SAMSON METALS LTD
SERVICE QUALITY INTEGRITY

NOMENCLATURE for COMPOSITE FLOORS

IMPERIAL - L.S.D.

.

As Cross- sectional area of steel deck (in^2 / ft width)

a $\dfrac{Øs \quad As \quad Fy}{0.85\ Øc\ f'c\ b} = \dfrac{As\ Fy}{6.8\ f'c}$

b Unit width of compression face of composite slab (12 in)

d Effective slab depth (distance from extreme concrete compression fiber to centroidal axis of the full cross - section of the steel deck) (in)

Ec Modulus of elasticity of concrete (psi)
Ec = ðc^1.5 x 0.043 SQRT (f'c)

Es Modulus of elasticity of steel deck (29.5 x 10^6 psi)

f'c Specified compressive strength of concrete (psi)

Fy Specified yield strength of steel deck (psi)

h Overall thickness of composite slab (in)

hc Thickness of concrete cover above top of steel deck (in)

Ic Moment of inertia of composite section based on cracked section and equivalent area of concrete (in^4 / ft of slab width)

Iu Moment of inertia of composite section based on uncracked section and equivalent area of concrete (in^4 / ft slab width)

Icd Average moment of inertia for uncracked and cracked composite section (in^4 / ft slab width) (Ic + Iu) / 2

k 0.85 for concrete strengths f'c </= 4000 psi, and is reduced at a rate of 0.055 for each 1000 psi of concrete strength in excess of 4000 psi

k' 0.425 for concrete strengths f'c </= 4000 psi, and is reduced at a rate of 0.025 for each 1000 psi of concrete strength in excess of 4000 psi

Ku = Square Root (þ § + (þ § / 2)² - þ § / 2)
where **§ =** $\dfrac{0.003\ \ Es}{0.85\ k\ f'c} = \dfrac{1.041 \times 10^{5}}{k\ f'c}$

þ = $\dfrac{As}{b\ d}$

K5 Shear bond coefficient (slope of line) (lb / in)

K6 Shear bond coefficient (intercept of line) (psi)

L Length of span (ft) lessor of
a) center to center distance of supporting members
b) clear distance between edges of supports plus the depth of the steel deck

LL Specified live load (psf)

LLmax Maximum permissible uniformly distributed superimposed load (psf)

LLd Permissible uniformly distributed superimposed load based on limiting deflection (psf / ft width)

LLc Permissible uniformly distributed superimposed load based on Flexural crushing (psf / ft width)

LLs Permissible uniformly distributed superimposed load based on shear - bond (psf / ft width)

LLy Permissible uniformly distributed superimposed load based on flexural yielding (psf / ft width)

Mnbc Maximum moment resulting from NBC 4.1.6.4 concentrated load criteria (ib.ft / ft width)

Mru Factored moment resistance an under-reinforced composite slab (lb.ft / ft width)

P Specified concentrated construction live load (137 lb / ft width)

R Load resistance (psf)

Sm Section modulus of steel deck at mid-span (in^3 / ft width)

Ss Section modulus of steel deck at support (in^3 / ft width)

Wc Dead load of wet concrete slab (psf / ft width)

Ws Dead load of steel deck (psf / ft width)

W1 = Wc + Ws (psf / ft width)

W2 Uniformly distributed construction live load (20.9 psf / ft width)

W4 Specified superimposed dead load (psf / ft width)

Ysb Distance from bottom of steel deck to centroidal axis of steel deck (in)

αd Dead load factor 1.25

αl Live load factor 1.50

Ø Resistance factor

Øs Resistance factor for steel 0.90

ðc Density of concrete (pcf)

Øc Resistance factor for concrete 0.60

Øv Resistance factor for shear-bond 0.70

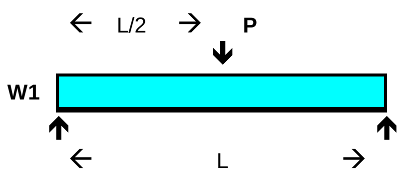
ðp Ponding factor 1.10

Br Bearing resistanceof deck as a form for a bearing length equal to deck depth

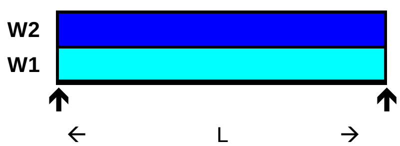
CRITERIA for STEEL DECK as a FORM

IMPERIAL - L.S.D.

