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ORIENS EX OCCIDENTE LUX - A LIGHT RISING FROM THE WEST

SEISMIC RESEARCH CENTRE

***Practical Examples employing the
International Building Code (IBC) regulations and
the New Seismic Hazard Maps for the Eastern Caribbean***

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Practical Examples

- Get the design response spectra and the **seismic coefficients C_s** for the following sites at rock conditions:

1) *Scarborough -Tobago (Building – 20 stories)*

2) *Indian River – Dominica (Bridge – 30 m multi-span intermediate columns with height $H = 15$ m)*





Design spectral acceleration parameters IBC – ASCE 7 05

- $S_{DS} = 2/3 * F_a * S_s$ → Spectral acceleration for 0.2 s
 - $S_{D1} = 2/3 * F_v * S_1$ → Spectral acceleration for 1.0 s
- } Obtained in the Seismic Hazard maps

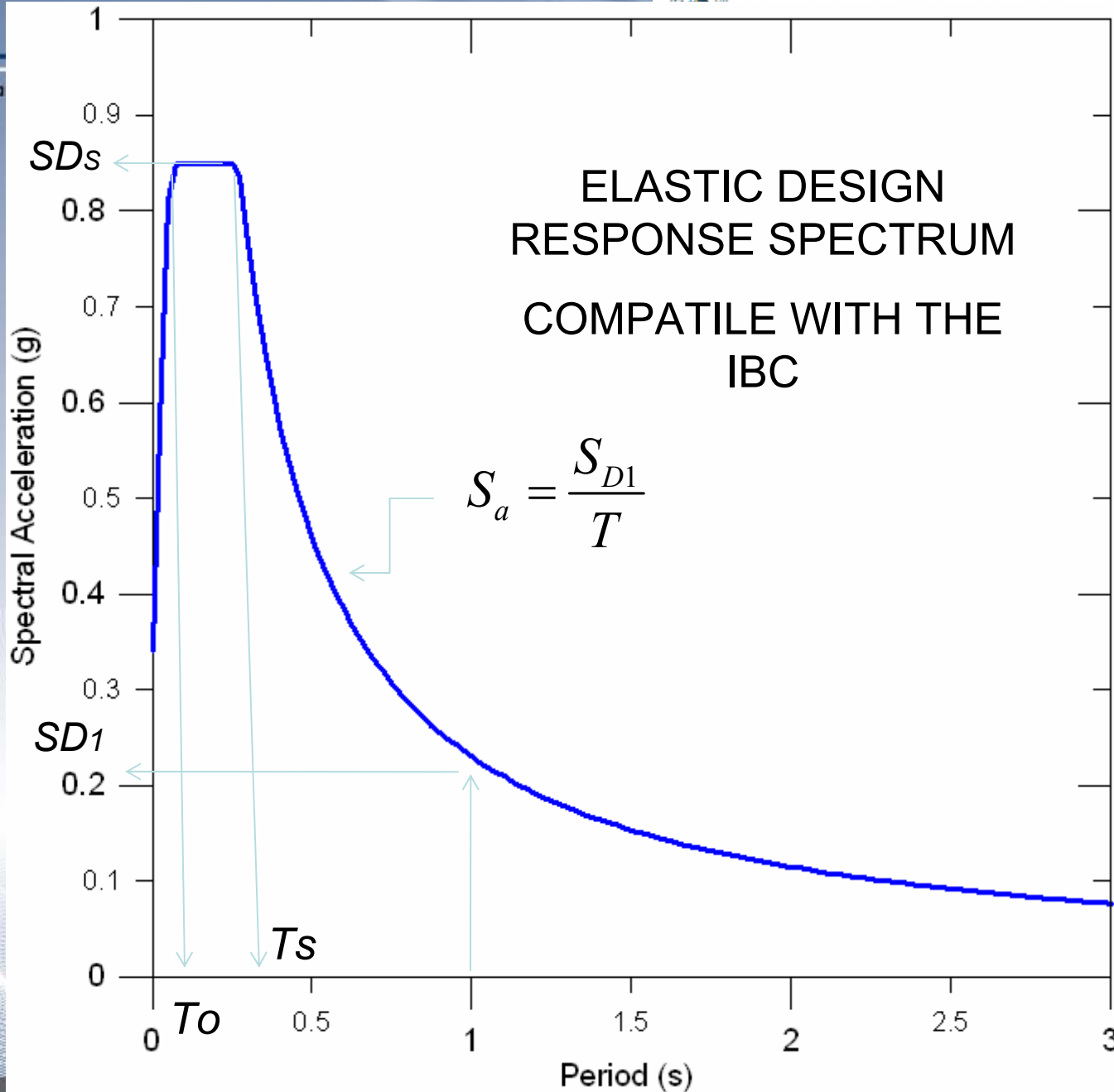
F_a and F_v : depends on soil conditions

