TUGAS AKHIR

ANALISIS DAN DESAIN STRUKTUR RUANG (SPACE TRUSS) KUBAH LAMELLA

Diajukan kepada Universitas Islam Indonesia
Untuk memenuhi sebagian persyaratan memperoleh
Derajat Sarjana Teknik Sipil

Disusun Oleh :

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LEMBAR PENGESAHAN
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Tanggal : 7-5-99.

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Dosen Pembimbing II

Tanggal : 7-5-'99

MOTTO

"Wahai Tuhanku,masukkan aku secara masuk yang benar dan keluarkanlah aku secara keluar yang benar, dan berikanlah kepadaku dari sisi Engkau kekuasaan yang menolong." (Al-Isra' : 80)

"Wahai Tuhanku, ampunilah dosa kesalahanku dan rahmatilah aku dan Engkaulah yang paling baik dari segala yang memberi rahmat." (Al-Mukminun : 118)

"Wahai Tuhanku, aku berlindung kepada dari gurisan dan hembusan-hembusan para syetan, dan aku berlindung kepada-Mu, wahai Tuhanku, dari kedatangan mereka kepadaku." (Al-Mukminun : 97-98)

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Mas yazid, Mbak Ida, Anna dan si kecil Cory
Terima kasih atas do'a dan dukungannya

Terima kasih banyak untuk:
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Anna, teman-teman eR Te House, terutama
Lantai 2: Dewi, Yuni, Naning, Naja, Mimi

Efie. S

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Assalamualaikum wr. wb.

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Tugas Akhir berjudul "Analisis dan Desain Struktur Ruang (Space Truss) Kubah Lamella" bertujuan untuk memberikan pengenalan terhadap struktur ruang. Dimana dalam perkuliahan tingkat strata satu, masalah struktur ruang ini belum banyak dibicarakan. Sehingga dirasa perlu dijadikan tambahan pengetahuan tentang bagian lain pemakaian baja.

Selama penyusunan Tugas Akhir ini kami banyak memperoleh bantuan, bimbingan serta pengarahan dari berbagai pihak hingga terselesaikannya Tugas Akhir ini dengan baik. Selanjutnya penyusun menyampaikan terima kasih sebesar-besarnya kepada :

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6. Semua pihak yang tidak dapat disebutkan satu persatu dan banyak membantu penyusun dalam menyelesaikan Tugas Akhir ini.

Akhirnya, besar harapan penyusunan semoga Tugas Akhir ini bermanfaat bagi penyusun dan bagi pihak yang membutuhkannya.

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Wassalamualaikum wr. wb.

Yogyakarta, 11 Mei 1999

Penyusun

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INTISARI

Dewasa ini fungsi gedung semakin lama semakin beragam, desainnya harus semakin disesuaikan pula. Beberapa gedung mensyaratkan adanya tempat yang luas untuk suatu kegiatan. Oleh karena itu kebutuhan akan ruang yang luas semakin meningkat. Melihat hal itu maka penggunaan struktur ruang jadi sangat menguntungkan. Struktur ruang yang sudah banyak penggunaannya adalah struktur berbentuk kubah. Tugas akhir yang berjudul Analisis dan Desain Struktur Ruang (Space Truss) Kubah Lamella bertujuan memberikan alternatif desain kubah selain menggunakan struktur beton yaitu dengan struktur baja, dengan menganalisis struktur ruang kubah, menganalisis beban-beban yang bekerja pada kubah dan menghitung gaya batang yang terjadi dengan program SAP90 sebagai aplikasi struktur ruang tiga dimensi.

Berdasarkan perhitungan gaya batang dari program SAP 90 , dilakukan pengecekan kapasitas batang . Pengecekan itu dilakukan dengan menggunakan rumus-rumus AISC dan mengganti profil untuk batang-batang yang tidak aman. Untuk kemudahan pabrikasi maka pada setiap lapis dari kubah digunakan diameter baut dan *ball joint* yang sama. Alat sambung yang digunakan batang berulir yang diasumsikan batang tarik.

Dari hasil perencanaan struktur ruang bentuk kubah didapat kesimpulan karena kubah yang direncanakan memiliki bentang yang relatif kecil dan jenis penutup yang ringan maka kubah satu lapis lebih efektif, karena menggunakan pendekatan space truss maka hanya gaya aksial saja yang bekerja. Dimensi batang yang digunakan untuk semua batang batang sama agar mudah dalam pelaksanaannya. Alat sambung Mero memiliki kekuatan yang besar dan proses pemasangan yang mudah.

BAB I

PENDAHULUAN

1.1. LATAR BELAKANG

Dewasa ini fungsi gedung semakin lama semakin beragam, desainnya harus semakin disesuaikan pula. Beberapa gedung mensyaratkan adanya tempat yang luas untuk suatu kegiatan. Banyaknya aktifitas manusia yang dilakukan secara bersamaan yang membutuhkan ruang tertutup yang luas. Misalnya tempat untuk stadion olahraga, ruang untuk pertunjukan, tempat ibadah dan tempat pertemuan yang dihadiri banyak peserta. Oleh karena itu kebutuhan akan ruang yang luas semakin meningkat. Ruang tersebut harus dapat memberikan keleluasaan gerak sehingga tidak mengganggu aktifitas tersebut. Namun kelemahan yang terdapat pada struktur penutup yang umum dijumpai adalah struktur dengan penggunaan ruang. Melihat hal itu maka penggunaan struktur ruang menjadi sangat menguntungkan. Hal ini karena struktur ruang memiliki kelebihan untuk menutupi ruang yang luas dengan menggunakan sedikit atau tanpa penopang antara.

Struktur ruang yang sudah banyak penggunaannya adalah struktur berbentuk kubah, yang merupakan salah satu bentuk konstruksi yang paling tua, dan sejak ditemukannya merupakan sebuah elemen tetap dalam arsitektur. Struktur bentuk kubah ini direncanakan agar dapat memungkinkan ditutupnya ruang secara maksimum dengan permukaan minimum yang menghasilkan suatu struktur ruang dengan bentang yang besar dan dimensi yang ekonomis.

Bentuk lengkung gandanya kubah merupakan salah satu bentuk yang paling cocok sebagai penutup ruang besar. Kubah rangka ruang yang dilaksanakan dari baja sudah banyak digunakan untuk berbagai bangunan yang besar. Kubah ini terdiri dari atas elemen yang ditempatkan pada permukaan kubah dan bagian lurus yang persilangannya terdapat pada permukaan itu sehingga ruang dalam tetap bebas sama sekali. Kubah rangka ruang merupakan contoh khas dari konstruksi trimarta, sedangkan di Indonesia kubah dengan struktur ruang masih jarang digunakan untuk bangunan yang relatif luas.

Kebanyakan kubah yang dibuat sekarang ini adalah prefab, maksudnya pelaksanaannya tidak banyak membutuhkan panjang batang yang berbeda. Berat konstruksi kubah rangka ruang memiliki keunggulan jika dibandingkan dengan konstruksi tradisional, juga untuk bentangan kecil sekalipun, misalnya kubah dengan struktur beton. Kubah dengan struktur beton selain memiliki berat struktur yang besar juga dalam pelaksanaannya membutuhkan perancah yang banyak dan rumit.

Kelebihan lain dari struktur ruang kubah ini adalah memiliki bentuk yang indah dan sangat ringan, sehingga banyak digemari oleh arsitek. Disamping itu ruang ini mudah dalam pengerjaannya, sehingga struktur kubah ini secara keseluruhan lebih ekonomis.

Untuk bentangan besar sekali, seringkali kubah merupakan pemecahan yang paling ekonomis. Dulu kubah dipakai untuk menaungi gedung pameran, ruang konser, stadion dan planetarium. Pada masa kini kubah itu terdapat pada atap ruang dansa, gedung olahraga skating, kolam renang, rumah hijau, toko serba ada, bangunan masjid dan ruang kerja.

1.2. TUJUAN

Tujuan penulisan Tugas Akhir ini yaitu untuk memberikan alternatif desain kubah selain menggunakan struktur beton, untuk mendesain kubah dengan struktur ruang, menganalisis struktur ruang kubah, menganalisis beban-beban yang bekerja pada kubah dan menghitung gaya batang yang terjadi dengan program SAP90 sebagai aplikasi struktur ruang tiga dimensi.

1.3. BATASAN MASALAH

Ruang lingkup pembahasan dibatasi hanya masalah struktur ruang kubah dengan satu lapis adalah:

a. Kubah yang didesain memiliki diameter 23 m dan tinggi 8,5 m dengan tipe kubah Lamella. Ukuran kubah tersebut mengacu pada ukuran kubah beton yang digunakan pada masjid kampus UII di Jalan Kaliurang.
b. Perhitungan struktur dilakukan menggunakan program aplikasi struktur tiga dimensi, dan input datanya disesuaikan dengan bentuk struktur sistem pembebanan dan sistem dukungan.

c. Beban-beban yang bekerja dihitung berdasarkan Pedoman Perencanaan Pembebanan untuk Rumah dan Gedung tahun 1987 , dan penetapan beban yang bekerja disesuaikan dengan posisi joint dan bentuk dari kubah.

d. Perhitungan dan pemilihan batang yang digunakan mengikuti ketentuan American Institute of Steel Construction (AISC) .

e. Sambungan antara batang digunakan sambungan sistem Mero atau ball joint , sehingga sifat hubungan antara batangnya sendi.

f. Faktor biaya pembangunan tidak termasuk dalam perencanaan ini.

g. Perencanaan hanya dilakukan pada struktur ruang rangka kubah sebagai atap , sedangkan struktur bawah tidak termasuk dalam perencanaan.

