Sharif University of Technology
Department of Mechanical Engineering

درس تحلیل و طراحی سازه های فراساحلی

بارگذاری موج در

SAP2000

تهیه: مجید قادری

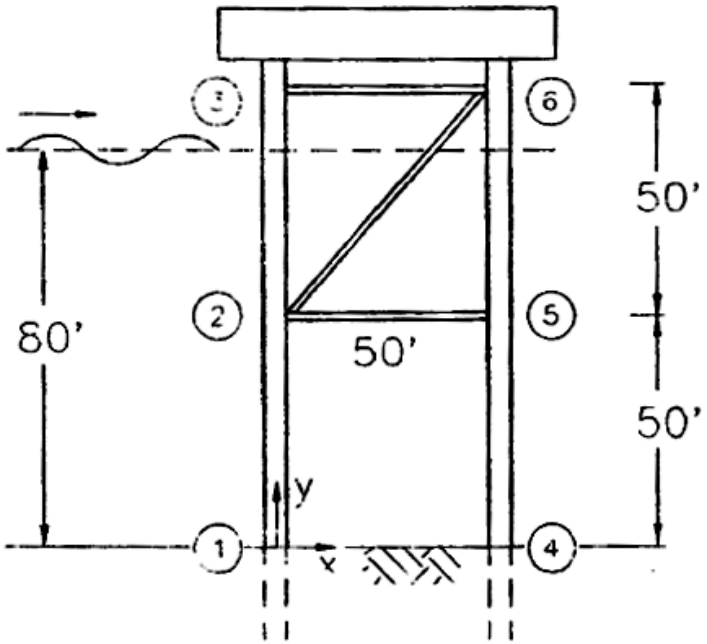
مدرس: تابش پور

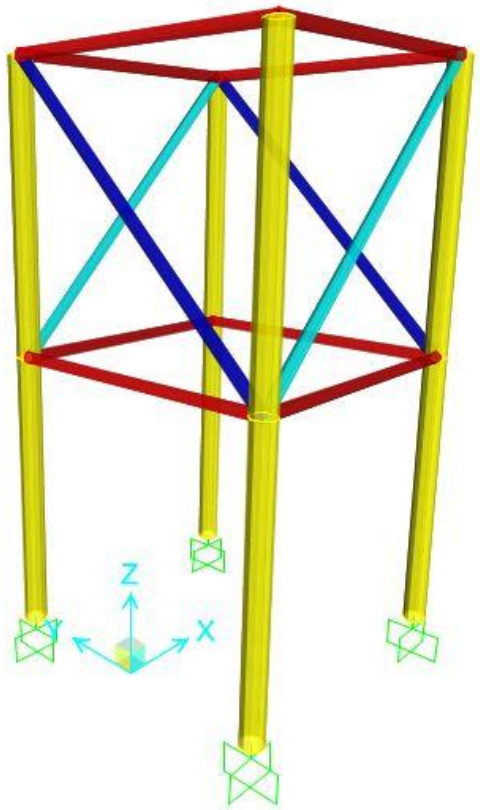
Content

- Model Properties
- Define Wave Load Pattern
- Modification of Wave Load
- Assign wave characteristics
- View wave characteristics
- Apply wave load

Model Properties

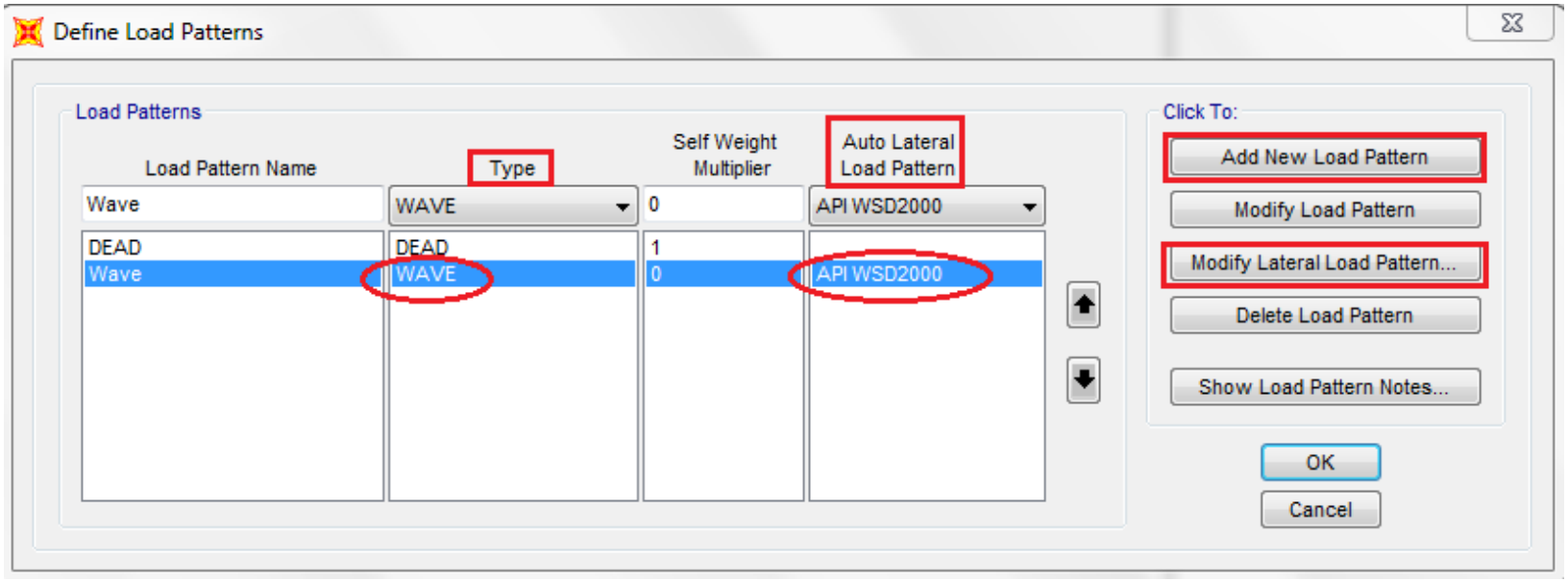
- $(D,t)_{(\text{brace \& beam})} = (2\ ^{ft}, 0.05\ ^{ft})$
- $(D,t)_{(\text{leg})} = (4\ ^{ft}, 0.1\ ^{ft})$