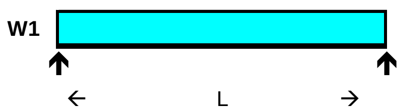
LOADING CONDITION	GOVERNING EXPRESSION
SINGLE SPAN	



$$\frac{0.9\ Fy\ Sm}{12} \geq 0.125\ \alpha d\ W1\ L^2 + 0.250\ \alpha l\ P\ L$$



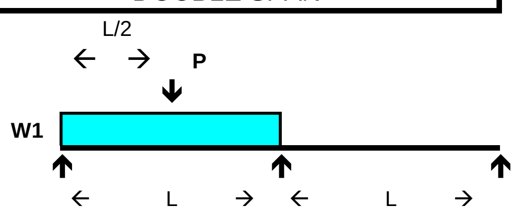
$$\frac{0.9\ Fy\ Sm}{12} \geq 0.125\ (\alpha d\ W1 + \alpha l\ W2)\ L^2$$



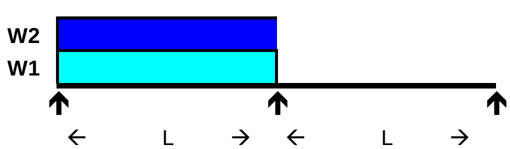
DEFLECTION

$$\frac{25.75\ W1\ L^4}{Es\ Id} \leq \frac{12\ L}{180}$$ (or .75 in maximum)

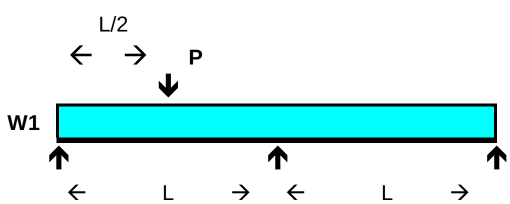
DOUBLE SPAN



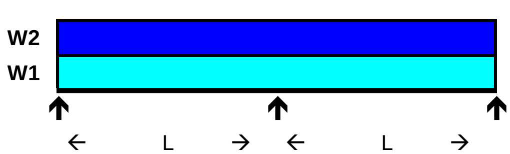
$$\frac{0.9\ Fy\ Sm}{12} \geq 0.096\ \alpha d\ W1\ L^2 + 0.203\ \alpha l\ P\ L$$



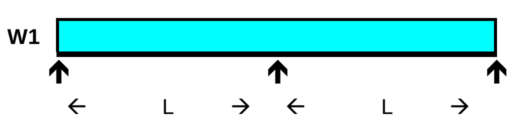
$$\frac{0.9\ Fy\ Sm}{12} \geq 0.096\ (\alpha d\ W1 + \alpha l\ W2)\ L^2$$



$$\frac{0.9\ Fy\ Ss}{12} \geq 0..125\ \alpha d\ W1\ L^2 + 0.094\ \alpha l\ P\ L$$



$$\frac{0.9\ Fy\ Ss}{12} \geq 0..125\ (\alpha d\ W1 + \alpha l\ W2)\ L^2$$



DEFLECTION

$$\frac{10.40\ W1\ L^4}{Es\ Id} \leq \frac{12\ L}{180}$$ (or .75 in maximum)

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CRITERIA for STEEL DECK as a FORM

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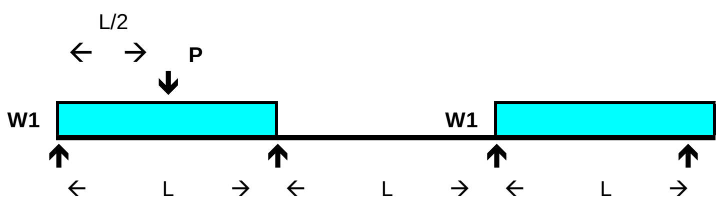
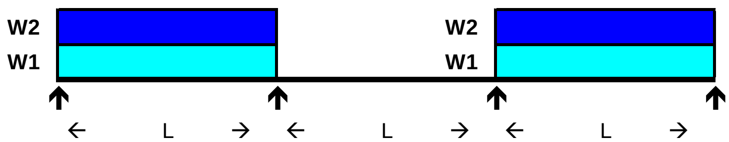
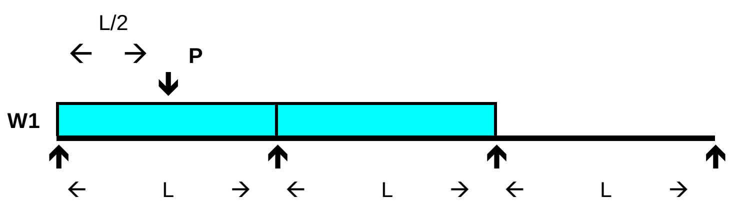
LOADING CONDITION	GOVERNING EXPRESSION
TRIPLE SPAN	