For rock site conditions – CLASS B

It Corresponds to a shear wave velocity $V_s = 760$ m/s:

$$F_a = 1.0 \text{ and } F_v = 1.0$$







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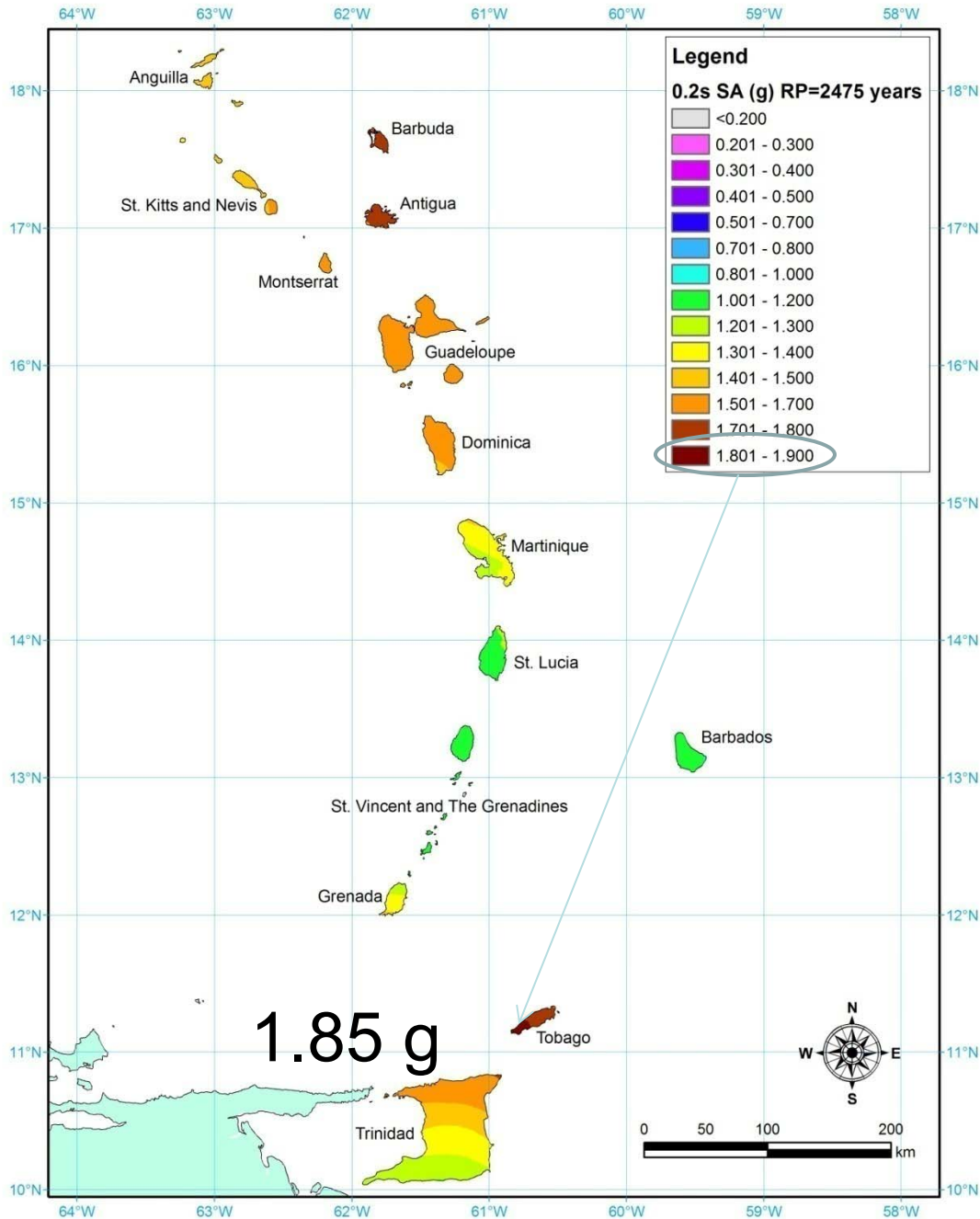
