Conference Poster

Rational Procedure in the Design of Bridges Using Pre-stressed Concrete Beams, a Theoretical Practical Method in Search of Sustainable Structures.

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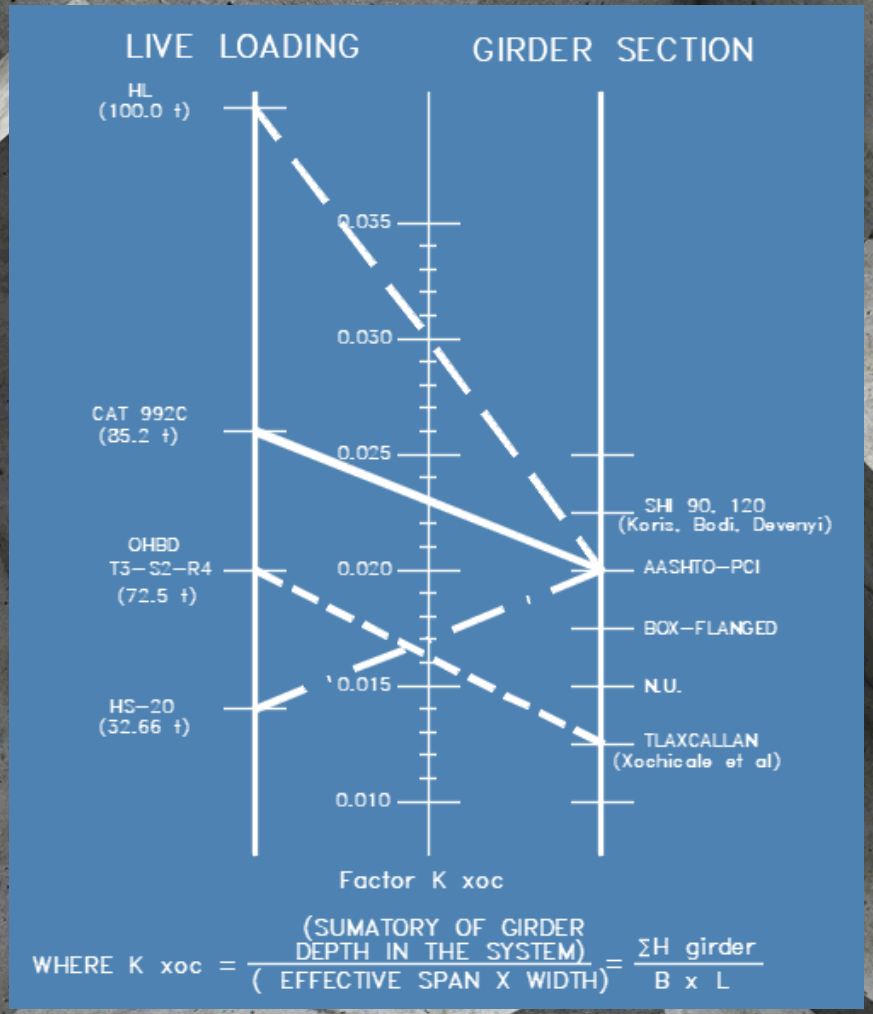
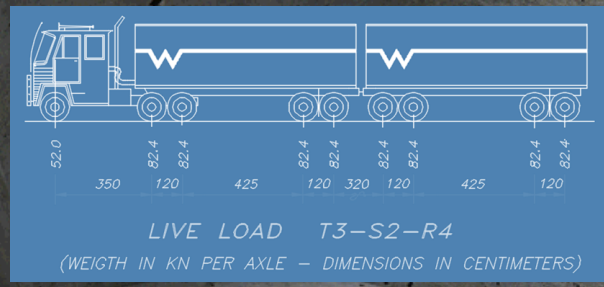
Optimization functions according to load and strength

$$\frac{\eta \times K_0 \times \int_0^{h_w} dy}{(L \times B)} \rightarrow \{K_1 \rightarrow 0.02\}$$

