Large road bridges rehabilitation Example of the Aquitaine bridge

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Sétra

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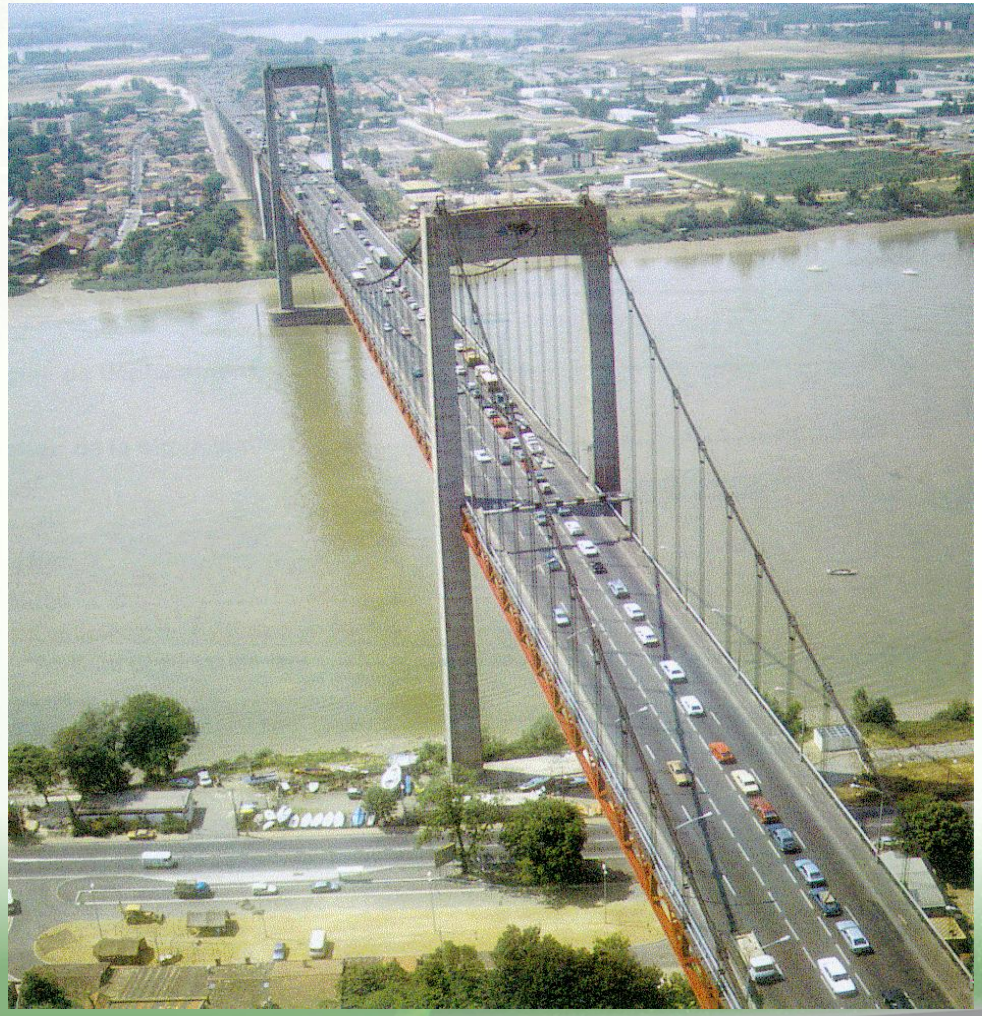
THE AQUITAINE BRIDGE