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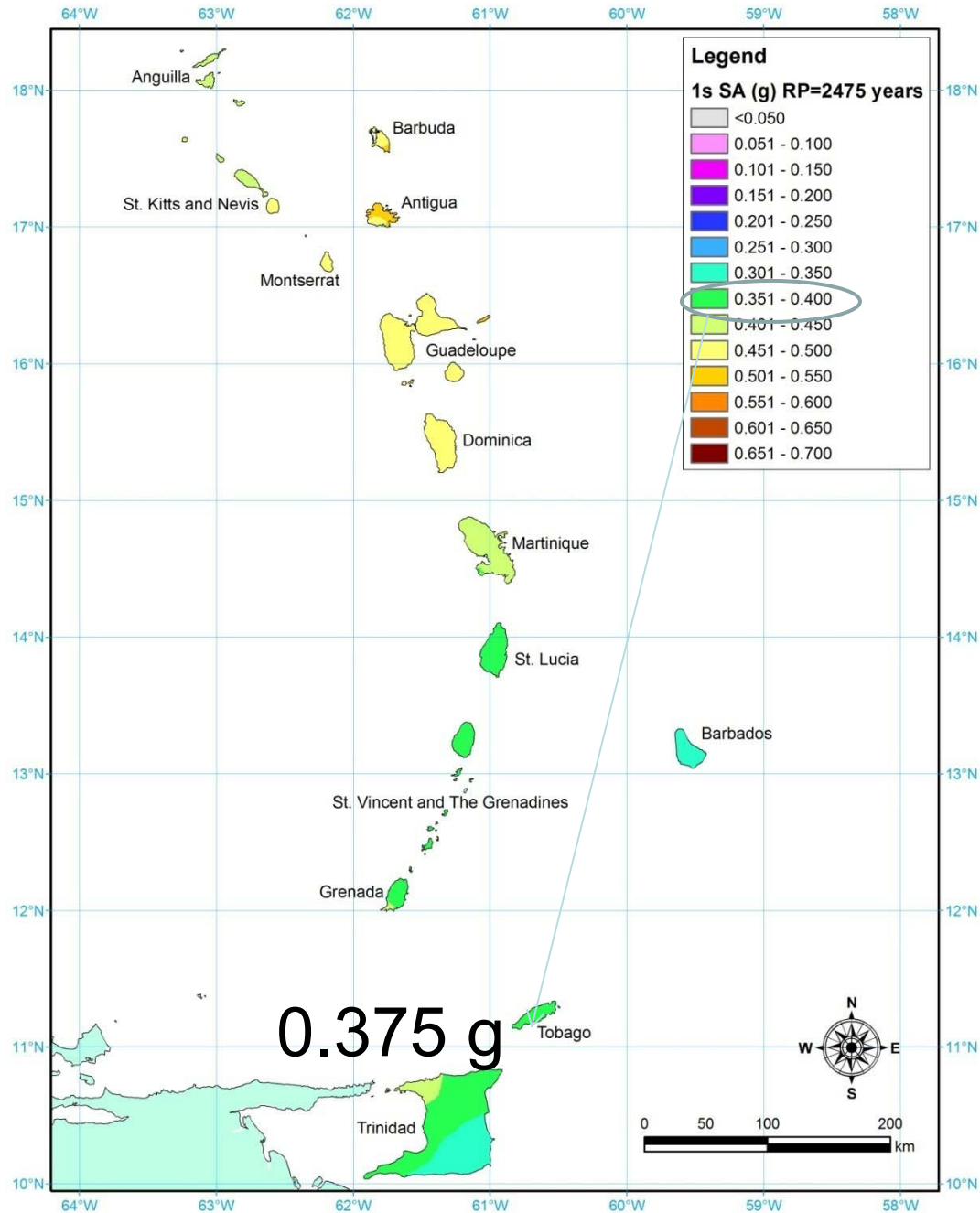
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EXAMPLE 1: Scarborough -Tobago