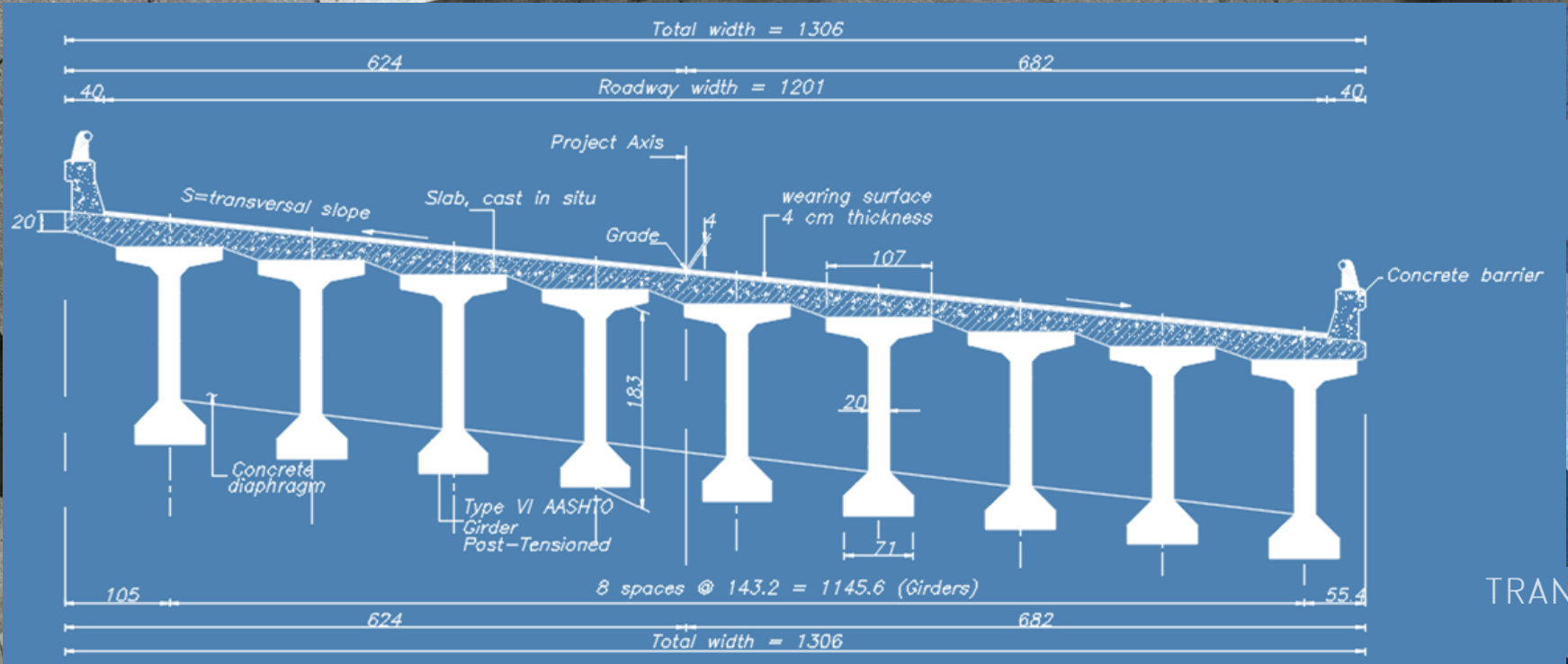
$$0.4 < \frac{\eta \times K_0 \times \int_0^{h_w} dy}{B} < 0.8$$





UNITS			
1 Mpa = 10.19 kg/cm2	= 14.22 psi	= 101.9 ton/m2	
1 KN = 101.9 kg	= 46.22 pound	= 0.1019 ton	
1 KN–m = 10190 kg–cm	= 1,819.68 pound–plg	= 0.1019 ton–m	