Suspension bridge

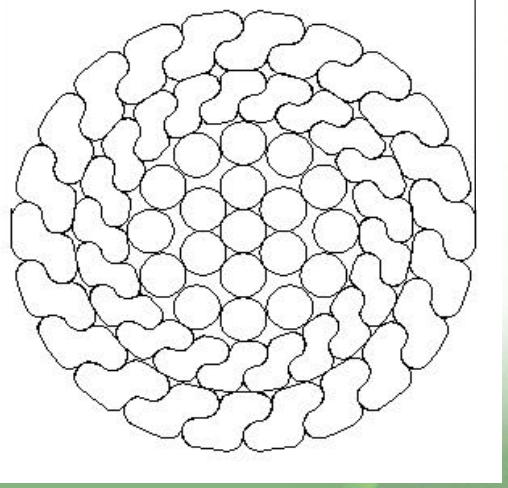


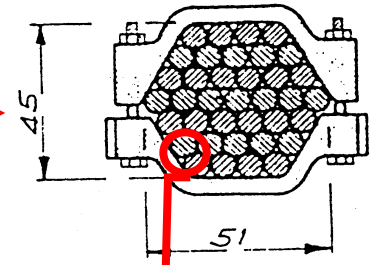
- Main span : 394 m
- Bridge girder : steel truss
- Replacement of suspension cables and widening of the deck in 2003

THE AQUITAINE BRIDGE

Crossing the river Garonne near Bordeaux

Main cable : 37 parallel strands





cable (hexagonal section)

37 strands

Each strand (∅ 72 mm)

- 217 wires (∅ 4mm)
- ULS 4450 KN (1390 MPa)

Assessment of damage : visual inspection

- 1979: 14 wires broken
- 1983 : 68 broken wires
- 1985 : new painting
- 1993 : 178 broken wires

(1% of total)

Assessment of damage : acoustic monitoring

Assessment : opening of 5 suspension clips

A severly damaged strand under clip n°8 after removal

Assessment of bearing capacity : strength

Expertise of broken wires :

- Brittle breaking due to friction between wires and stress corrosion
- Corrroded wires have a reduced yielding capacity

Residual resistance :

- Two strands + 15% of all wires (corroded) are ignored
- Residual resistance : 0,85 x 35/ 37 x initial Resistance

Residual resistance = 0,8 initial resistance.

Assessment of actions

Permanent tension due to dead loads :

- Calculation + dynamic measurements (frequencies)

Trafic loads

- Calculation and measurements (strain gauges)
- Recording of trafic data and simulation of traffic jam situations

Traffic simulation	Tension (KN)
French Code traffic loads	122280
Traffic Jam (distance between vehicles reduced to zero)	**3885**