1. Pemilihan profil yang direncanakan menggunakan profil dari tabel American Institute of Steel Construction (AISC). Jenis profil yang digunakan adalah pipa dengan Fy = 36 ksi.

BAB II

TINJAUAN PUSTAKA

Pada struktur ruang , garis kerja gaya menyebar bercabang-cabang di dalam ruang. Pemakaian baja untuk bahan pembentukan struktur ruang mempunyai keuntungan karena logam ini mempunyai daya tahan yang besar terhadap patahan yang disebabkan oleh berbagai beban bergerak mekanis. (Z.S. Makowski ,1964).

Analisis rangka ruang secara luas didasarkan pada pengalaman dan penyederhanaan asumsi dari pengetahuan rangka ruang. Untuk beberapa tipe rangka ruang pendekatan tersebut dapat memberikan hasil yang baik , tetapi untuk kasus-kasus umum pendekatan itu tidak dapat digunakan sebagai analisis akhir. Dengan meningkatnya kompleksitas desain dan perkembangan material yang lebih kuat membutuhkan solusi struktur yang lebih tepat. Dengan ketersediaan alat hitung elektronik yang lebih canggih dan perkembangan program komputer standart , dapat diperoleh solusi analisis struktur yang lebih akurat untuk masalah yang lebih kompleks (Boris Bresler).

Hadori dan Liana (1998) mendesain Struktur Ruang bentuk Kubah Satu Lapis dengan tipe kubah Lamella. Dalam penulisan tugas akhir ini mereka mendesain struktur kubah dan struktur analisis yang dipakai untuk program menggunakan sistem space frame yang menghasilkan momen yang terjadi cenderung lebih besar pada join-join yang lemah, selain itu gaya batang dan momen ujung yang diperoleh relatif kecil. Dan dari hasil tersebut ukuran dimensi dari batang dan diameter baut sangat kecil.

BAB III

LANDASAN TEORI

3.1. Struktur Rangka Ruang (SPACE TRUSS)

Tidak seperti struktur dua dimensi, dimana semua batang dan gaya-gaya terjadi pada bidang yang sama, pada struktur tiga dimensi, batang dan gaya-gaya yang terjadi pada sebuah ruang. Batang Truss pada struktur tiga dimensi tidak perlu disambung dengan hinge (sendi) tapi disambung dengan di-las ataupun dengan baut.

3.1.1 Komponen Gaya pada Keseimbangan Global dari Space Truss

Gaya yang terjadi pada rangka kaku dari struktur ruang terjadi pada beberapa arah dan momen yang terjadi pada beberapa sumbunya. Sebuah gaya pada ruang dapat diperinci berapa besarnya, arah dan garis aksinya, atau dengan 3 sumbu koordinat yang saling tegak lurus. Seperti diperlihatkan gambar 3.1, garis aksi gaya yang berubah-ubah membuat 3 bidang dengan sumbu X, Y dan Z. Sedangkan sudutnya θ_X , θ_Y dan θ_Z pada bidang antara gaya P dan P_X , P_Y dan P_Z disebut *sudut arah* (*direction angles*). Sudut arah adalah sudut pada sumbu batang dengan sumbu koordinat.Cosinus arah adalah perbandingan dari panjang proyeksi dan panjang batangnya.Cosinus arah (*direction cosines*) digunakan untuk menghitung komponen gaya. Cosinus arah didapat dari koordinat joint-jointnya, titik-titik ujung batangnya. Untuk sebuah batang disambungkan pada joint 1 dan 2, cosinus arah koordinat joint-jointnya adalah :

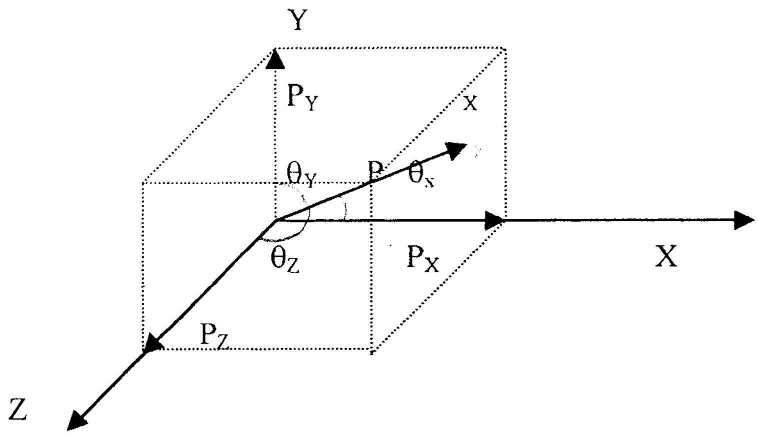
$$\cos\theta_X = \frac{X_2 - X_1}{l} = \frac{l_X}{l} \quad (3.1a)$$

$$\cos\theta_Y = \frac{Y_2 - Y_1}{l} = \frac{l_Y}{l} \quad (3.1b)$$

$$\cos\theta_Z = \frac{Z_2 - Z_1}{l} = \frac{l_Z}{l} \quad (3.1c)$$

dan panjang batangnya adalah

$$l = \left[(X_2 - X_1)^2 + (Y_2 - Y_1)^2 + (Z_2 - Z_1)^2\right]^{1/2} \quad (3.1d)$$



Gambar 3.1 Batang-batang pada struktur rangka ruang

Komponen gaya aksial pada cosinus arah adalah

$$P_X = P\cos\theta_X = P\frac{l_X}{l} \quad (3.2a)$$

$$P_Y = P\cos\theta_Y = P\frac{l_Y}{l} \quad (3.2b)$$

$$P_Z = P\cos\theta_Z = P\frac{l_Z}{l} \qquad (3.2c)$$

dan $$P = \left[P_X^2 + P_Y^2 + P_Z^2\right]^{1/2} \qquad (3.2d)$$

Dari persamaan diatas dapat dilihat apakah komponen gaya sebanding dengan panjang proyeksinya

$$\frac{P_X}{l_X} = \frac{P_Y}{l_Y} = \frac{P_Z}{l_Z} = \frac{P}{l} \qquad (3.3)$$

Persamaan keseimbangan dari struktur rangka dinyatakan dengan sebuah nomor dari bentuk yang berbeda bergantung bagaimana kondisi keseimbangan yang dipakai. Jika kita tahu salah satu komponen gaya, maka dua komponen gaya yang lainnya dapat dicari dengan geometri (diukur). Aksi momen hampir berubah-ubah pada sumbu dapat diuraikan kedalam 3 komponen pada 3 sumbu ortogonal. Komponen ini akan mempunyai bentuk yang sama seperti gaya-gaya pada persamaan (3.2). Untuk struktur tiga dimensi persamaan keseimbangannya terdiri dari gaya-gaya yang seimbang pada tiga arah yang saling tegak lurus, dan momen yang seimbang pada tiga sumbu yang saling tegak lurus. Jika koordinat sumbu itu adalah X , Y dan Z, persamaan keseimbangan yang didapat adalah :

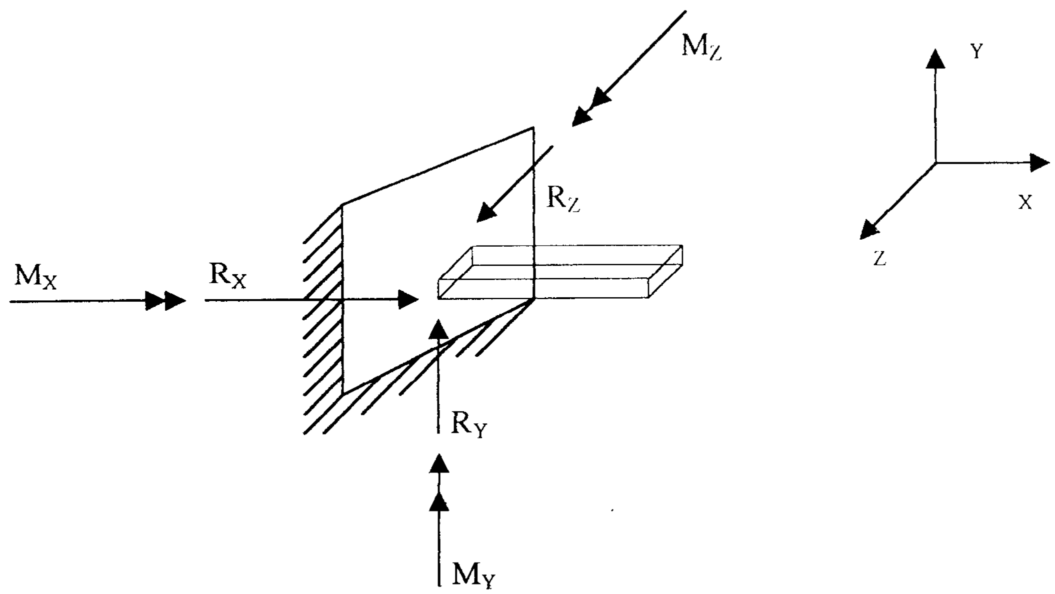
$$\sum F_X = 0 \qquad \sum F_Y = 0 \qquad \sum F_Z = 0 \qquad (3.4a,b,c)$$