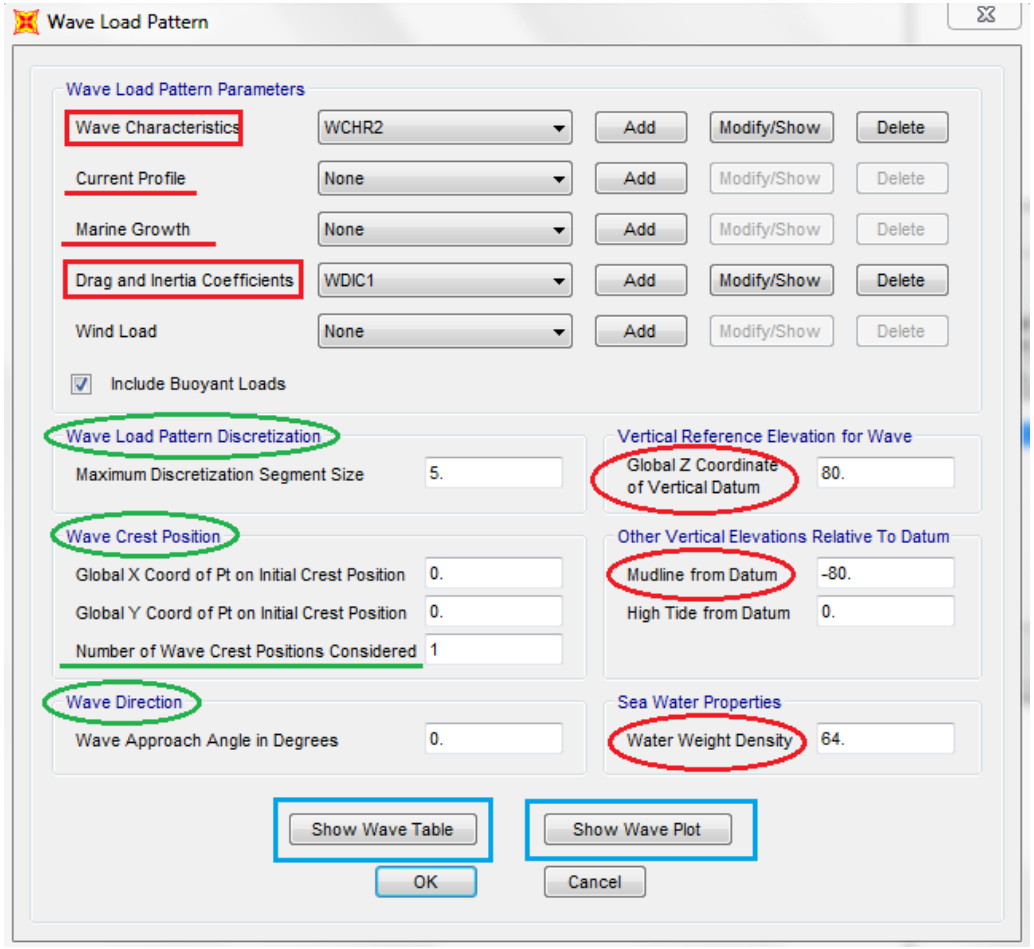


Define Wave Load Pattern

- Define -> Load Pattern
- Load Type : WAVE -> Auto Lateral Load Pattern -> Add New Load Pattern
- Modify Lateral Load Pattern -> Wave Load Pattern