Traditional transversal section in Mexican highways

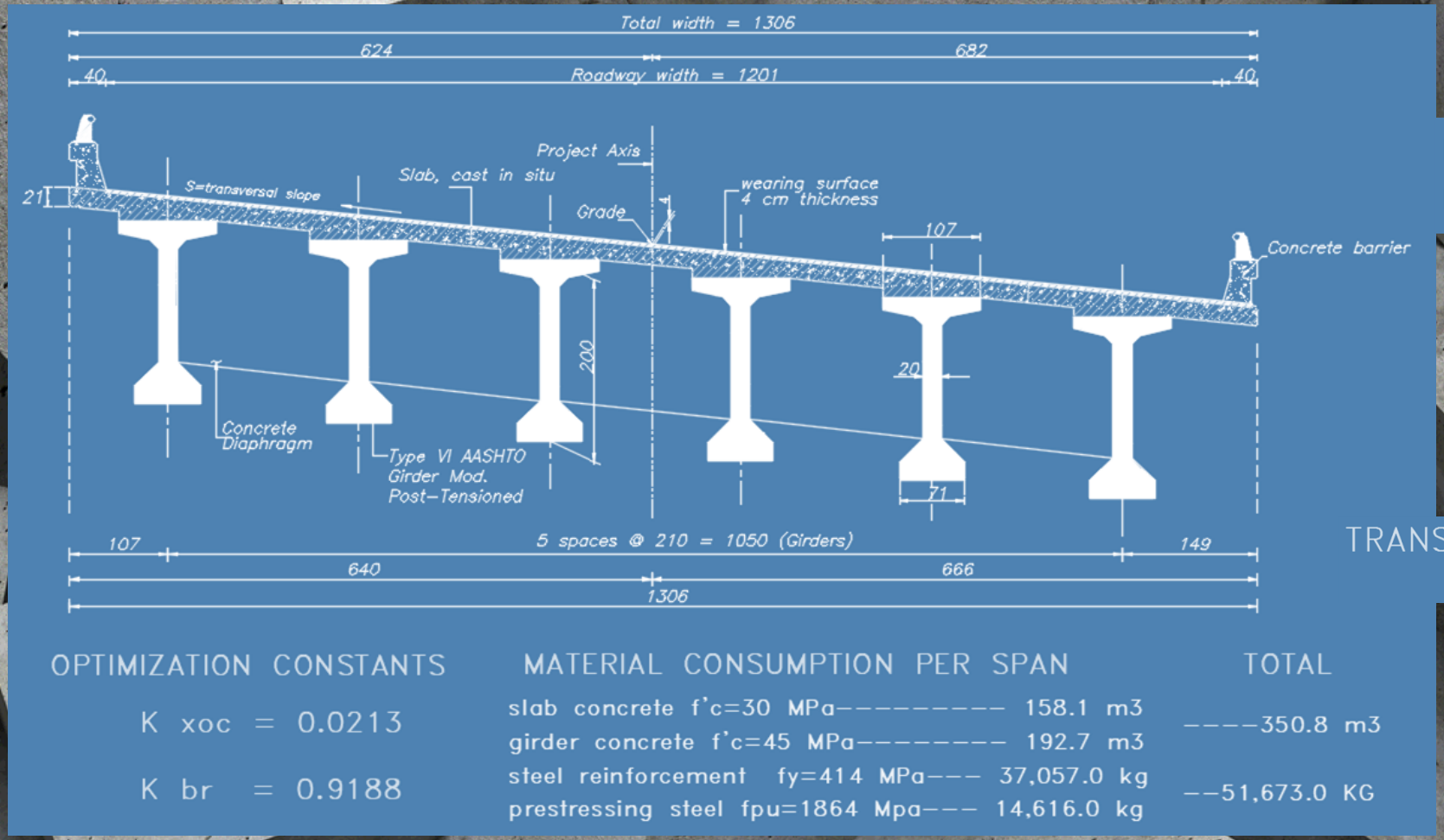


L (span) =43.8 meters (143.7')
B (total width)=13.06 meters (42.8')