dan $$\sum M_X = 0 \qquad \sum M_Y = 0 \qquad \sum M_Z = 0 \qquad (3.4d,e,f)$$

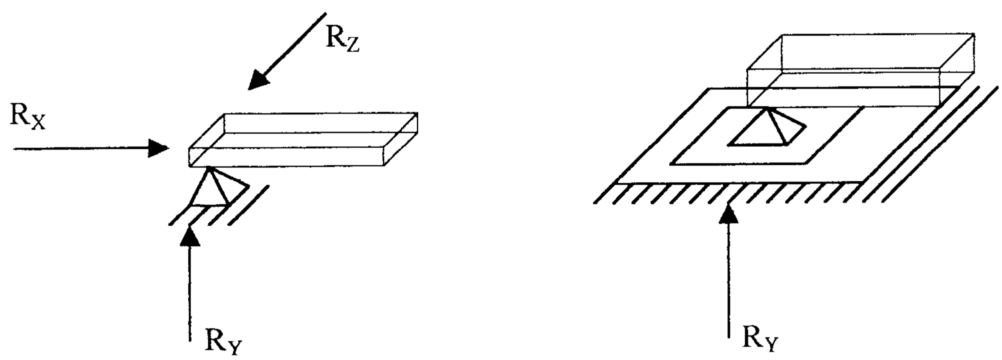
Persamaan ini dapat digunakan untuk mencari reaksi yang sama baik pada gaya-gaya batangnya pada statik tertentu dan gaya aksial, geser, momen dan torsi pada balok tiga dimensi.

3.1.2 Struktur Dukungan pada Space Truss

Dukungan pada struktur ruang mempunyai bermacam bentuk, tergantung dari jenis kekangan yang dipakai pada struktur dukungan tersebut.(seperti pada gambar 3.2).Kekangan akan melawan displasmen pada semua arah yang saling tegak lurus atau melawan rotasi pada semua sumbunya. Reaksi beban dapat berupa kombinasi dari gaya R_X , R_Y dan R_Z dan momen M_X , M_Y dan M_Z.



(a) Fixed Support (dukungan tetap)



(b) Pinned Support (c) Roller Support (dukungan rol)

Gambar 3.2 Dukungan pada struktur ruang.

Fixed Support (dukungan tetap). Dukungan tetap pada struktur ruang mencegah translasi dan rotasi pada semua arah dan semua sumbu dari dukungan jointnya. Reaksi beban pada dukungan ditunjukkan dengan gaya R_X , R_Y dan R_Z dan momen M_X , M_Y dan M_Z yang terjadi pada dukungan joint seperti diperlihatkan gambar 3.2a. Letak momen M_X , M_Y dan M_Z ditunjukkan dengan vektor sebagai simbol standar panah berkepala ganda.

Pinned Support. Pinned support untuk struktur ruang mencegah translasi pada semua arah dari dukungan joint dan membolehkan terjadi rotasi pada joint dari beberapa sumbunya. Reaksi beban pada dukungan joint ditunjukkan dengan gaya R_X , R_Y dan R_Z , seperti pada gambar 3.2b.

Roller Support (dukungan rol). Pada struktur ruang menyediakan sebuah kekangan translasi pada dukungan joint dan rotasi pada beberapa sumbunya. Reaksi beban terdiri dari sebuah reaksi komponen gaya tunggal yang terjadi pada dukungan joint tegak lurus rol, seperti pada gambar 3.2c.

3.1.3 Model Matematika untuk Struktur Rangka Ruang

Model matematika untuk rangka ruang terdiri dari kumpulan joint-joint yang mana disambungkan dengan batang lurus. Perbedaan antara rangka ruang dan rangka bidang adalah pada joint-joint, dalam rangka ruang ditempatkan pada banyak posisi dalam ruanng tiga dimensi, demikian juga dibutuhkan batang untuk dimiringkan pada banyak hadapan. Sifat model matematika dari kedua jenis *truss* adalah sama:

1. Semua batang harus mengikat pada joint ujungnya,tidak ada momen antara joint dan batangnya. Penyambungan pada setiap joint ujung sama dengan

sebuah bola dan sendi yang dibolehkan terjadi rotasi pada setiap akhir dari batang pada semua sumbu saat pengekangan translasi pada ujung dengan pengaruh dari jointnya.

2. Semua beban yang terjadi pada struktur terdiri dari gaya-gaya, yang terpusat yang terjadi pada joint-jointnya. Gaya terjadi pada beberapa arah dalam ruang tiga dimensi.

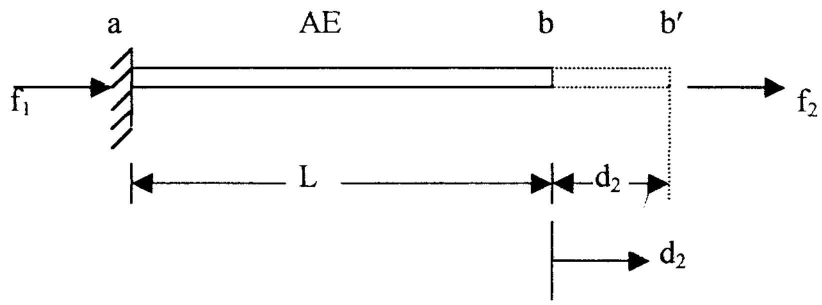
3. Semua dukungan joint-joint hanya dikekang melawan translasi. Joint-joint tersebut bebas untuk terjadi rotasi pada semua sumbunya.

3.1.4 Metoda Kekakuan Rangka (Trusses) Tiga Dimensi

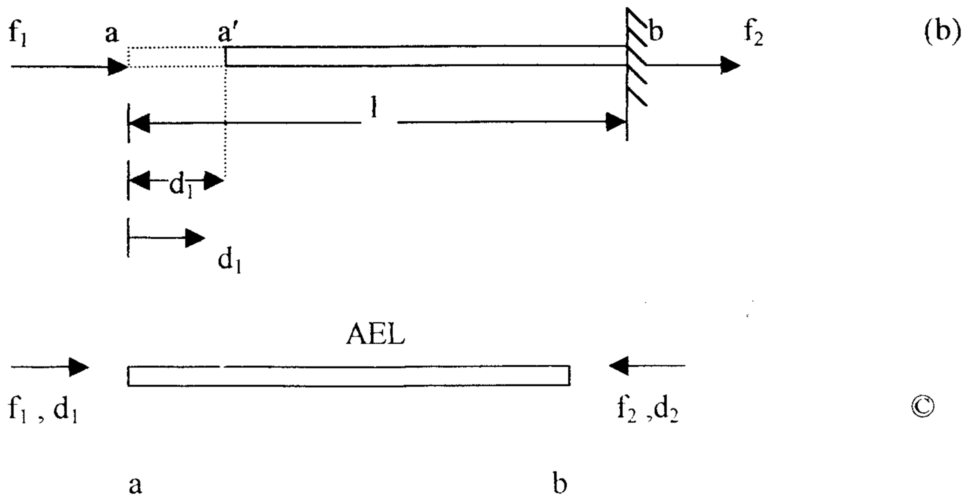
Analisis dari rangka tiga dimensi dengan metoda kekakuan adalah sama dengan pengaplikasian dari metode ini pada struktur-struktur lainnya yang bisa dibahas dengan metode ini. Langkah pertama yaitu menentukan matriks kekakuan elemen dalam koordinat lokal dan transformasi serta hubungan displasmen gaya pada koordinat global.

Matriks Kekakuan untuk Elemen Rangka Tiga Dimensi

Gaya-gaya batang dan displasmen-displasmen pada koordinat elemen lokal seperti pada gambar 3.3. Matriks kekakuan didapat dengan mencari hubungan antara gaya-gaya pada ujungnya dan displasmennya.