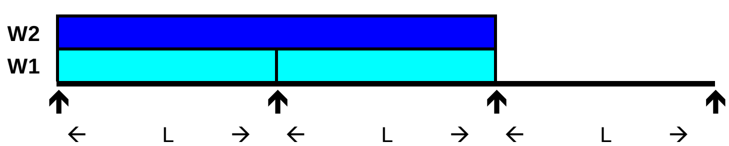
$$\frac{0.9\ Fy\ Sm}{12} \geq 0.101\ \alpha d\ W1\ L^2 + 0.200\ \alpha l\ P\ L$$



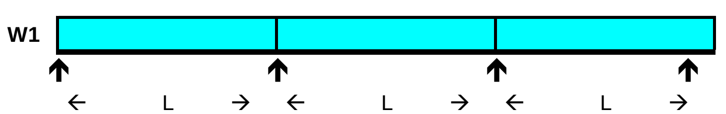
$$\frac{0.9\ Fy\ Sm}{12} \geq 0.101\ (\alpha d\ W1 + \alpha l\ W2)\ L^2$$



$$\frac{0.9\ Fy\ Ss}{12} \geq 0.117\ \alpha d\ W1\ L^2 + 0.100\ \alpha l\ P\ L$$



$$\frac{0.9\ Fy\ Ss}{12} \geq 0.117\ (\alpha d\ W1 + \alpha l\ W2)\ L^2$$



DEFLECTION

$$\frac{13.12\ W1\ L^4}{Es\ Isd} \leq \frac{12\ L}{180}$$

(or .75 in maximum)

COMPOSITE SLAB DESIGN EXPRESSIONS

Refer to NOMENCLATURE for symbol definitions and factors assumed.
Formulae assume simple span conditions for composite configuration.

BASIS:

$$\text{Ø}R = \alpha d\ W1 + \alpha d\ W4 + \alpha l\ LL$$

$$\frac{\text{Ø}R}{\alpha l} - \frac{\alpha d\ W1}{\alpha l} \geq LL + \frac{\alpha d\ W4}{\alpha l}$$

LLmax >/= LL + 0.833 W4

1. SHEAR BOND CONTROLLING

$$LLs = \frac{11.2\ d}{L}\left[\frac{4\ K5}{12\ L} + K6\right] - 0.833\ W1$$

LLs >/= LL + 0.833 W4

2. FLEXURAL YIELDING CONTROLLING FOR UNDER- REINFORCED FLOOR SLAB

$$LLy = \frac{.40\ As\ Fy}{L^2}\left[d - \frac{a}{2}\right] - 0.833\ W1$$

LLy >/= LL + 0.833 W4

3. FLEXURAL CRUSHING CONTROLLING FOR OVER-REINFORCED FLOOR SLAB

$$LLc = \frac{2.72\ k1\ f'c\ b\ d^2\ Ku}{L^2}\left[1 - K2\ Ku\right] - 0.833\ W1$$

LLc >/= LL + 0.833 W4

4. DEFLECTION CONTROLLING BASED ON L / 360 LIMITATIONS ON COMPOSITE SLAB

$$LLd = \frac{Es\ Icd}{675\ n\ L^3}$$

LLd >/= LL + W4

5. NBC CONCENTRATED LOAD CONTROLLING

$$Mu = \frac{0.9\ As\ Fy}{12}\left[d - \frac{a}{2}\right]$$

$$Mbc = \frac{1}{8}\left[\frac{3035\ (2\ L - d\ /\ 6) - 7587}{(\ 2.5 + d\ /\ 6\ )} + 1.25\ W1\ L^2\right]$$

Mu >/= Mbc