TRANSVERSAL SECTION OF THE BRIDGE STRUCTURE UNDER STUDY

OPTIMIZATION CONSTANTS	MATERIAL CONSUMPTION PER SPAN		TOTAL
K xoc = 0.0292	slab concrete f'c=25 MPa----------	168.3 m3	----450.0 m3
	girder concrete f'c=45 MPa---------	281.7 m3	
K br = 1.2611	steel reinforcement fy=414 MPa---	33,174.0 kg	--53,982.0 KG
	prestressing steel fpu=1,864 Mpa---	20,808.0 kg	

Transversal section worked ¡



L (span) =43.8 meters (143.7')
B (total width)=13.06 meters (42.8')

TRANSVERSAL SECTION OF THE BRIDGE STRUCTURE UNDER STUDY

OPTIMIZATION CONSTANTS	MATERIAL CONSUMPTION PER SPAN		TOTAL
K xoc = 0.0213	slab concrete f'c=30 MPa----------	158.1 m3	----350.8 m3
	girder concrete f'c=45 MPa---------	192.7 m3	
K br = 0.9188	steel reinforcement fy=414 MPa---	37,057.0 kg	--51,673.0 KG
	prestressing steel fpu=1864 Mpa---	14,616.0 kg	

Transversal section optimized ¡ mimimun material consumption.

L (span) =43.8 meters (143.7')
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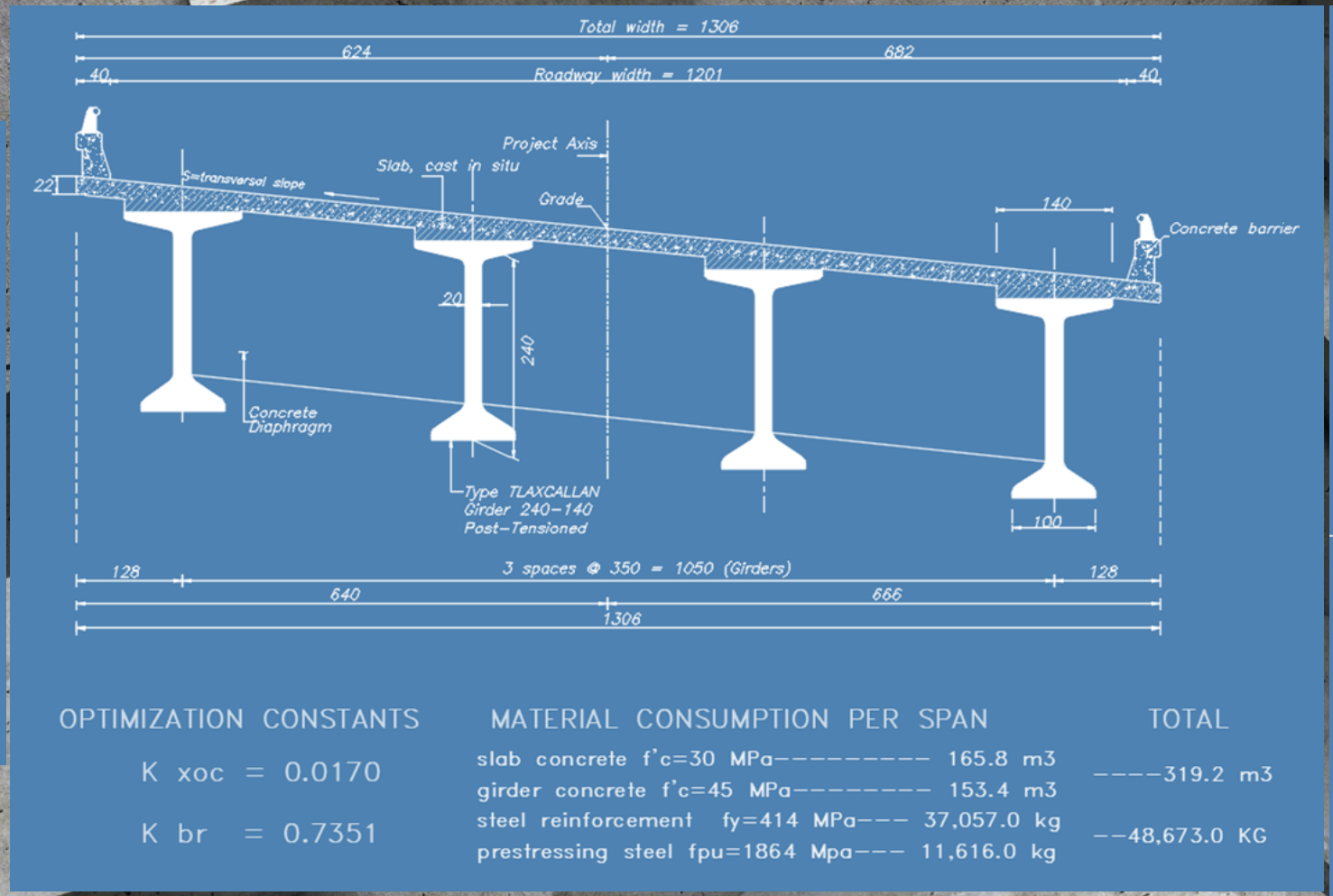