(a)



Gambar 3.3 Koordinat elemen lokal

Jika titik b diberi deformasi atau batang a b diperpanjang sebesar d_2 sehingga b menjadi b'.(lihat gambar3.3.a). Syarat kesetimbangan :

$$f_1 = -\frac{AE}{l} d_2 \qquad (3.5a)$$

$$f_2 = \frac{AE}{l} d_2 \qquad (3.5b)$$

a menjadi a'(lihat gambar 3.3.b), syarat kesetimbangan :

$$f_1 = \frac{AE}{l} d_1 \qquad (3.6a)$$

$$f_2 = -\frac{AE}{l} d_1 \qquad (3.6b)$$

Persamaan (3.5) dan (3.6) digabungkan menjadi :

$$f_1 = \frac{AE}{l} d_1 - \frac{AE}{l} d_2 \qquad (3.7a)$$

$$f_2 = -\frac{AE}{l} d_1 + \frac{AE}{l} d_2 \qquad (3.7b)$$

Persamaan (3.7) diatas dapat dituliskan dalam bentuk matriks

$$\begin{Bmatrix} f_1 \\ f_2 \end{Bmatrix} = \begin{bmatrix} \frac{AE}{l} & -\frac{AE}{l} \\ -\frac{AE}{l} & \frac{AE}{l} \end{bmatrix} \begin{Bmatrix} d_1 \\ d_2 \end{Bmatrix} \tag{3.8}$$

Persamaan (3.8) diatas dapat dituliskan menjadi

$$\{f\} = [k]\{d\}$$

{f} = matriks beban

[k] = matriks kekakuan

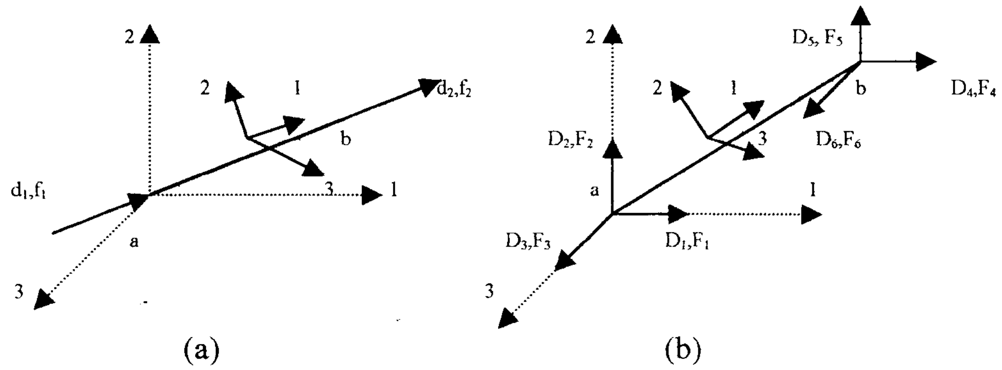
{d} = matriks displasmen

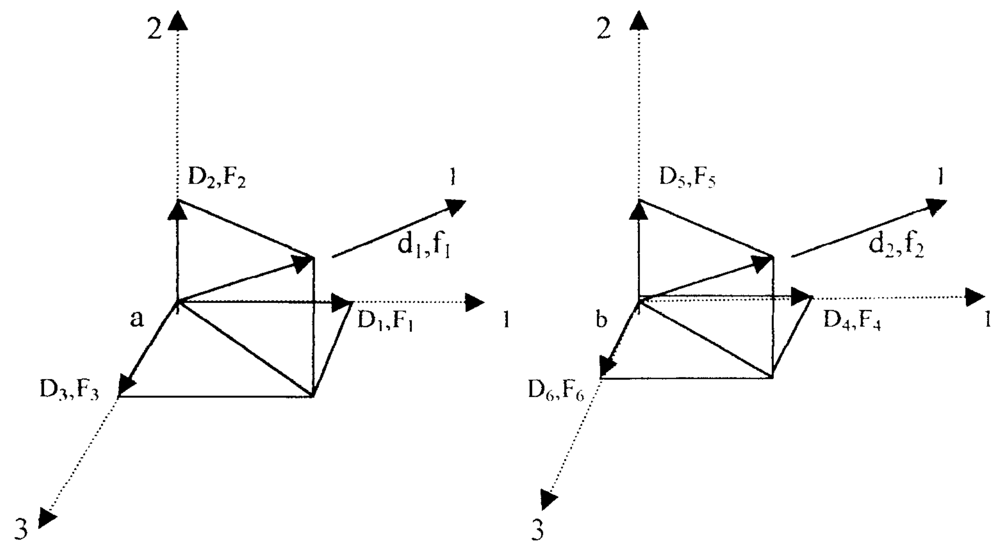
Matriks Transformasi

Persamaan dasar dari matriks transformasi adalah

f = k . d

$$\begin{Bmatrix} f_1 \\ f_2 \end{Bmatrix} = \gamma \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \begin{Bmatrix} d_1 \\ d_2 \end{Bmatrix} \quad , \quad \gamma = \frac{AE}{l}$$





(c) (d)

Gambar 3.4 Elemen Rangka Ruang (a) Kondisi lokal ; (b) Kondisi global ; (c) ujung a ; (d) ujung b

Deformasi d_1 disini mempunyai komponen-komponen D_1 , D_2 , D_3 pada koordinat global seperti pada gambar 3.4.

$$d_1 = D_1 \cos\theta_X + D_2 \cos\theta_Y + D_3 \cos\theta_Z \tag{3.9a}$$

$$d_2 = D_4 \cos\theta_X + D_5 \cos\theta_Y + D_6 \cos\theta_Z \tag{3.9b}$$

$$d_1 = \begin{bmatrix} \cos\theta_X & \cos\theta_Y & \cos\theta_Z \end{bmatrix} \begin{Bmatrix} D_1 \\ D_2 \\ D_3 \end{Bmatrix} \tag{3.10a}$$

$$d_2 = [\cos\theta_X \quad \cos\theta_Y \quad \cos\theta_Z]\begin{Bmatrix} D_4 \\ D_5 \\ D_6 \end{Bmatrix} \tag{3.10b}$$

jika dipakai :

$d_1 = d_a$ = deformasi lokal ujung a

$d_2 = d_b$ = deformasi lokal ujung b

$$\begin{Bmatrix} D_1 \\ D_2 \\ D_3 \end{Bmatrix} = D_a = deformasi\ global\ ujung\ a$$

$$\begin{Bmatrix} D_4 \\ D_5 \\ D_6 \end{Bmatrix} = D_b = deformasi\ global\ ujung\ b$$

dimana θ_X , θ_Y , dan θ_Z adalah sudut-sudut antara sumbu batang x, dan X ,Y dan Z adalah sebagai sumbunya. Cosinus dari sudut-sudut tersebut adalah cosinus arah dari sumbu x dengan pengaruh dari koordinat sumbu global. Dengan

$$c_1 = \cos\theta_X \qquad c_2 = \cos\theta_Y \qquad c_3 = \cos\theta_Z \tag{3.11a,b,c}$$

maka :

$$d_a = [c_1 \quad c_2 \quad c_3] D_a$$
$$d_b = [c_1 \quad c_2 \quad c_3] D_b$$

jika diambil $\lambda = [c_1 \quad c_2 \quad c_3]$

$$\begin{Bmatrix} d_a \\ d_b \end{Bmatrix} = \begin{bmatrix} \lambda & 0 \\ 0 & \lambda \end{bmatrix} \begin{Bmatrix} D_a \\ D_b \end{Bmatrix}$$

$\lambda = matriks\ transformasi$

$$\begin{Bmatrix} d_1 \\ d_2 \end{Bmatrix} = \begin{bmatrix} c_1 & c_2 & c_3 & 0 & 0 & 0 \\ 0 & 0 & 0 & c_1 & c_2 & c_3 \end{bmatrix} \begin{Bmatrix} D_1 \\ D_2 \\ D_3 \\ D_4 \\ D_5 \\ D_6 \end{Bmatrix}$$

$$\{d\} = [\Lambda]\{D\}$$

$$Ana\log : \begin{Bmatrix} f_a \\ f_b \end{Bmatrix} = \begin{bmatrix} \lambda & 0 \\ 0 & \lambda \end{bmatrix} \begin{Bmatrix} F_a \\ F_b \end{Bmatrix}$$

$$\{f\} = [\Lambda]\{F\}$$

$$\{d_a\} = [\lambda]\{D_a\} \rightarrow \{D_a\} = [\lambda]^T \{d_a\}$$

$$\{d_b\} = [\lambda]\{D_b\} \rightarrow \{D_b\} = [\lambda]^T \{d_b\}$$

$$\{D\} = [\Lambda]^T \{d\} \quad dan \quad \{F\} = [\Lambda]^T \{f\}$$

$$\{F\} = [\Lambda]^T \{f\}$$

$$\rangle \quad \{F\} = [\Lambda]^T [k]\{d\}$$

$$\{f\} = [\Lambda]^T \{d\}$$

$$\{F\} = [\Lambda]^T [k]\{d\}$$

$$\rangle \quad \{F\} = [\Lambda]^T [k][\Lambda]\{D\}$$

$$\{d\} = [\Lambda]\{D\}$$

$$\{F\} = [\Lambda]^T [k][\Lambda]\{D\}$$

$$\rangle \quad [K] = [\Lambda]^T [k][\Lambda]$$

$$\{F\} = [K]\{D\}$$

$$[K] = \begin{bmatrix} \lambda^T & 0 \\ 0 & \lambda^T \end{bmatrix} \begin{bmatrix} k_{aa} & k_{ab} \\ k_{ba} & k_{bb} \end{bmatrix} \begin{bmatrix} \lambda & 0 \\ 0 & \lambda \end{bmatrix}$$