Building – 20 stories









- Reading from the maps

$$S_s = 1.85g$$

$$S_1 = 0.375g$$



$$S_{DS} = (2/3) * 1.85g = 1.23g$$

$$S_{D1} = (2/3) * 0.375g = 0.25g$$

$$T_o = 0.2 \frac{S_{D1}}{S_{DS}} = 0.2 * \frac{0.25}{1.23} = 0.04s$$

$$S_a = S_{DS} \left(0.4 + 0.6 \frac{T}{T_o} \right) = 1.23 * \left(0.4 + 0.6 \frac{T}{0.04} \right) = 0.492 + 18.45T$$

T : the fundamental period
of the structure in "s"





$$S_a = S_{DS} = 1.23g$$

Flat spectral response

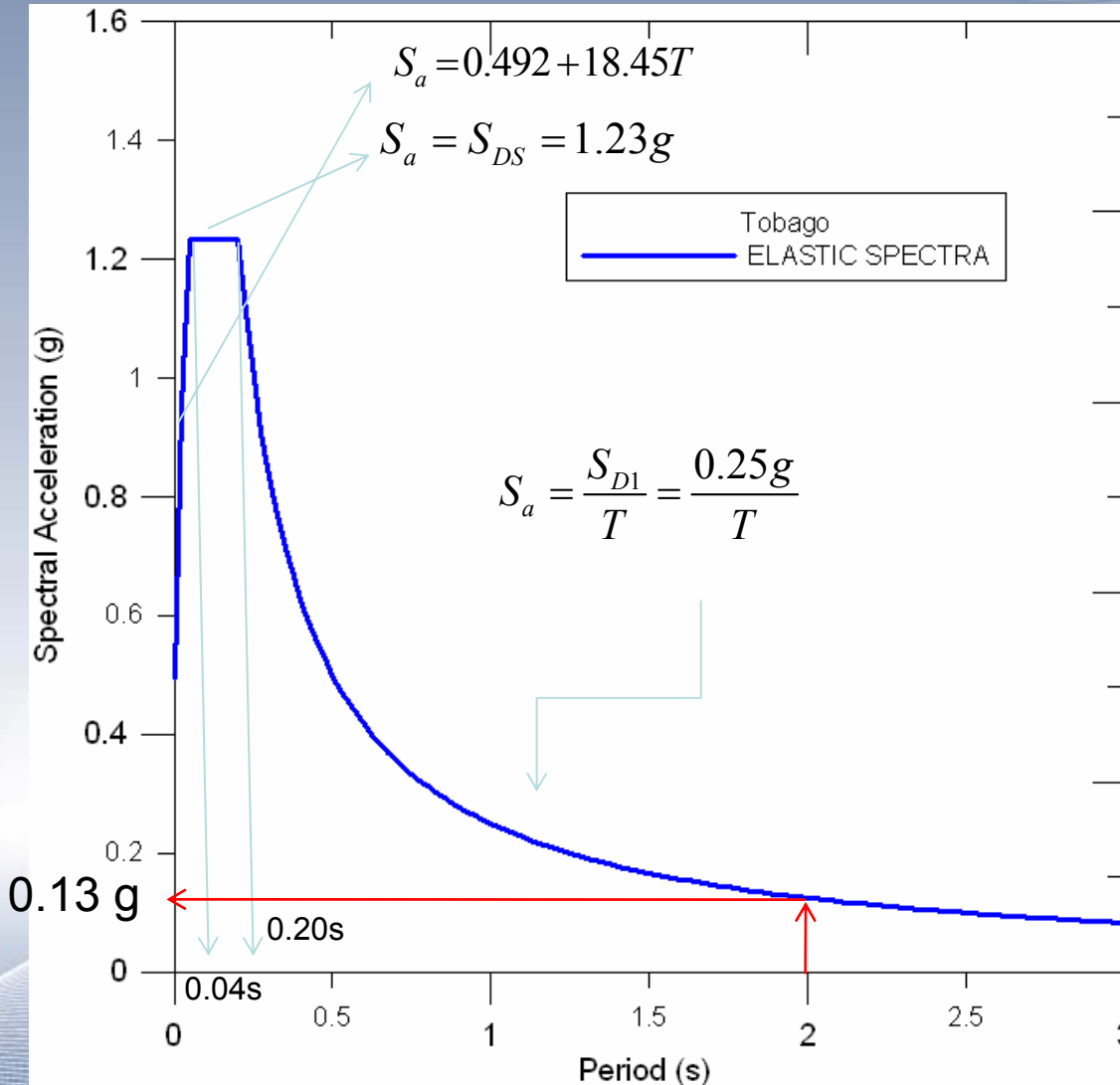
$$T_S = \frac{S_{D1}}{S_{DS}} = \frac{0.25}{1.23} = 0.20s$$