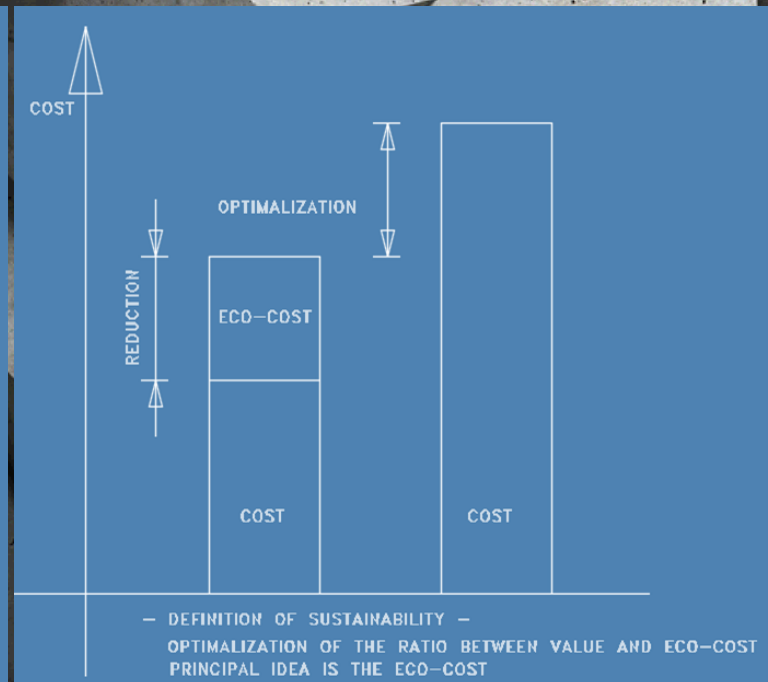
OPTIMIZATION CONSTANTS

K xoc = 0.0170

K br = 0.7351

MATERIAL CONSUMPTION PER SPAN

		TOTAL
slab concrete f'c=30 MPa	165.8 m3	
girder concrete f'c=45 MPa	153.4 m3	----319.2 m3
steel reinforcement fy=414 MPa	37,057.0 kg	
prestressing steel fpu=1864 Mpa	11,616.0 kg	--48,673.0 KG



– DEFINITION OF SUSTAINABILITY –

OPTIMALIZATION OF THE RATIO BETWEEN VALUE AND ECO-COST
PRINCIPAL IDEA IS THE ECO-COST

MATERIAL SAVINGS

	CONCRETE	STEEL
INITIAL PROJECT	0.0 %	0.0 %
WORKED PROJECT	22 %	5 %
OPTIMIZED PROJECT	29 %	10 %

"OPTIMIZATION LEADS TO GREATER MATERIAL SAVINGS"