$K_{aa} = \lambda^T k_{aa} \lambda$

$K_{aa} = \lambda^T k_{aa} \lambda$

$K_{ab} = \lambda^T k_{ab} \lambda$

$K_{ba} = \lambda^T k_{ba} \lambda$

$K_{bb} = \lambda^T k_{bb} \lambda$

$$[K_{aa}] = \begin{Bmatrix} c_1 \\ c_2 \\ c_3 \end{Bmatrix} \gamma [1] [c_1 \quad c_2 \quad c_3] = \gamma \begin{bmatrix} c_1^2 & c_1 c_2 & c_1 c_3 \\ c_1 c_2 & c_2^2 & c_2 c_3 \\ c_1 c_3 & c_2 c_3 & c_3^2 \end{bmatrix}$$

dengan cara yang sama dapat dihitung : K_{ab} , K_{ba} dan K_{bb} sehingga diperoleh :

$$[K] = \frac{EA}{l} \begin{bmatrix} c_1^2 & c_1 c_2 & c_1 c_3 & -c_1^2 & -c_1 c_2 & -c_1 c_3 \\ c_1 c_2 & c_2^2 & c_2 c_3 & -c_1 c_2 & -c_2^2 & -c_2 c_3 \\ c_1 c_3 & c_2 c_3 & c_3^2 & -c_1 c_3 & -c_2 c_3 & -c_3^2 \\ -c_1^2 & -c_1 c_2 & -c_1 c_3 & c_1^2 & c_1 c_2 & c_1 c_3 \\ -c_1 c_2 & -c_2^2 & -c_2 c_3 & c_1 c_2 & c_2^2 & c_2 c_3 \\ -c_1 c_3 & -c_2 c_3 & -c_3^2 & c_1 c_3 & c_2 c_3 & c_3^2 \end{bmatrix} \quad (3.12)$$

Cosinus Arah

Cosinus arah, adalah cosinus dari sudut-sudut pada sumbu batang dengan koordinat sumbu global.Joint-joint a dan b dari batang a b (gambar 3.3) mempunyai koordinat (X_a, Y_a, Z_a) dan (X_b, Y_b, Z_b) pada sistem koordinat global X ,Y, Z. Panjang batang a b adalah

$$l = \sqrt{(X_b - X_a)^2 + (Y_b - Y_a)^2 + (Z_b - Z_a)^2} \quad (3.13)$$

dan cosinus arahnya adalah

$$c_1 = \frac{X_b - X_a}{l} \qquad c_2 = \frac{Y_b - Y_a}{l} \qquad c_3 = \frac{Z_b - Z_a}{l} \quad (3.14a,b,c)$$

Proses Penyelesaian

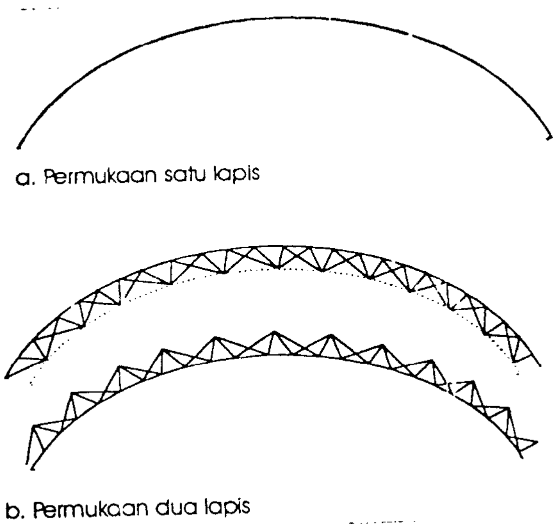
Langkah-langkah dari proses penyelesaian dapat kita lihat berikut ini :

1. Nomor elemen, joint dan derajat kebebasan pada koordinat global.
2. Perhitungan matriks kekakuan global untuk semua elemen dan menunjukkan hubungan derajat kebebasan pada setiap tempat.
3. Memasang matriks kekakuan global dalam matriks kekakuan struktur.
4. Membuat vektor beban.
5. Memecahkan persamaan keseimbangan untuk mendapatkan displasmen joint.

3.2. Struktur Ruang Kubah

Struktur ruang adalah rangka tiga dimensi yang terdiri dari batang-batang yang berhubungan satu sama lain secara kaku sehingga menjadi stabil dan dapat menahan gaya-gaya yang bekerja dari segala arah (Gillespie , 1961)

Struktur ruang kubah satu lapis adalah struktur ruang dimana joint-jointnya terletak pada bidang kubah. Struktur ruang kubah dua lapis adalah struktur ruang dimana jointnya terdapat pada dua bidang sepusat. Kubah ini dipakai untuk menutup permukaan yang luas.(lihat gambar 3.5)



Gambar 3.5 (a) Kubah permukaan satu lapis, (b) Kubah permukaan dua lapis

3.3 Jenis-jenis Kubah

Kubah diklasifikasikan berdasarkan cara perakitan batang-batangnya. Banyak pola perakitan yang digunakan , tetapi secara garis besar dibagi atas (dapat dilihat pada gambar 3.6)

1. Kubah Schwedler

Kubah terdiri dari batang-batang meridian yang bertemu pada puncak kubah dan ring paralel yang terletak secara horisontal dan memiliki pembagian panjang yang sama. Batang-batang tersebut dijepit oleh batang diagonal. Kubah ini juga dibuat dengan joint yang kaku

2. Kubah Lamella

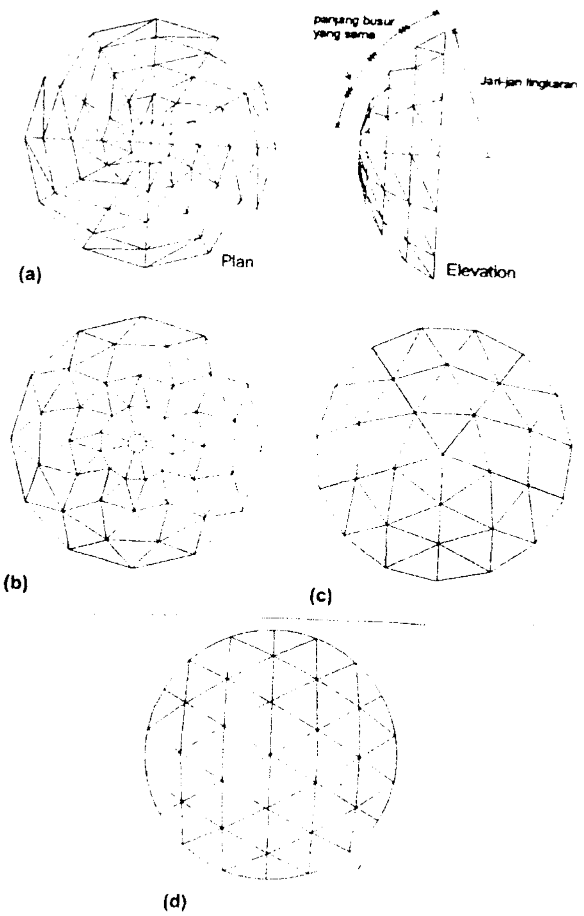
Bagian utama dari kubah ini adalah batang-batang yang membentuk lingkaran paralel yang memiliki panjang yang sama. Lingkaran tersebut kemudian dihubungkan dengan berbagai macam pola penyambungan. Kubah Houston di Amerika Serikat adalah kubah jenis Lamella dengan diameter 200m. Penyebaran tegangan pada kubah tipe ini sangat seragam , apapun macam bebannya , beban titik atau beban terbagi merata. Tambahan pula Lamella ini dibebani secara langsung yang sangat mengurangi pemakaian bahan. Perakitan kubah Lamella sangat cepat dan membutuhkan perancah sedikit saja. Harga perakitannya tidak mahal merupakan keuntungan yang besar lainnya dari kubah Lamella.

3. Kubah Grid

Kubah ini dibentuk oleh busur yang bersilangan dua atau tiga arah. Busur ini biasanya bagian dari suatu lingkaran yang besar.

4. Kubah Geodesik

Sistem konstruksi kubah ini dikembangkan dan dipatenkan oleh Buckminster Fuller. Kubah ini berdasarkan pada isokahedron dengan 20 bidang yang merupakan suatu segitiga sama sisi lengkung. Segitiga-segitiga ini selanjutnya ditutup dengan suatu busur. Kubah ini terbentuk dari bagian-bagian busur tersebut.