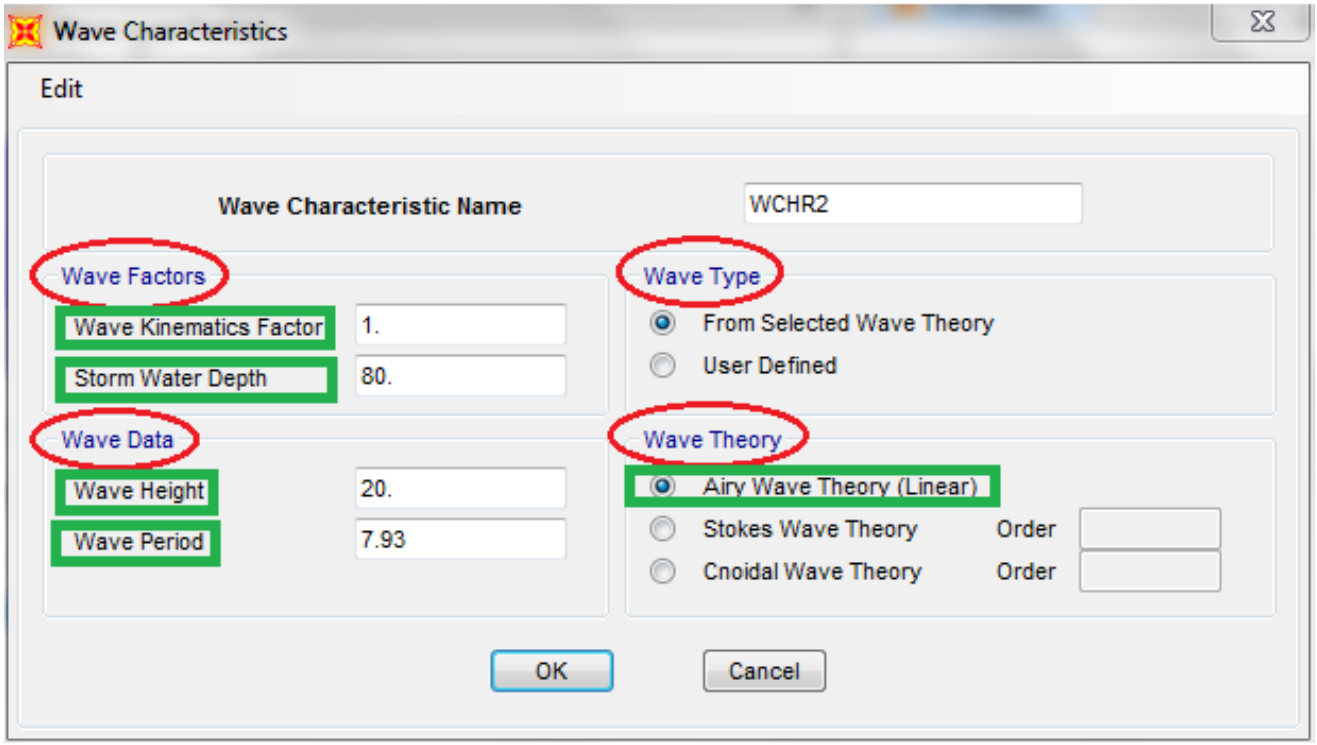


Define Wave Load Pattern



Define Wave Load Pattern

- Wave Characteristics



Define Wave Load Pattern

- Wave kinematic factor -> API 5.3.1.2.4

5.3.1.2.4 Wave Kinematics Factor

The two-dimensional regular wave kinematics from stream function or Stokes V wave theory do not account for wave directional spreading or irregularity in wave profile shape. These "real world" wave characteristics can be approximately modeled in deterministic wave analyses by multiplying the horizontal velocities and accelerations from the two-dimensional regular wave solution by a wave kinematics factor. Wave kinematics measurements support a factor in the range 0.85 to 0.95 for tropical storms and 0.95 to 1.00 for extratropical storms. Particular values within these ranges that shall be used for calculating guideline wave forces are specified for the Gulf of Mexico and for other U.S. waters in API 2MET. Section B.5.3.1.2.4 provides additional guidance for calculating the wave kinematics factor for particular sea states whose directional spreading characteristics are known from measurements or hindcasts.

Define Wave Load Pattern

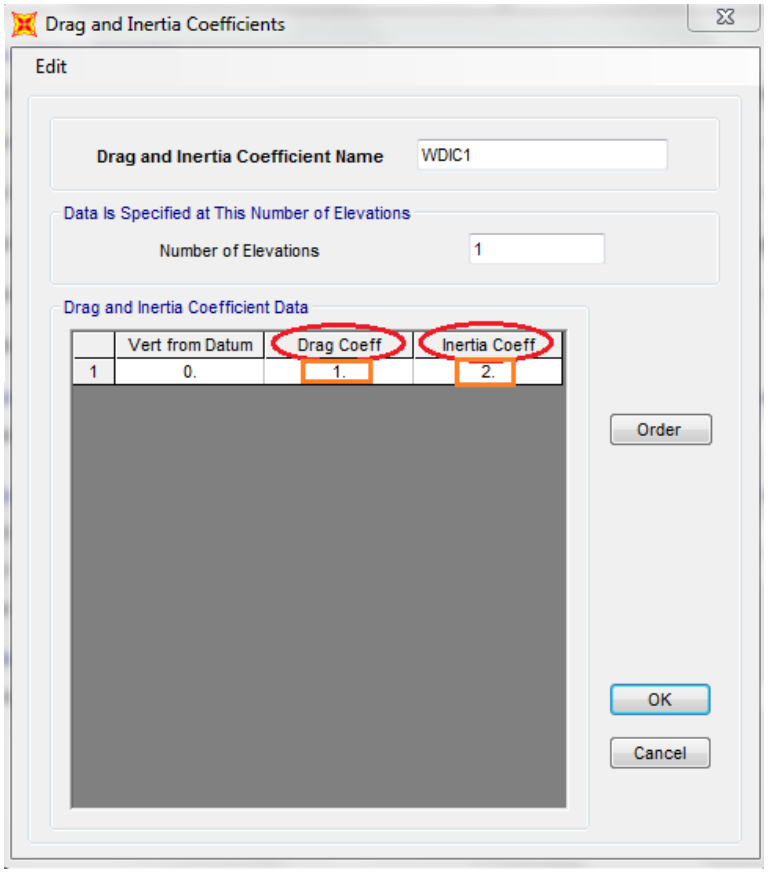
- Drag & Inertia Coefficient -> API 5.3.1.2.8:

5.3.1.2.8 Drag and Inertia Coefficients

Drag and inertia coefficients are discussed in detail in B.5.3.1.2.8. For typical design situations, global platform wave forces can be calculated using the following values for unshielded circular cylinders:

Smooth: $C_d = 0.65$, $C_m = 1.6$

Rough: $C_d = 1.05$, $C_m = 1.2$



Define Wave Load Pattern

- Drag & Inertia Coefficient , Wave kinematic factor in 300-9:

۲-۳-۱-۲-۲ سینماتیک دو بعدی امواج

اندازه‌گیریهای انجام شده در مورد سینماتیک امواج، بیانگر آن است که ضریب سینماتیکی موج برای طوفانهای شدید، بین ۰/۹۵-۰/۸۵ و برای طوفانهای بسیار شدید، بین ۱-۰/۹۵ می‌باشد.