Period to which begin
the exponential decay

$$S_a = \frac{S_{D1}}{T} = \frac{0.25g}{T}$$

Spectral exponential
decay





The Seismic Coefficient C_s

Fundamental Period:

$T = 2.0$ s (after dynamic analysis)

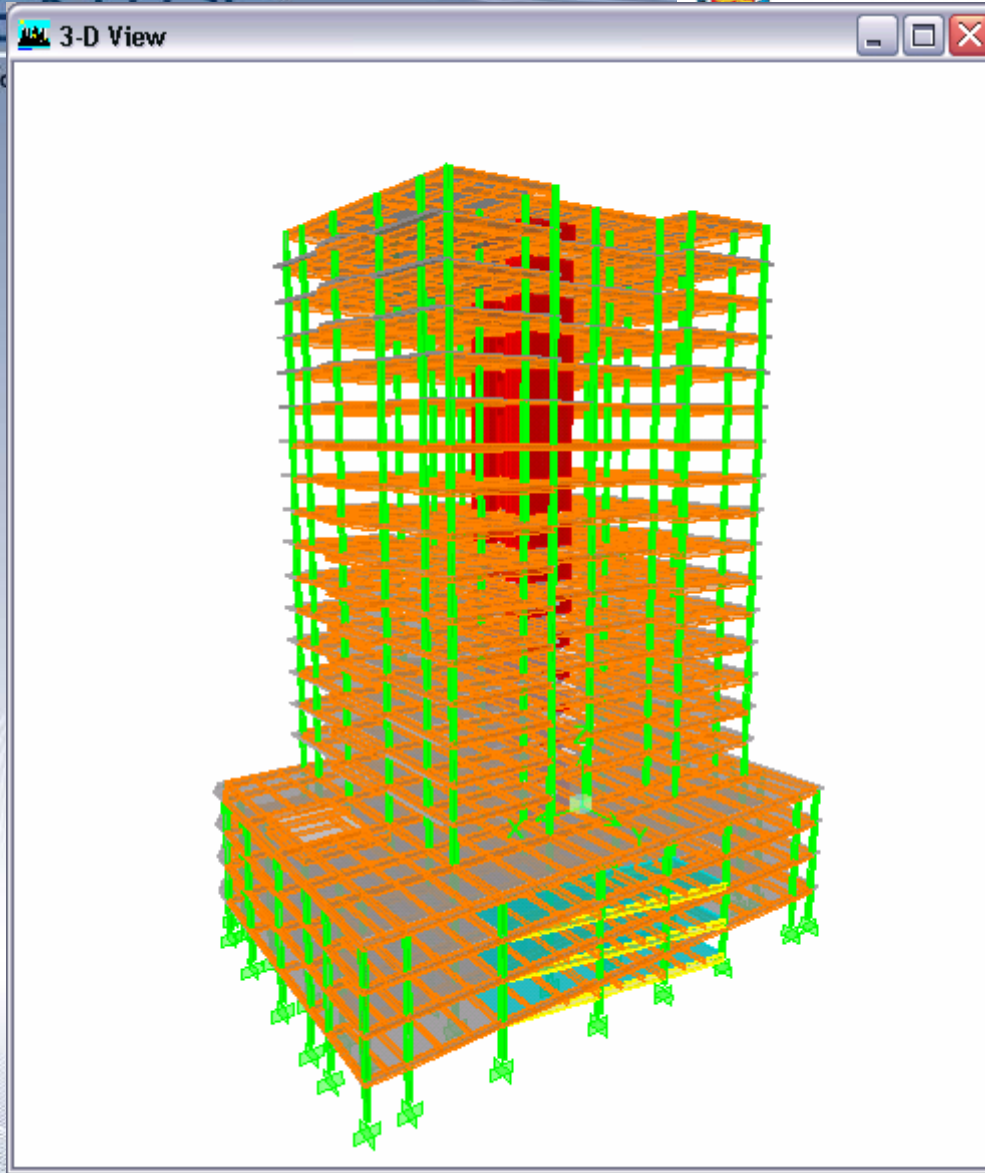
SA = 0.13g (elastic spectral acceleration)