Gambar 3.6 (a) Kubah Schwedler (b) Kubah Lamella (c) Kubah Lamella tipe jaring (d) Kubah Geodesik

3.4 Beban-beban yang Bekerja

a. Beban mati , yaitu berat semua bagian dari suatu gedung yang bersifat tetap termasuk segala unsur tambahan , serta peralatan tetap yang merupakan bagian yang tak terpisahkan dari bangunan itu. Beban mati terdiri dari berat penutup , berat struktur , dan berat alat sambung.

b. Beban hidup , adalah semua beban yang terjadi akibat penggunaan atap tersebut.

c. Beban angin , adalah semua beban yang bekerja pada gedung atau bagian gedung yang disebabkan oleh selisih dalam tekanan udara.

Beban gempa dalam disain struktur ruang ini tidak diperhitungkan , karena tugas akhir ini hanya mendisain atap yang merupakan bagian dari suatu bangunan. Sedangkan beban gempa diperhitungkan pada perencanaan balok dan kolom bangunan. Selain itu karena *fiber glass* yang digunakan sebagai penutup atap memiliki berat yang sangat ringan sehingga berat struktur keseluruhan menjadi ringan dan memperkecil pengaruh beban gempa.

3.5 Gambaran Program SAP 90

Program SAP 90 digunakan untuk mencari gaya-gaya batang dan momen yang terjadi. Pengolahan data untuk program analisis struktur pada dasarnya meliputi : (1) penggambaran struktur geometri , dan (2) mendefinisikan kondisi beban statis dan atau dinamik yang diperlukan untuk analisis. Penggambaran struktur geometri dilakukan dengan memasukkan data joint dan elemen struktur ke dalam input data. Data joint meliputi koordinat joint dengan sistem sumbu x , y dan z, perletakan struktur dan berat joint. Sedangkan data elemen meliputi penomoran elemen , jenis material dan beban elemen. Beban struktur diberikan dalam bentuk beban statis dan atau dinamik ke dalam *Loads Data* dan *Response Spectrum Data* serta *Time History Data.*

Untuk memproses data digunakan file SAP 90 , untuk melihat gambar geometri digunakan file SAPLOT dan gaya-gaya batang beserta momen dapat dilihat melalui file F3F.

3.6 Perhitungan kekuatan batang

Perhitungan kekuatan batang pada perencanaan ini menggunakan ketentuan dari AISC. Gaya-gaya yang diperhitungkan adalah gaya-gaya batang yang diperoleh dari perhitungan program komputer. Gaya batang yang dihasilkan dari program komputer adalah gaya tarik dan desak aksial. Rumus tegangan langsung adalah dasar untuk analisis (dan desain) elemen struktur tarik. Rumus tersebut dapat ditulis :

$$f_t = \frac{P}{A} \qquad (3.15)$$

untuk tegangan, atau kapasitas tarik :

$$P_t = F_t A \qquad (3.16)$$

dimana : f_t = tegangan tarik yang dihitung

P = gaya aksial yang dialami

P_t = kapasitas gaya tarik aksial (atau gaya tarik aksial ijin maksimum)

F_t = tegangan tarik aksial ijin

A = luas penampang melintang elemen struktur yang dibebani aksial

Jadi tegangan ijin yang digunakan untuk batang tarik aksialnya adalah sesuai dengan AISC

$$f_a < F_a \tag{3.17}$$

$$P_a = 0{,}60 F_y A_g \tag{3.18}$$

$$P_a = 0{,}50 F_u A_{ef} \tag{3.19}$$

dimana : fa = tegangan akibat beban aksial yang terjadi

Fa = tegangan ijin akibat gaya tarik aksial

Pa = kapasitas gaya akibat gaya tarik aksial

Ag = luasan total

Aef = luas efektif

Sedang untuk tegangan ijin pada batang desak aksial juga sama untuk $f_a < F_a$, persamaannya adalah sebagai berikut :

$$C_c = \sqrt{\frac{2\pi^2 E}{F_y}} = \frac{755}{\sqrt{F_y}}$$

dikontrol dengan rumus sebagai berikut untuk tekuk kolomnya yang dalam desain ini bentuk K adalah sendi-sendi sehingga K=1

bila $\frac{K l}{r} \leq C_c$, *maka*

$$F_a = \frac{F_y}{FS}\left[1 - \frac{\left(\frac{K l}{r}\right)^2}{2C_c^2}\right] \tag{3.20}$$

= tegangan ijin desak aksial pada luas brutto pada konsidi beban kerja

FS = faktor keamanan

$$FS = \frac{5}{3} + \frac{3}{8}\frac{\left(\frac{Kl}{r}\right)}{C_c} - \frac{1}{8}\frac{\left(\frac{Kl}{r}\right)^3}{C_c^3}$$

bila $\frac{Kl}{r} > C_c$, *maka*

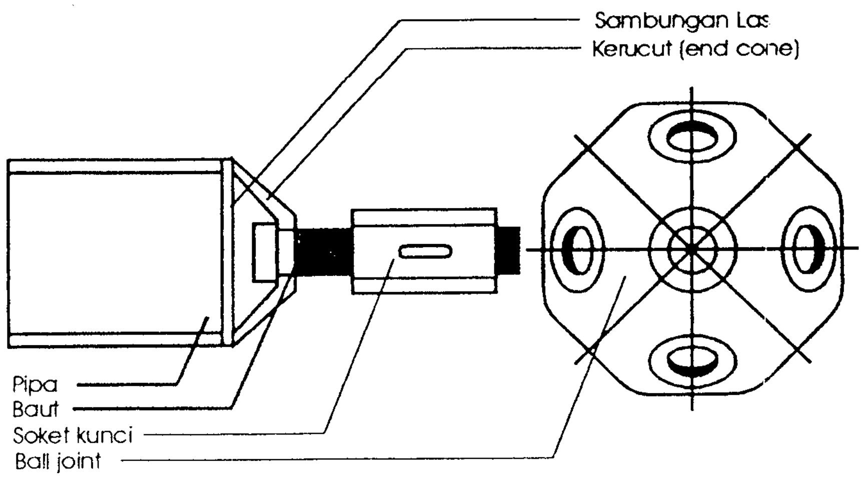
$$F_a = \frac{\pi^2 E}{\left(\frac{23}{12}\right)\left(\frac{Kl}{r}\right)^2} \qquad (3.21)$$

Untuk persamaan diatas berlaku untuk semua kondisi pembebanan baik beban tetap maupun beban sementara.

3.7 Sistem Penyambungan

Sistem penyambungan yang umum digunakan pada struktur ruang adalah sambungan sistem Mero. Sambungan ini terdiri sebuah bola baja berulir dimana ujung batang rangka disekrup kedalam bola baja tersebut dengan sebuah konektor ujung yang khusus. Batangnya biasanya berupa pipa (circular hollow section). Sebuah titik simpul dapat menerima ujung dari 18 batang tanpa kesukaran.

Sistem Mero sangat luwes dan mengetengahkan prefabrikasi secara maksimum. Pemasangan batang dapat dilaksanakan oleh pekerja bukan ahli tanpa kesukaran apapun , di bawah pengawasan seorang teknisi , sehingga menghemat waktu dan biaya.



Gambar 3.7 Sistem Sambungan Mero (Ball Joint)

Sebagai alat sambung dari sistem Mero ini adalah bola-bola baja. Untuk menghubungkan batang-batang dengan bola baja tersebut , dipakai baut yang mana baut ini menyatu pada kedua ujung tiap batang. Dalam hal ini baut menderita gaya aksial , sehingga dalam perencanaan ukuran baut diperlukan rumus-rumus yang berbeda jika baut direncanakan menderita gaya geser.

Kekuatan baut dan mur terletak pada ulirannya. Dengan demikian tinggi mur dapat dicari dari jumlah uliran yang mampu menahan gaya aksial yang terjadi. Tinggi mur inilah yang merupakan tebal dari bola baja. Tinggi baut = (0,8-1) D.

Tegangan izin untuk batang berulir diambil sebesar $0{,}33F_u$ dan ini berlaku untuk luas nominal tak berulir batang tersebut (luas dihitung dari diameter D). Batang bulat tersedia untuk berbagai jenis baja yang umum digunakan dalam konstruksi. Untuk memperoleh data mengenai ulir didapat dari data alat penyambung berulir pada AISC. Dalam memilih batang berulir perlu diingat bahwa tidak ada rekomondasi angka kelangsingan dari AISC. Ada pedoman sederhana yang dapat digunakan yaitu diameter batang tidak dapat lebih kecil daripada 1/500 dari panjang batang. Diameter minimum batang itu dibatasi pada 3/8 in, karena batang tarik dengan diameter lebih kecil akan mudah rusak pada saat pelaksanaan. Selain itu, beban desain minimum untuk alat penyambung berulir (dan juga untuk batang berulir) adalah 6 kips menurut AISC, Bab 1.15.1.Luas badan nominal tak berulir yang diperlukan (A_D bruto) adalah :

$$A_{perlu} = \frac{P}{0{,}33\,F_u} \tag{3.22}$$

Untuk mencari kekuatan las dapat dicari dengan tegangan-tegangan yang diijinkan untuk geser pada luas efektif semua las adalah sama dengan 0,30 kali kekuatan tarik elektroda. Namun tegangan logam dasar yang berdekatan tidak boleh melampaui 0,60F_y atau 0,40F_y untuk geser.