۲-۳-۱-۲-۶ ضرایب دراگ و اینرسی

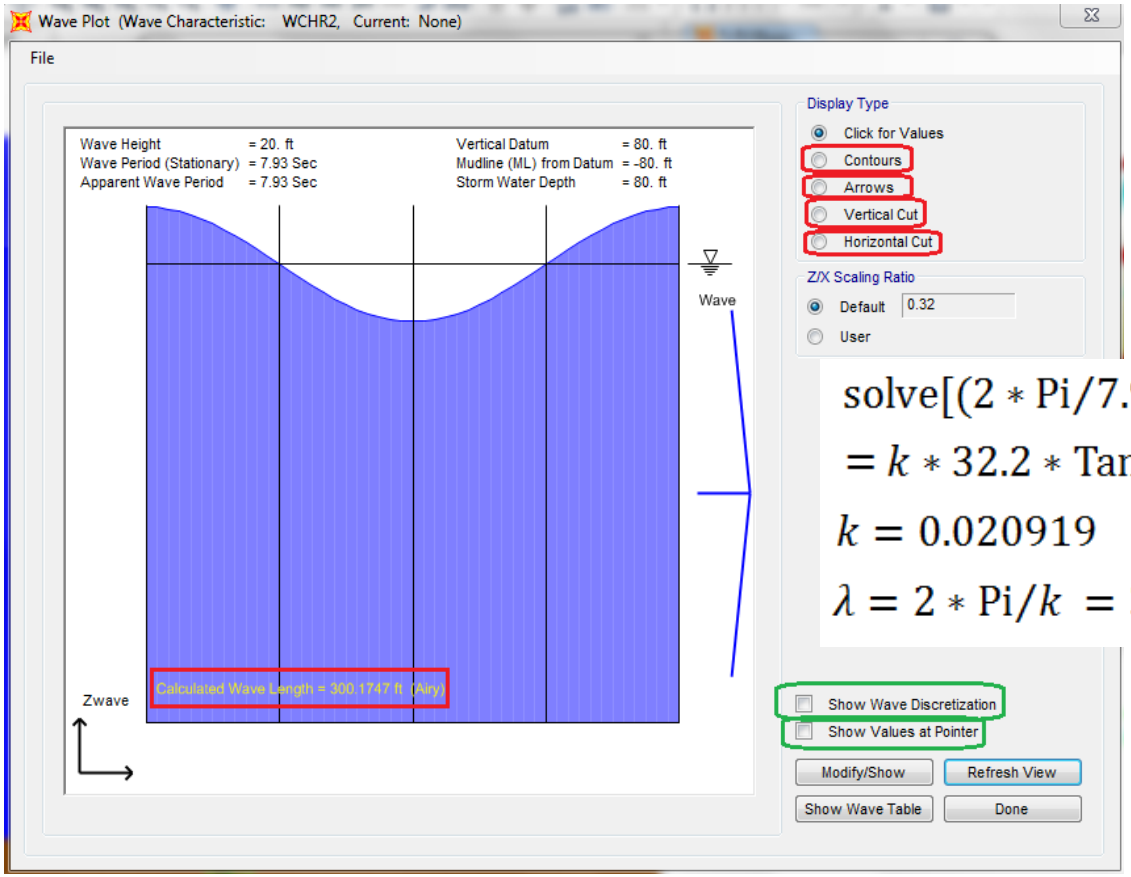
در بخش اول آیین‌نامه، در مورد ضرایب دراگ و اینرسی بحث شده است. برای شرایط طراحی نمونه، می‌توان برای استوانه‌های بدون پوشش، نیروهای کلی موج بر سکو را با استفاده از مقادیر زیر محاسبه کرد:

صاف $C_d = 0/65 , C_m = 1/6$

زبر $C_d = 1/05 , C_m = 1/2$

Define Wave Load Pattern

- Wave Plot



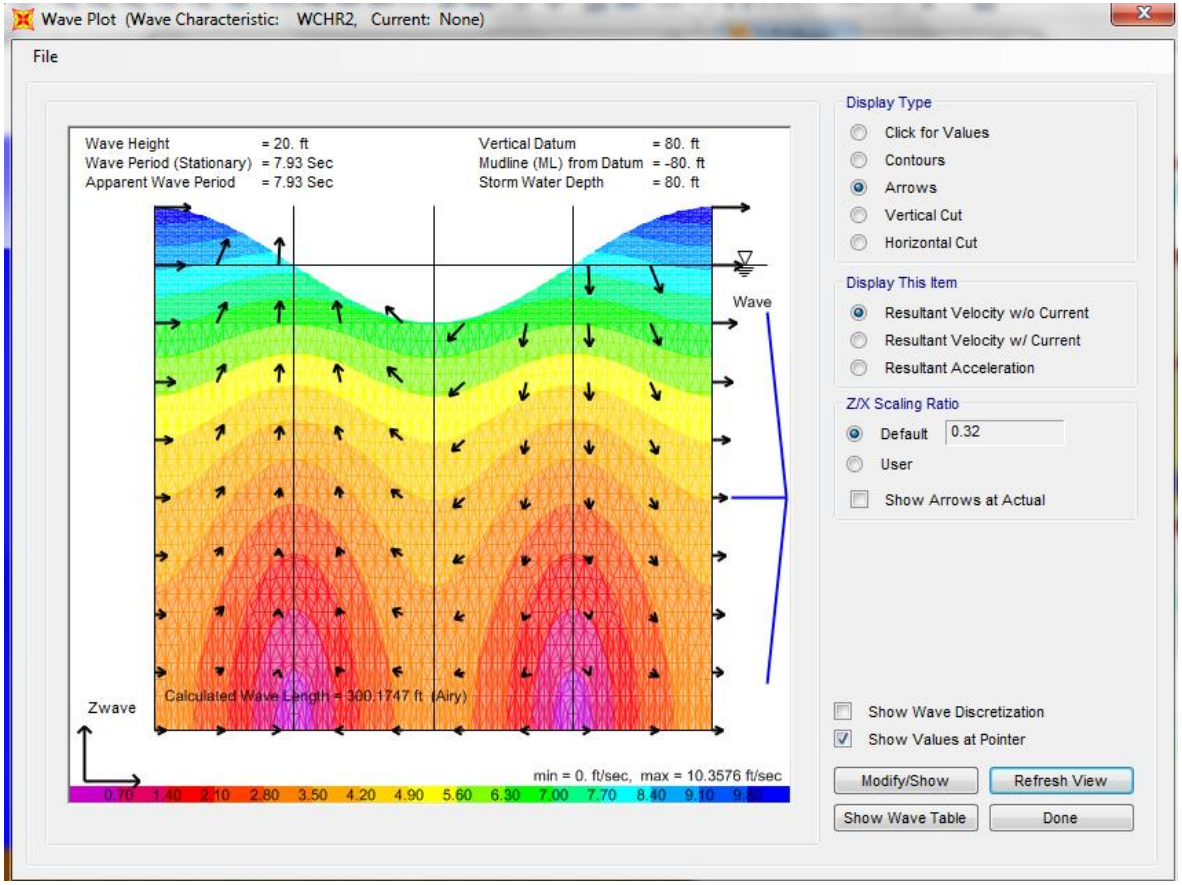
$$\text{solve}[(2 * \text{Pi}/7.93)\text{^}2 = k * 32.2 * \text{Tanh}[k * 80], k]$$