Assessment of safety

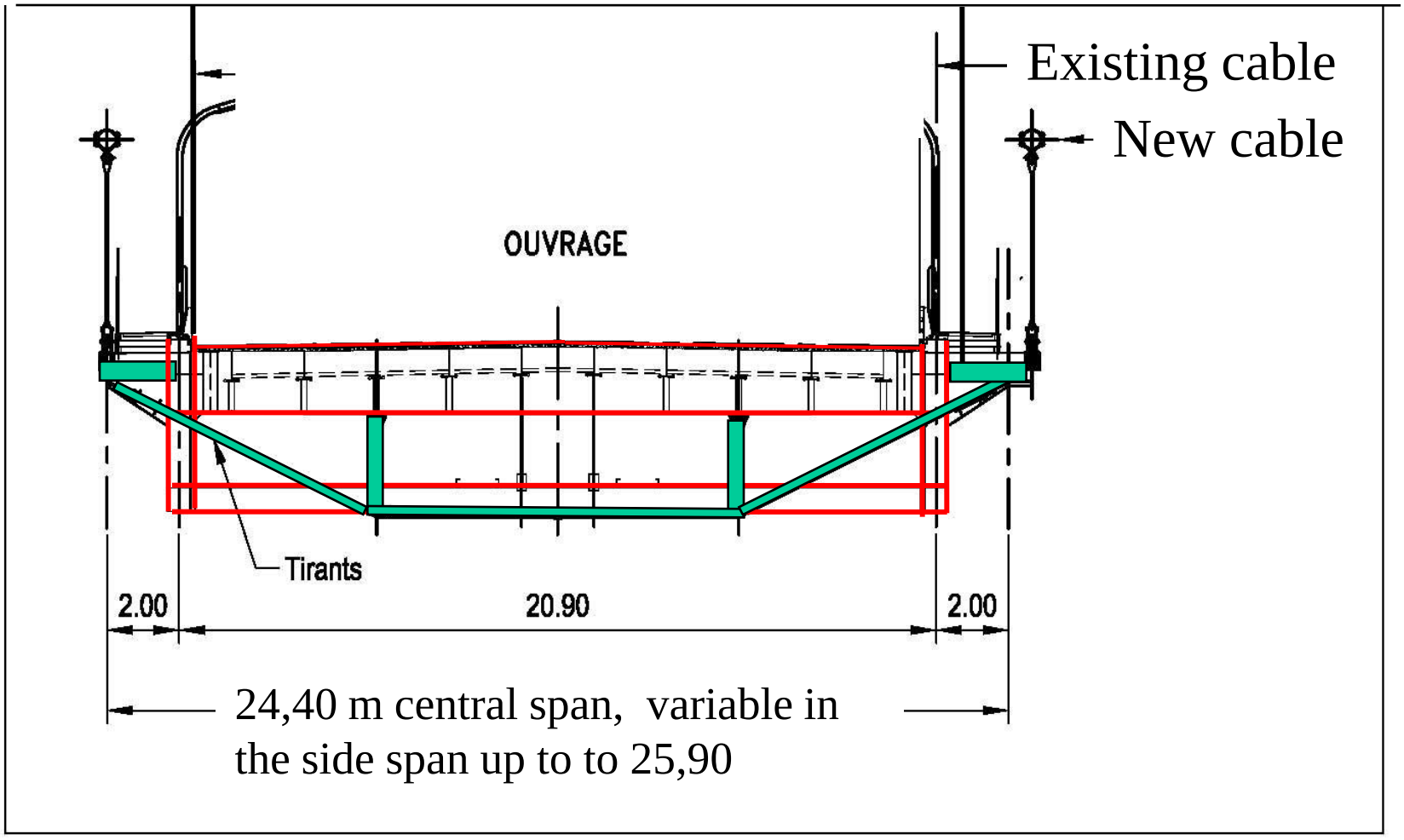
Design safety factor : 2,5

- Residual cable strength : R = 125784 KN

- Tension due to permanent actions T = 49640 kN
- Tension due to trafic loads T = 3885 kN
- Total : T = 53525 kN

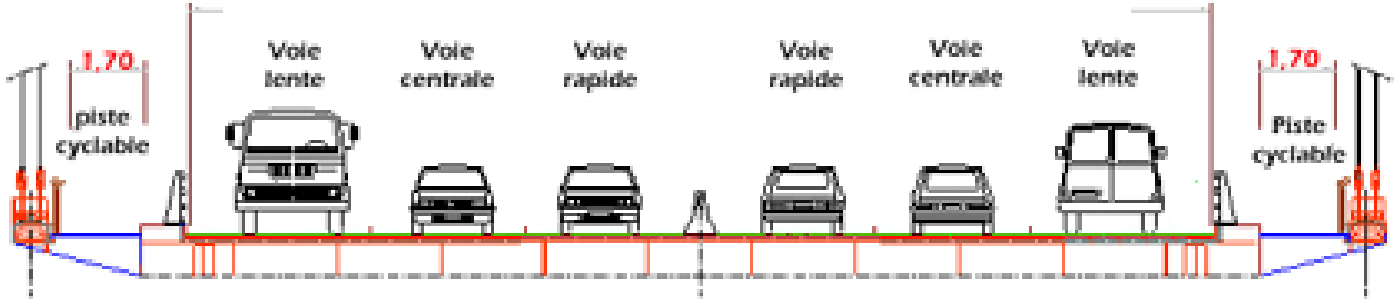
Residual safety factor : 125787 /53525 = 2,35