Kapasitas las = kapasitas las dari tabel AISC x panjang total las.

$$F_t = 0{,}30F_u \tag{3.23}$$

Kekuatan tarik (dengan menggunakan $F_t = 0{,}30F_u$) adalah

$$P_t = A_{perlu}\,F_t \tag{3.24}$$

BAB IV

ANALISIS DAN PERHITUNGAN BEBAN

4.1. Data Struktur dan Pembebanan

a. Penutup yang digunakan diasumsikan dengan menggunakan lapisan *fiberglass* dengan tebal 1 cm dengan berat jenis 1,8 t/m^3.

b. Sebagai asumsi awal dimensi batang digunakan pipa diameter 1,5 inci dengan tebal 0,145 inci.

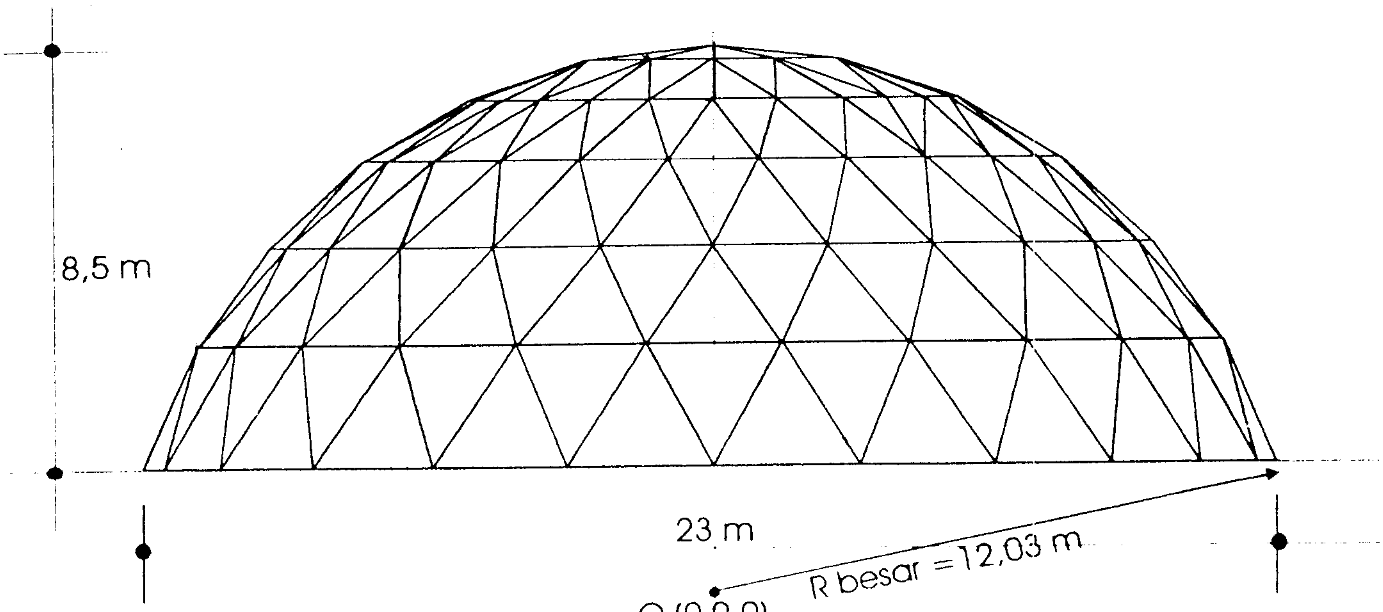
c. Berat alat sambung (*ball joint*) diasumsikan 4 kg dengan diameter 4 inci dan berat jenis besi = 450 lbs/ft^3 (7208,3026 kg/m^3).

d. Beban hidup diasumsikan sebagai berat dari alat penerangan yang menggantung pada puncak rangka dengan berat 300 kg.

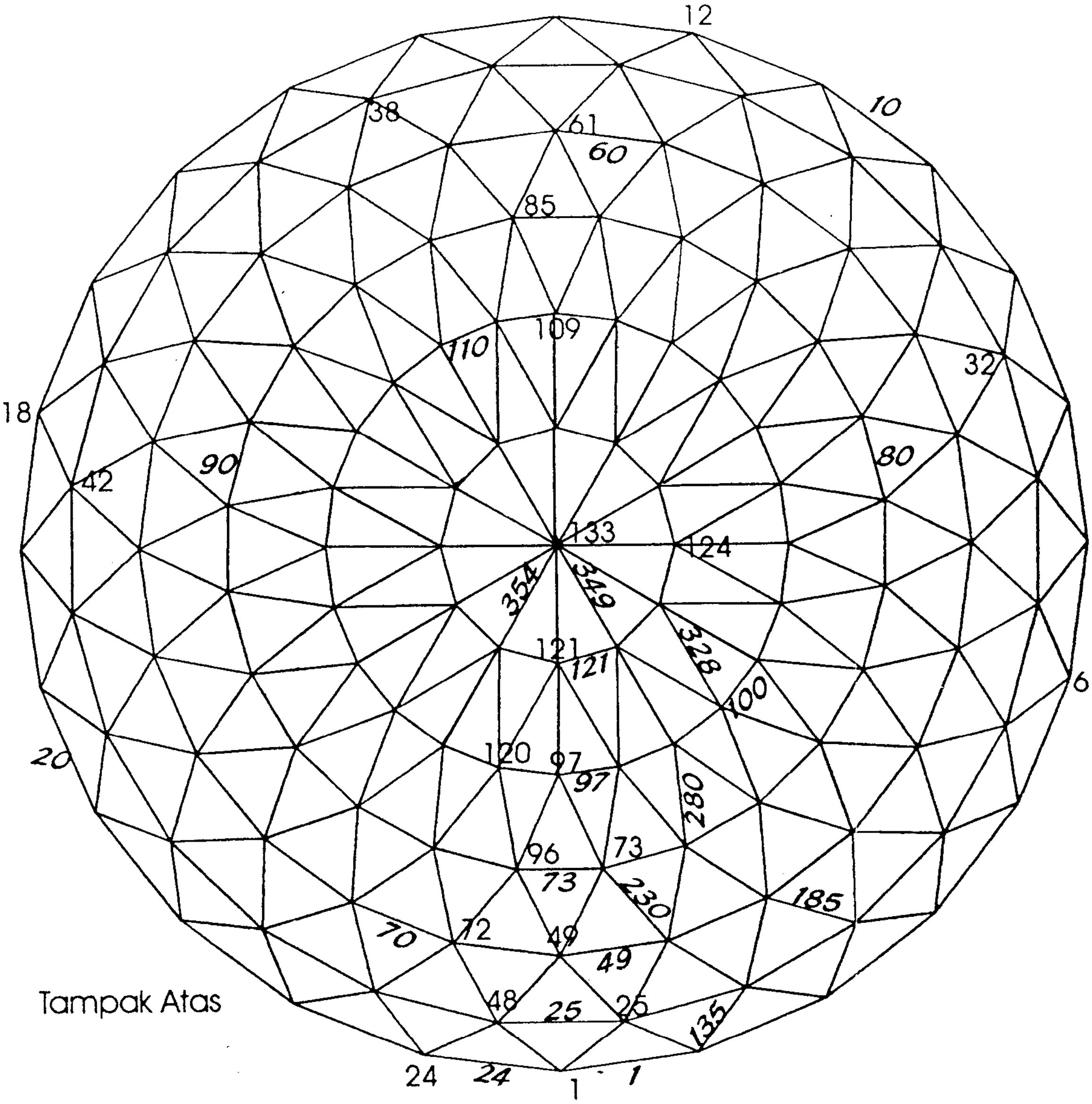
e. Beban angin diasumsikan diperoleh dari angin yang bekerja dengan tekanan maksimum 30 kg/m^2.