$$k = 0.020919$$

$$\lambda = 2 * \text{Pi}/k = 300.357$$

Define Wave Load Pattern

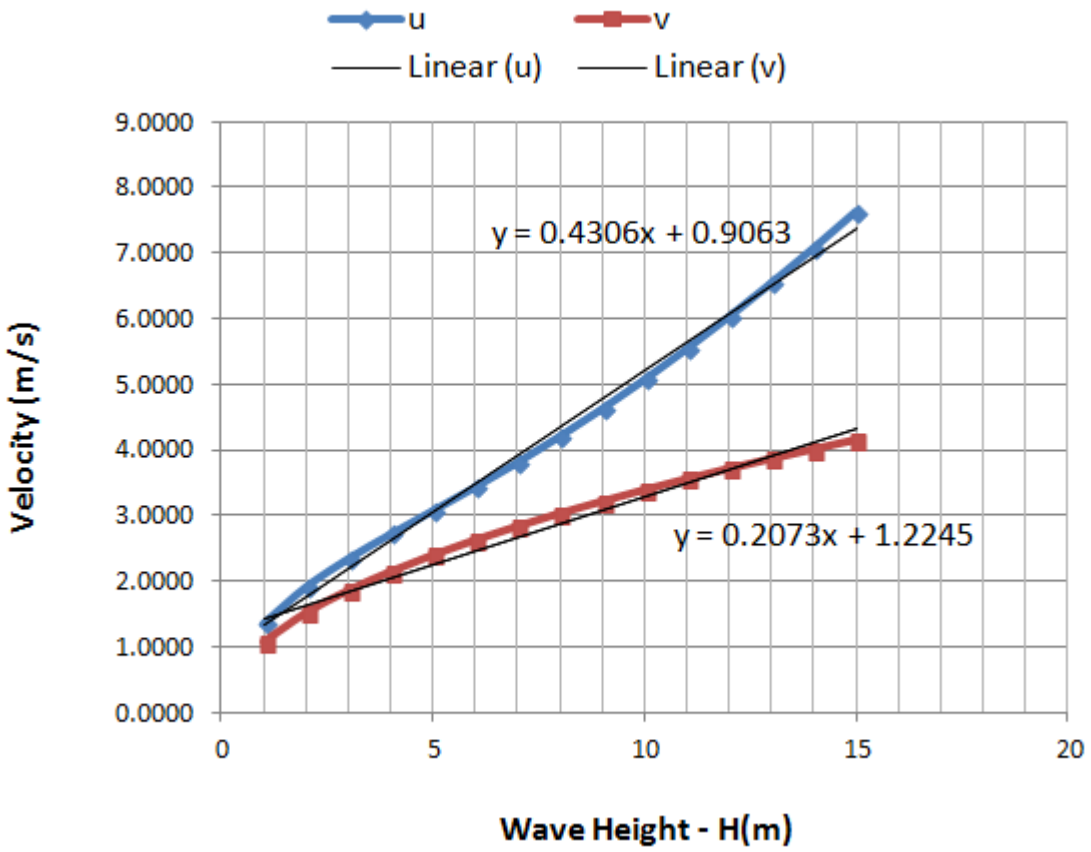
- Wave Plot



Wave Loading via SAP2000

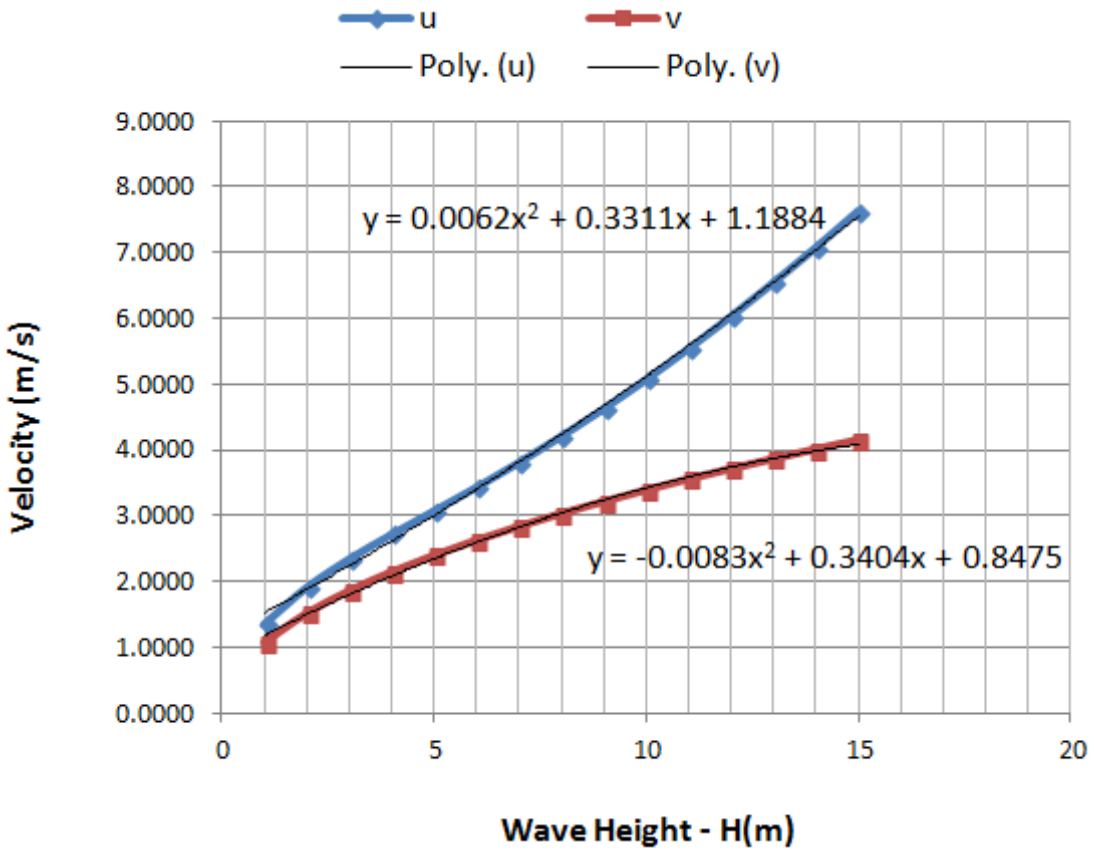
Define Wave Load Pattern

- Wave velocity