Reduction factor $R = 8.0$ considering ductility and overstrength

Seismic design coefficient:

$C_s = SA/R = 0.13g/8 = 0.016g$





SAP MODEL FOR THE 20 STORY BUILDING





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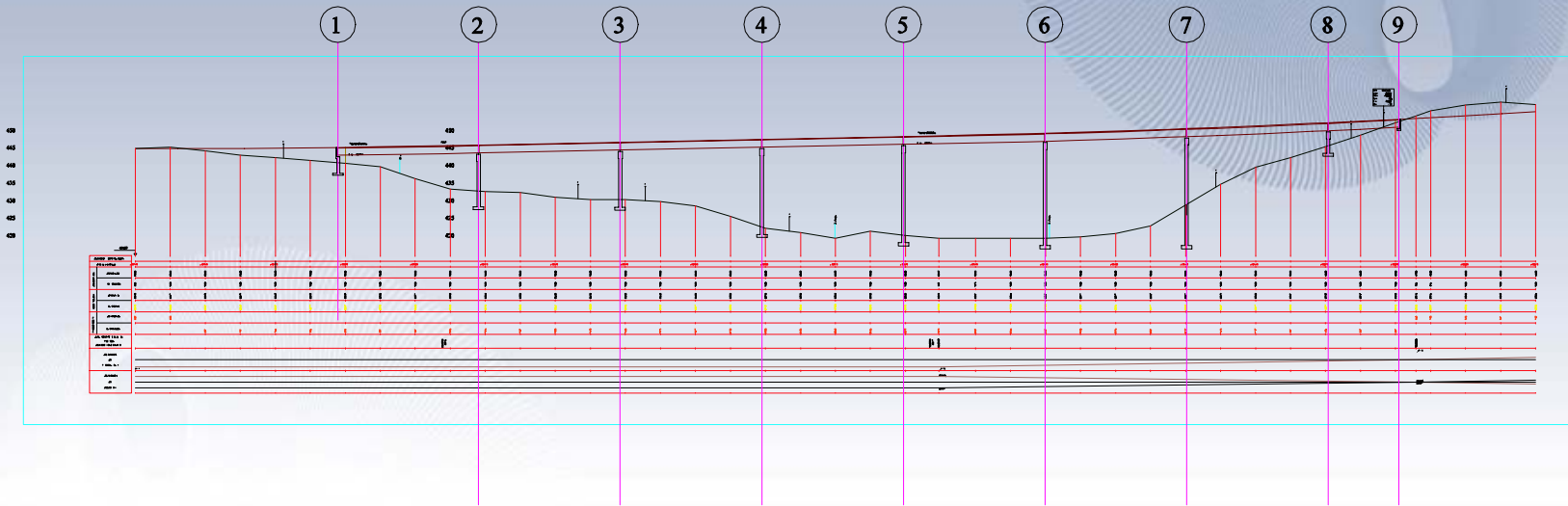
EXAMPLE 2: MULTI SPAN BRIDGE