The rehabilitation project

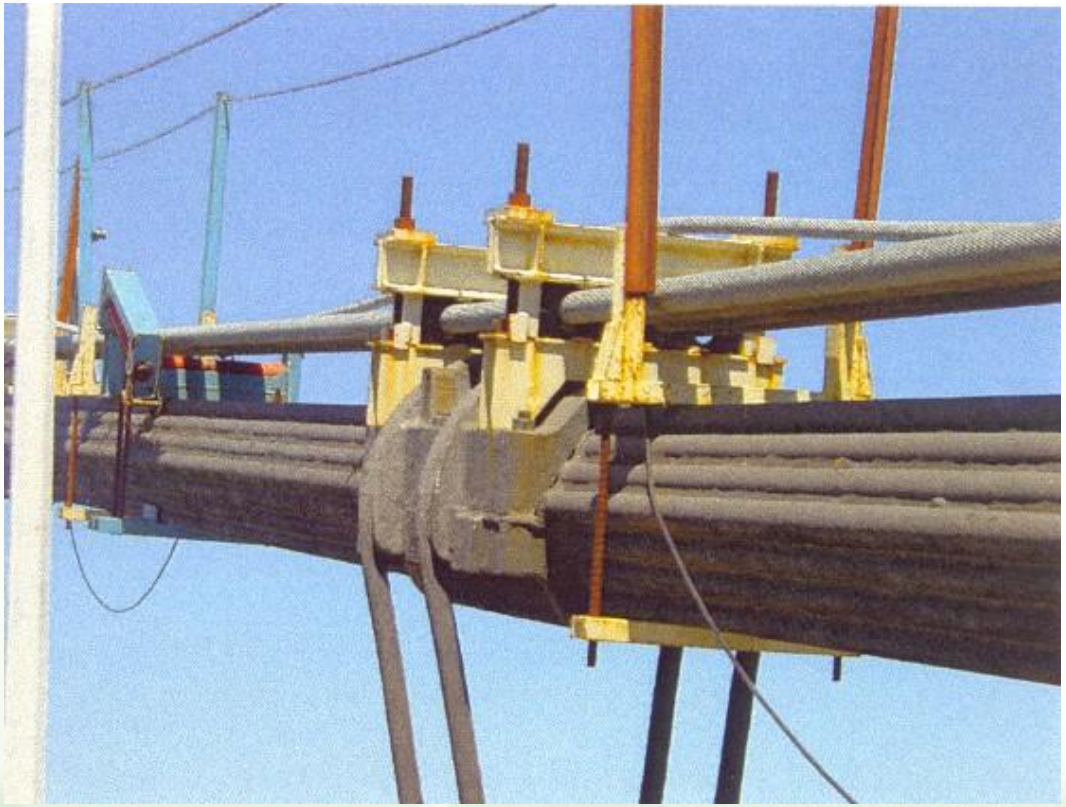


The rehabilitation project

New functional cross section



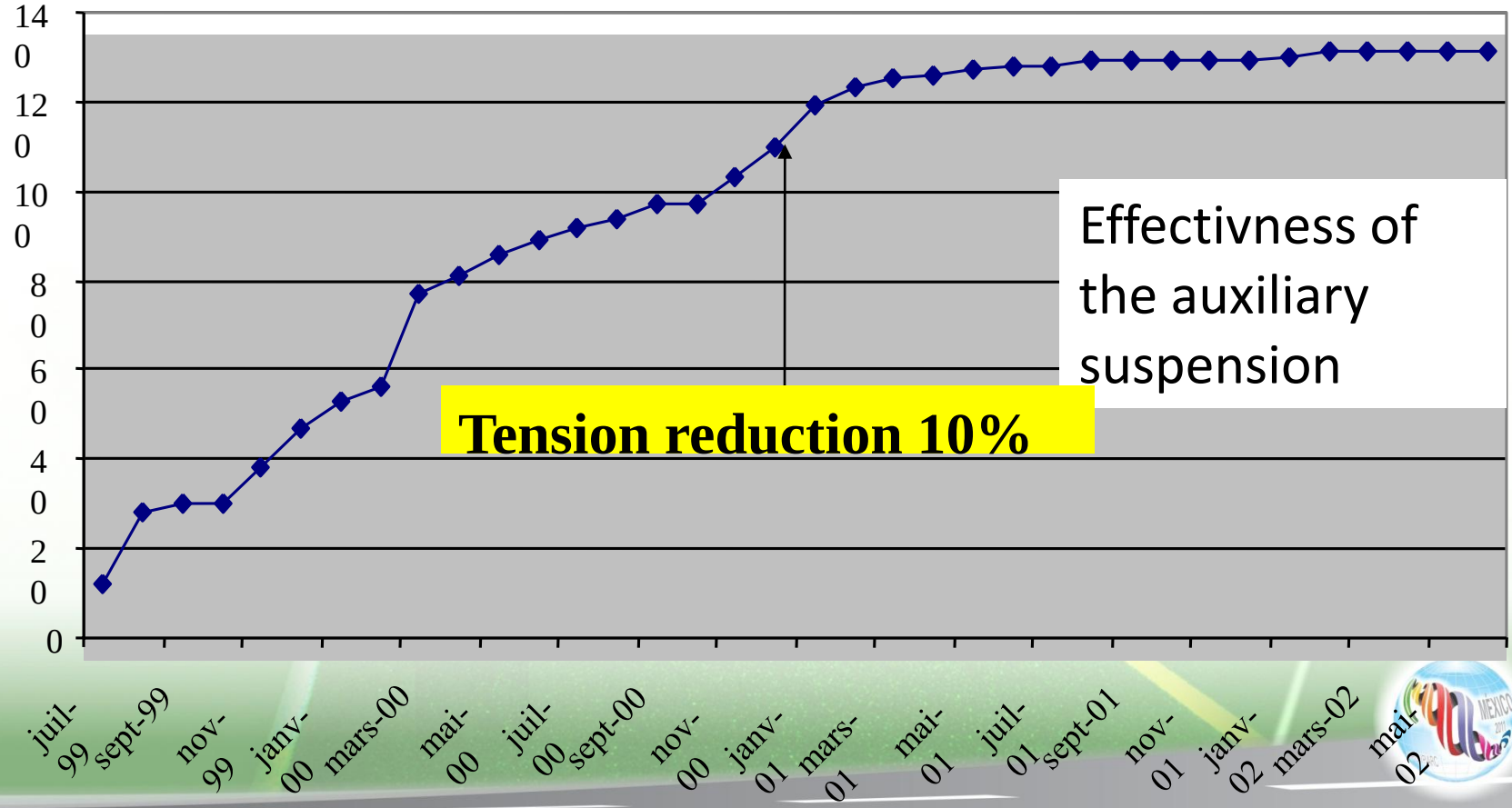
Sequences of the construction work



Installation of auxillary suspension (4 x 19T15 stands

Sequences of the construction work

Cumulative acoustic monitoring events from July 1999 to March 2002



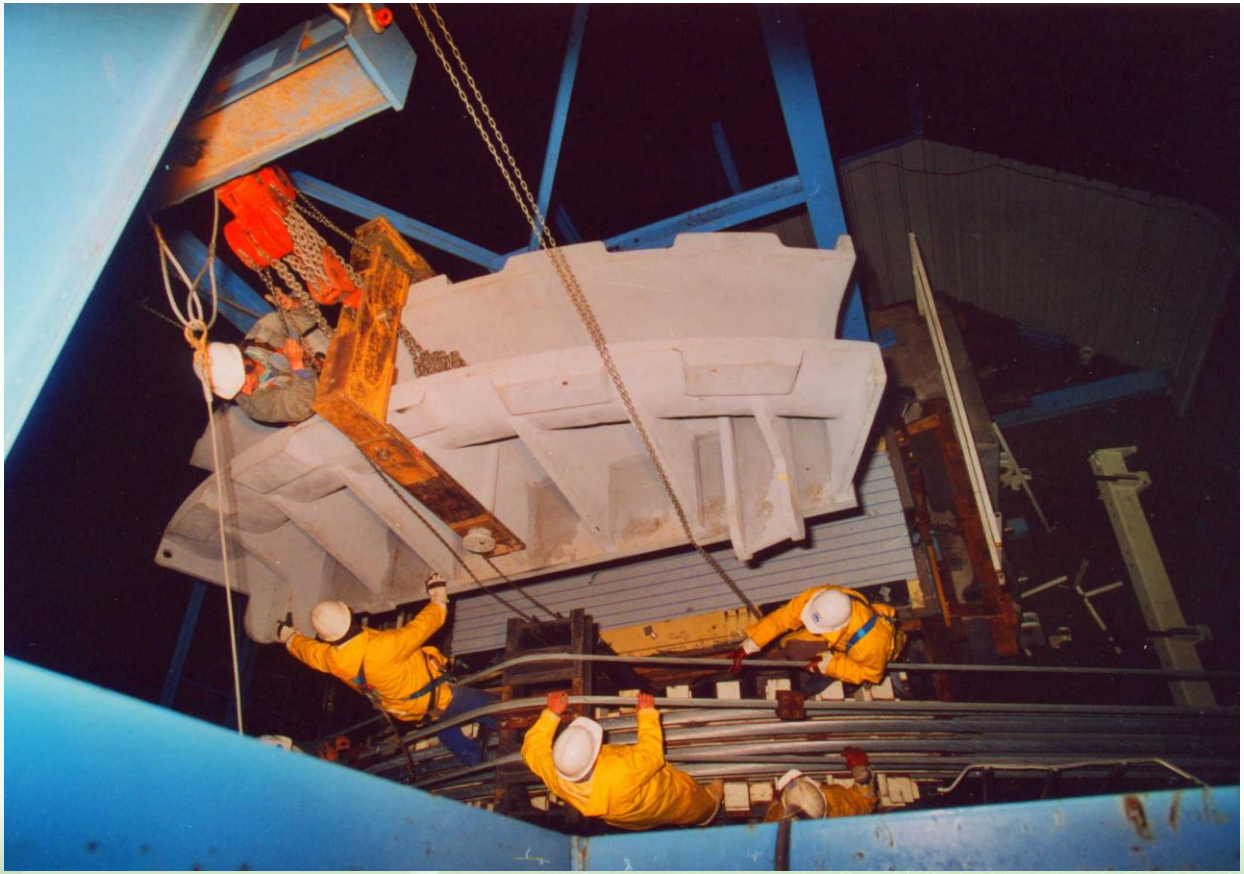
Sequences of the construction work

Widening of the tower heads

Sequences of the construction work

Lifting of the anchorage beam (left bank)

Sequences of the construction work



Lifting of a saddle on a tower head

Sequences of the construction work

Widening
of the deck

Sequences of the construction work

Launching of the new strands

Sequences of the construction work

Lay of the clips and the suspenders

Sequences of the construction work

Transfer of the loads

Sequences of the construction work

Dismantling of the old cables

The new suspension cable

- 61 strands
- 4 protective barriers:
  - Galvanized wires
  - Galvanized wrapping wire
  - Air tigth duct
  - Dehumidification

Sequences of the construction work

Final protection of the cables

Sequences of the construction work

Air tight covering of the anchoring chambers

Sequences of the construction work

Duration of the works : 3 years

Completed without almost any trafic interruption