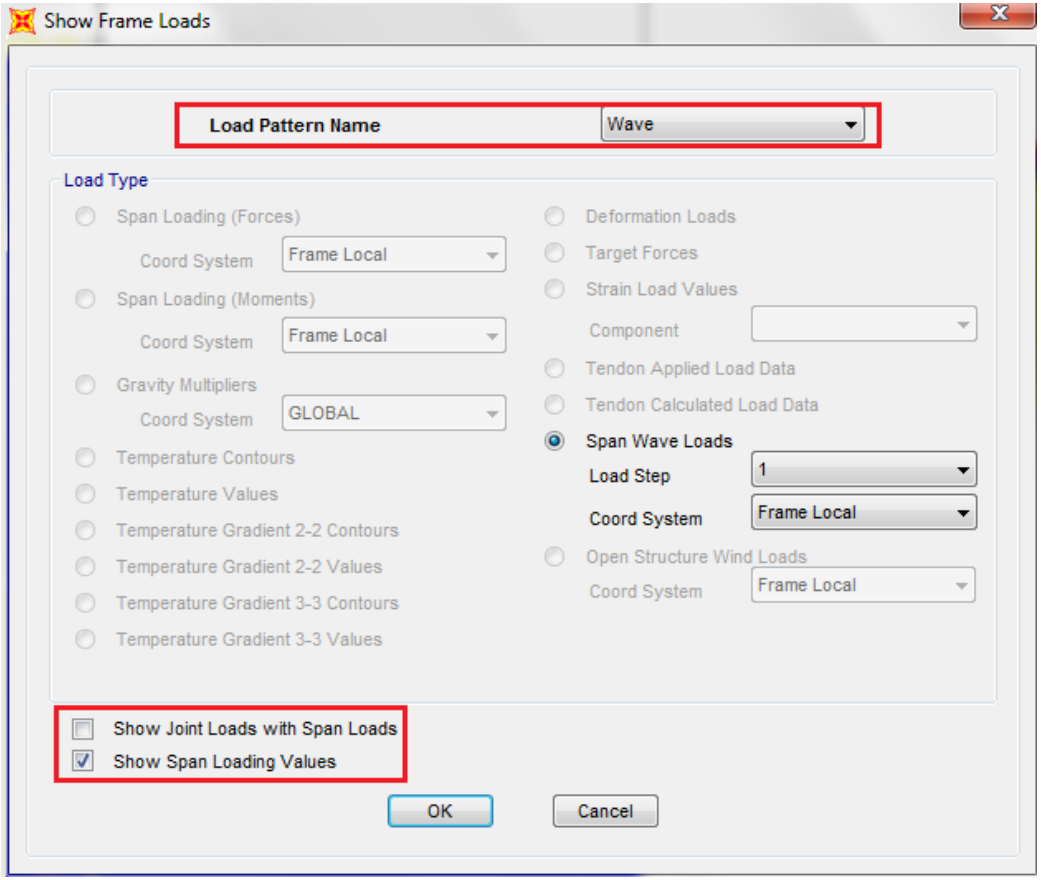
Define Wave Load Pattern

- Wave velocity



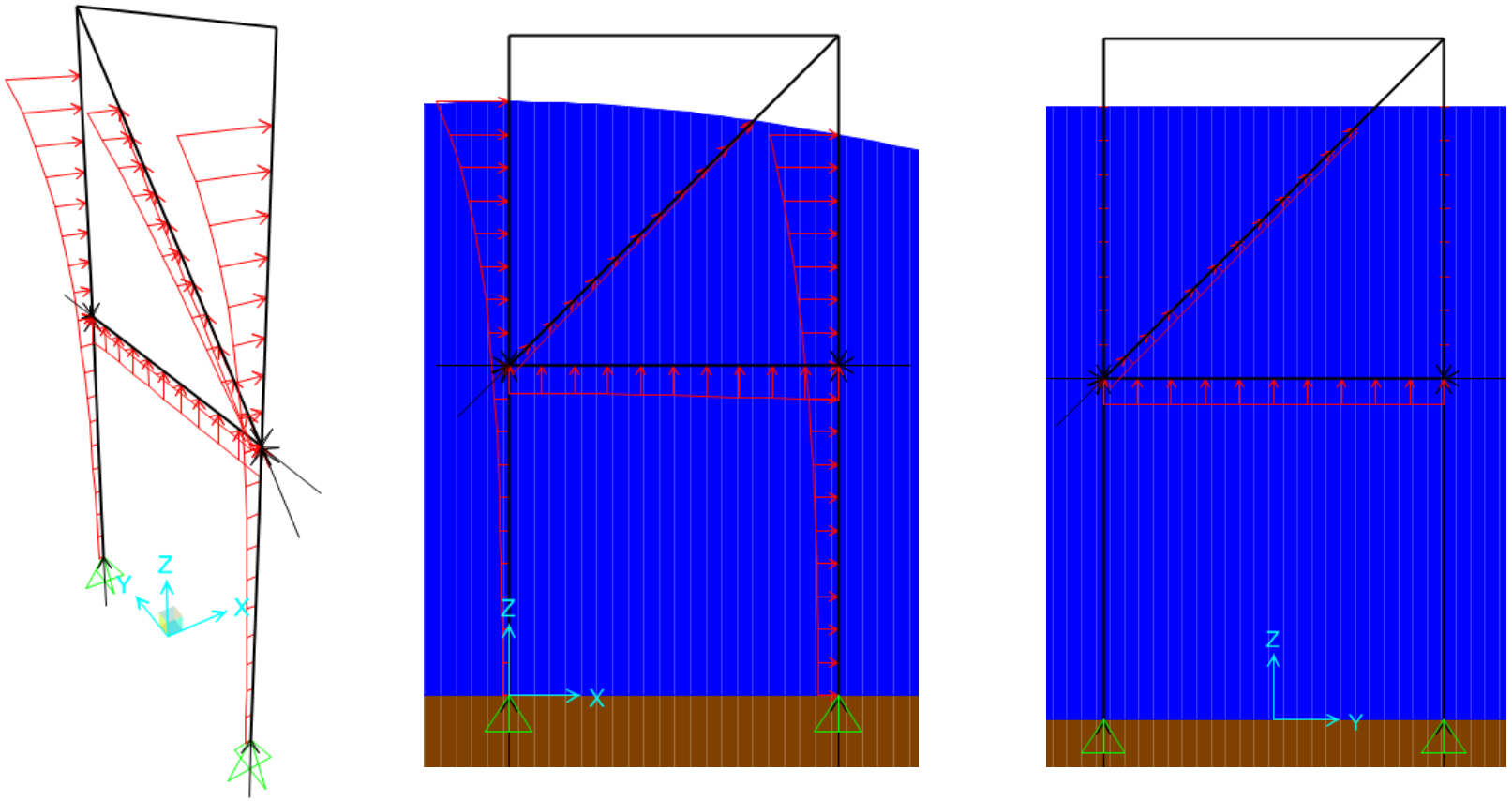
Define Wave Load Pattern

- Menu -> Display -> Show Load Assigns -> Frame …



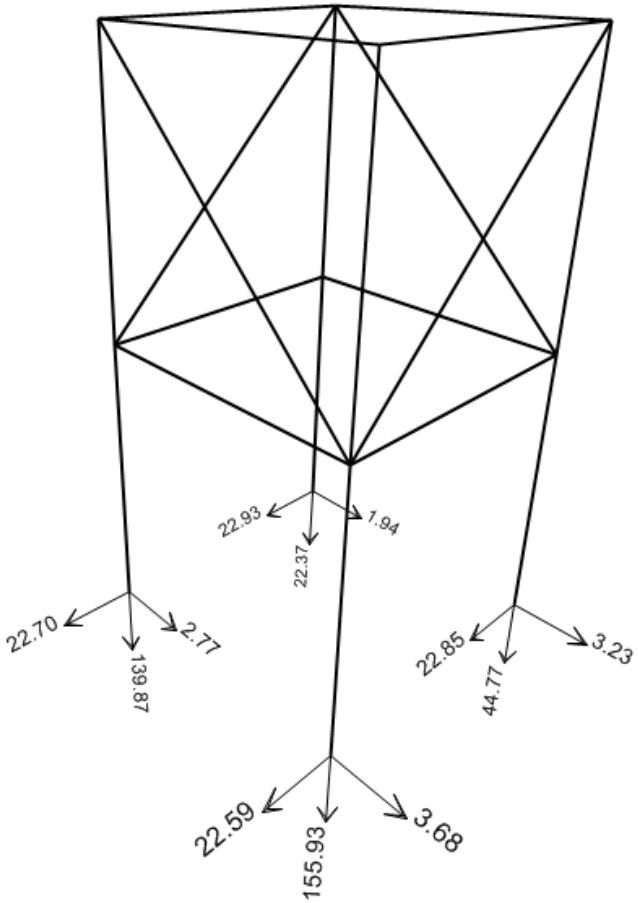
Wave Loading via SAP2000