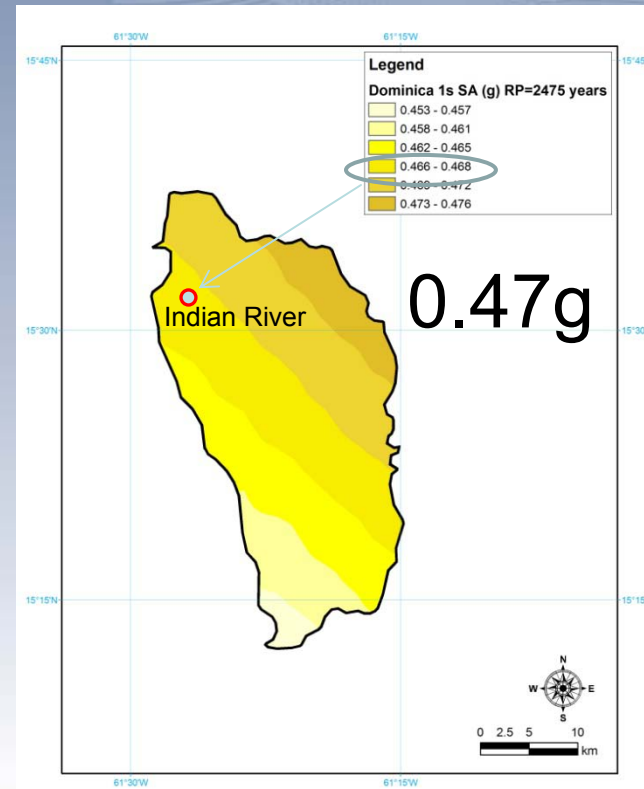
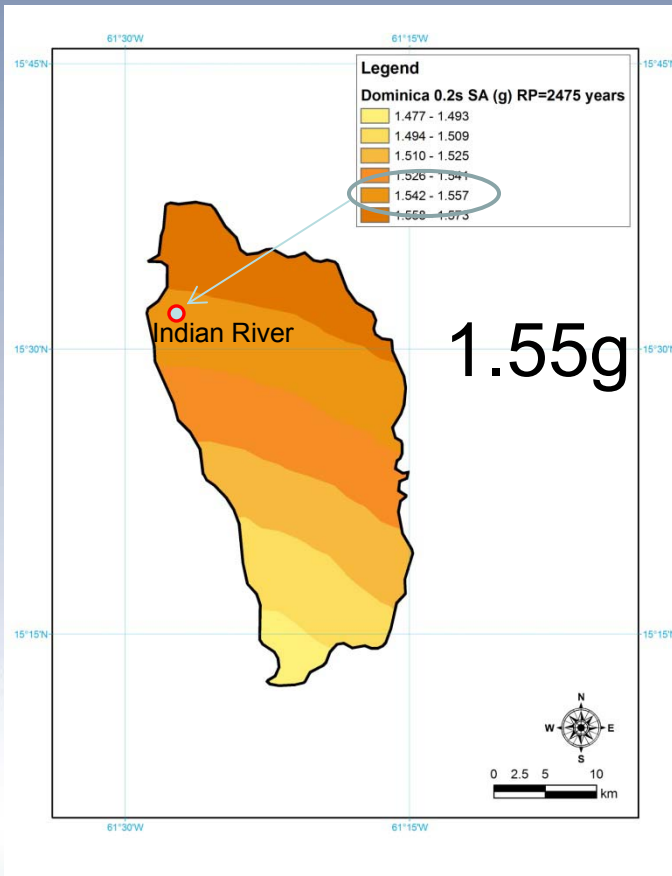
INDIAN RIVER - DOMINICA





MULTI SPAN BRIDGE INDIAN RIVER - DOMINICA



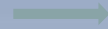




- Reading from the maps

$$S_S = 1.55g$$

$$S_1 = 0.47g$$



$$S_{DS} = (2/3) * 1.55g = 1.03g$$

$$S_{D1} = (2/3) * 0.47g = 0.31g$$

$$T_o = 0.2 \frac{S_{D1}}{S_{DS}} = 0.2 * \frac{0.31}{1.03} = 0.06s$$

$$S_a = S_{DS} \left(0.4 + 0.6 \frac{T}{T_o} \right) = 1.03 * \left(0.4 + 0.6 \frac{T}{0.06} \right) = 0.41 + 10.3T$$

