10 km</b>
Total LCC incl. full repairation costs			
<b>LCC 10 years</b>	<b>361 k€ / 10 km</b>	<b>634 k€ / 10 km</b>	<b>1 124 k€ / 10 km</b>
<b>LCC 20 years</b>	<b>509 k€ / 10 km</b>	<b>749 k€ / 10 km</b>	<b>1 124 k€ / 10 km</b>
<b>LCC 30 years</b>	<b>657 k€ / 10 km</b>	<b>865 k€ / 10 km</b>	<b>1 124 k€ / 10 km</b>