Wave Load on Structure

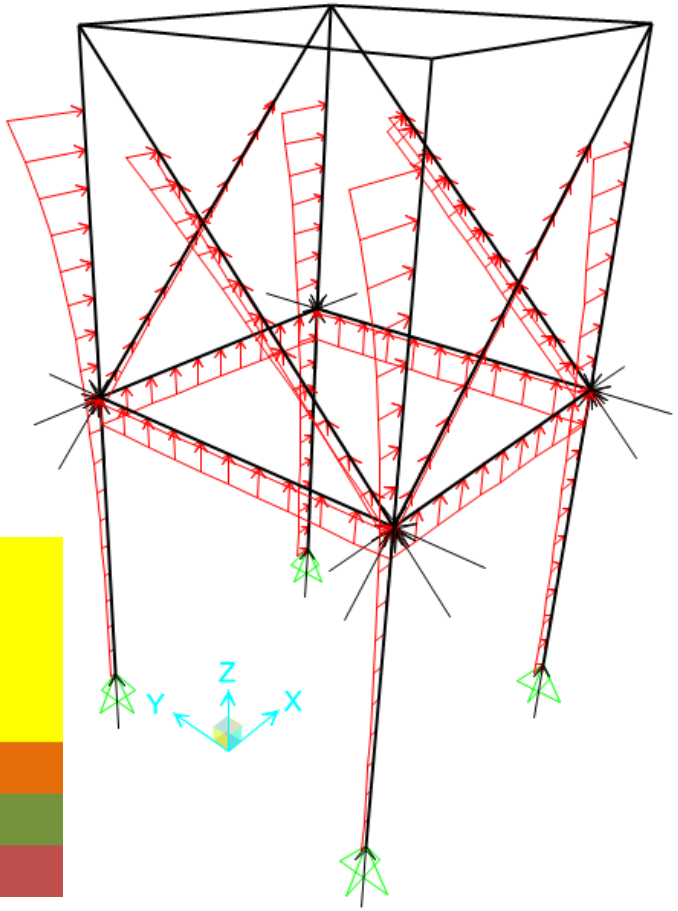


Wave Loading via SAP2000

Wave Load on Structure

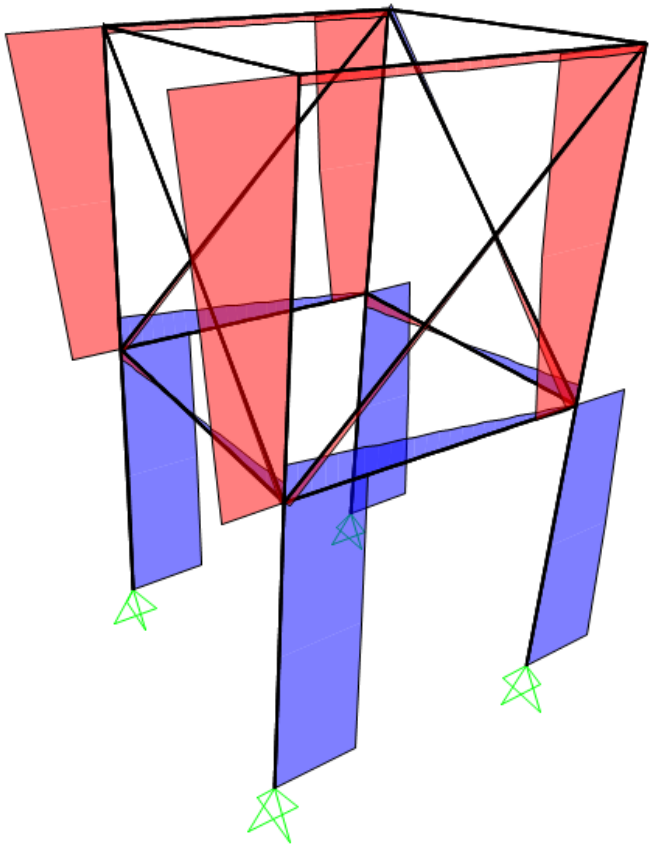


F1=	22.93	lb
F2=	22.70	lb
F3=	22.59	lb
F4=	22.85	lb
Total=	91.07	lb
Dawson=	83.60	lb
Difference=	8.20	%