T : the fundamental period
of the structure in "s"





$$S_a = S_{DS} = 1.03g$$

Flat spectral response

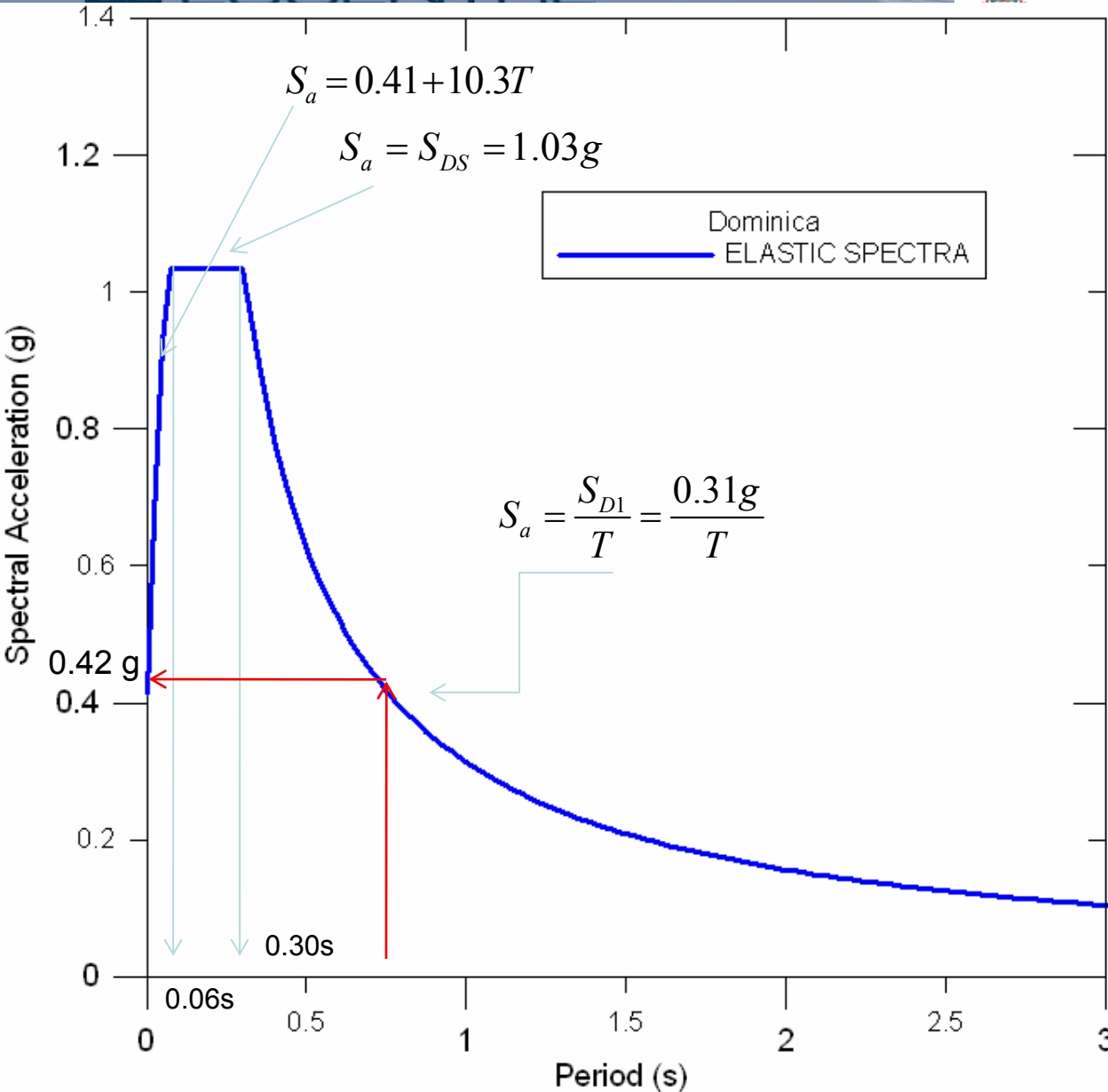
$$T_S = \frac{S_{D1}}{S_{DS}} = \frac{0.31}{1.03} = 0.30s$$

Period to which begin
the exponential decay

$$S_a = \frac{S_{D1}}{T} = \frac{0.31g}{T}$$

Spectral exponential
decay





The Seismic Coefficient C_s

Design of a column

Fundamental Period (after dynamic analysis):

$T = 0.75$ s (H=15 m and 30 m span)

SA = 0.42g (elastic spectral acceleration))

Reduction factor $R = 8.0$

Considering ductility and overstrength

$C_s = SA/R = 0.42g/8 = 0.053g$