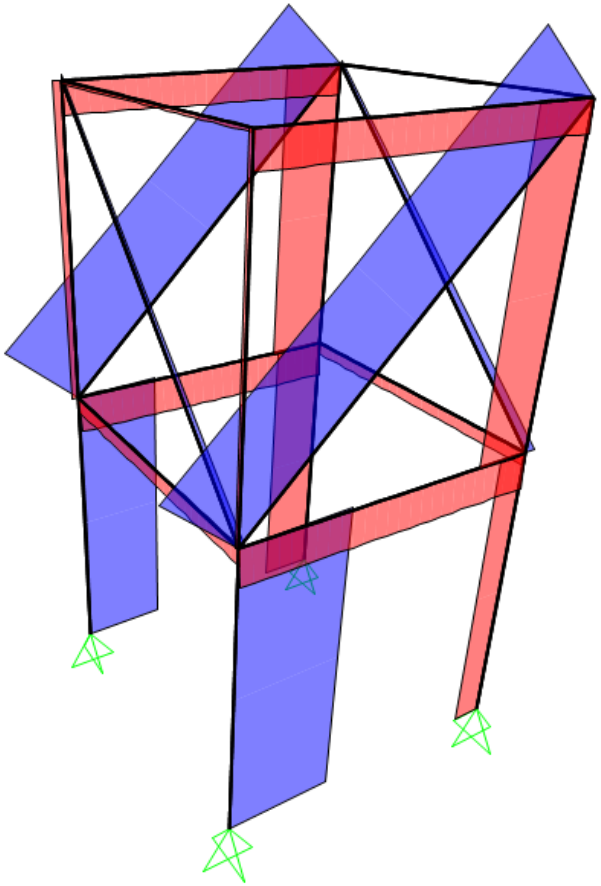


Wave Loading via SAP2000

Wave Load on Structure

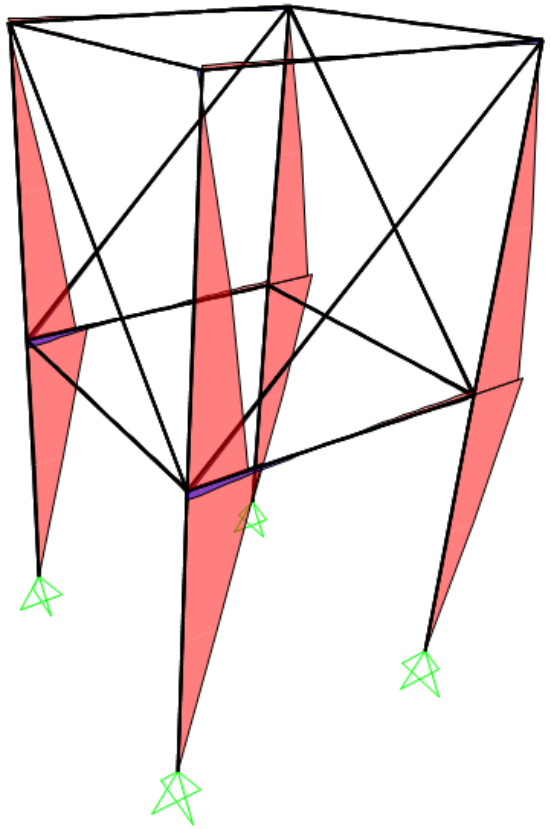


Shear Force

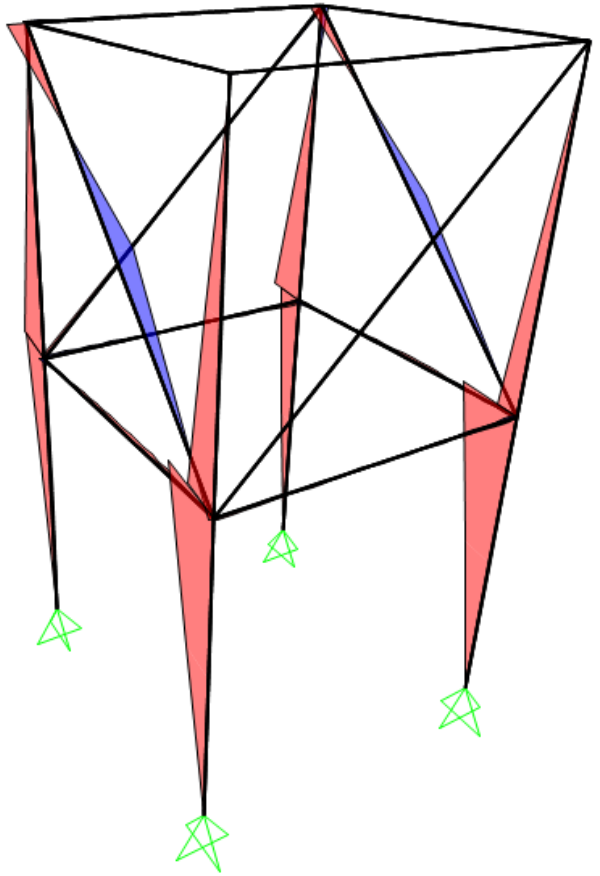


Axial Force

Wave Load on Structure



Bending Moment (3-3)



Bending Moment (2-2)