4.2. Koordinat Joint-joint

Titik O (0,0,0) terletak pada pusat bola. Seluruh koordinat joint dihitung dari titik O. Perhitungan koordinat-koordinat jointnya dihitung dengan persamaan matematika sebagai berikut :

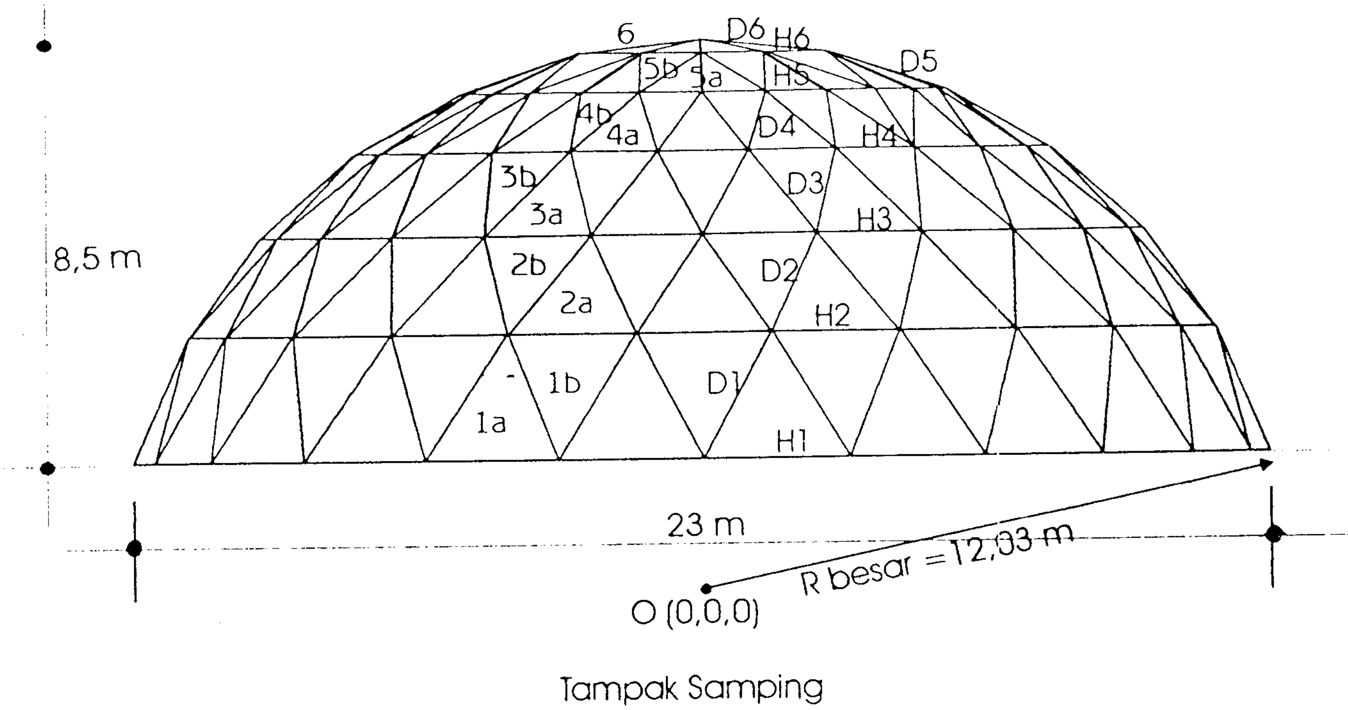


Tampak Samping



Tampak Atas

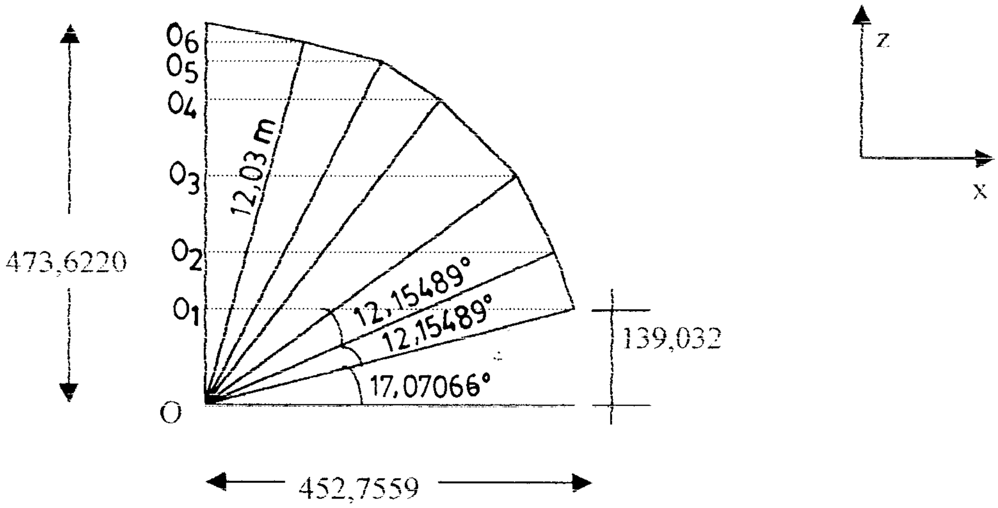
Skala : 1 : 150



Gambar 4.1 : Layout Struktur Kubah

Titik n ⟶ koordinat (Xn , Yn , Zn)

Tampak Samping



n = 1 s/d n = 24 $Z_n = \sqrt{473{,}6220^2 - 452{,}7559^2} = 139{,}032$ inci

n = 25 s/d n = 48 $Z_n = 473{,}6220 .\sin(17{,}07066 + 12{,}15489) = 231{,}2453$ inci

n = 49 s/d n = 72 $Z_n = 473{,}6220 .\sin(17{,}07066 + 2.12{,}15489) = 313{,}0906$ inci

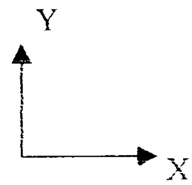
n = 73 s/d n = 96 $Z_n = 473{,}6220 .\sin(17{,}07066 + 3.12{,}15489) = 380{,}8980$ inci

n = 97 s/d n = 120 $Z_n = 473{,}6220 .\sin(17{,}07066 + 4.12{,}15489) = 431{,}6276$ inci

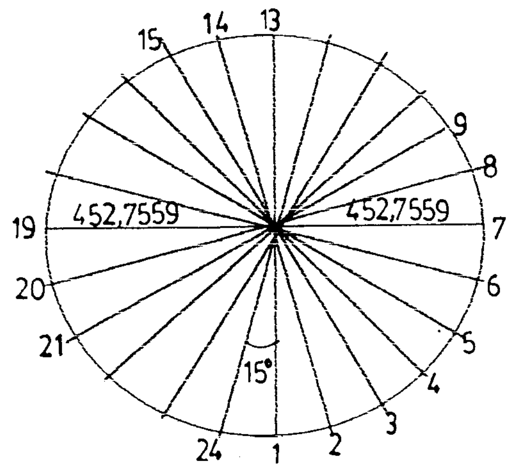
n = 121 s/d n = 132 $Z_n = 473{,}6220 .\sin(17{,}07066 + 5.12{,}15489) = 463{,}0043$ inci

n = 133 $Z_n = 473{,}6220$ inci

1. Koordinat O_1 (0 ; 0 ; 139,032)



Tampak Atas



$$\frac{360}{24} = 15°$$

Untuk n =1 s/d n =24 $\qquad Z_n = \sqrt{473,6220^2 - 452,7559^2} = 139,032$ inci

n = 1 s/d n = 7

$$X_n = 452,7559 \sin\{(n-1).15°\} \quad \rightarrow 15°,30°,45°,60°,75°,90°$$
$$Y_n = -452,7559 \cos\{(n-1).15°\}$$

n = 8 s/d n = 13

$$X_n = 452,7559 \cos\{(n-7).15°\} \quad \rightarrow 15°,30°,45°,60°,75°,90°$$
$$Y_n = 452,7559 \sin\{(n-7).15°\}$$

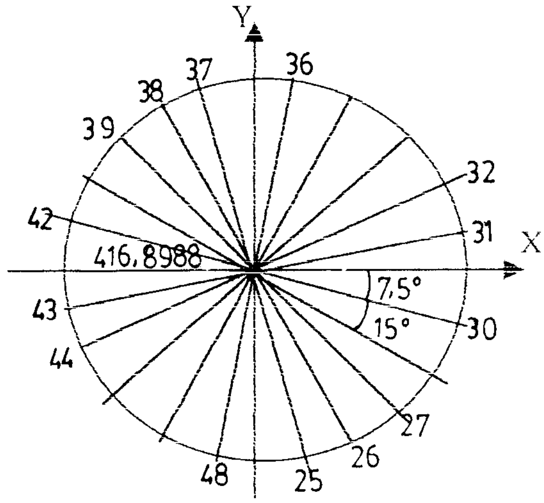
n = 14 s/d n = 19

$$X_n = -452,7559 \sin\{(n-13).15°\} \quad \rightarrow 15°,30°,45°,60°,75°,90°$$
$$Y_n = 452,7559 \cos\{(n-13).15°\}$$

n = 20 s/d n = 24

$$X_n = -452,7559 \sin\{(n-19).15°\} \quad \rightarrow 15°,30°,45°,60°,75°,90°$$
$$Y_n = -452,7559 \cos\{(n-19).15°\}$$

2. Koordinat O_2 (0 ; 0 ; 231,2453)



Lihat dari gambar tampak samping didapat :

473,6220 . cos (17,07066° + 12,15489°) = 413,3319 inci

dari gambar diatas didapat : $\dfrac{413{,}3319}{\cos 7{,}5^\circ} = 416{,}8988\ inci$

n = 25 s/d n = 48 $\quad Z_n$ = 473,6220 .sin (17,07066 + 12,15489) =231,2453 inci

n = 25 s/d n = 30

$$X_n = 416{,}8988 \sin\{7{,}5^\circ + (n-25).15^\circ\} \rightarrow 7{,}5^\circ;22{,}5^\circ;37{,}5^\circ;52{,}5^\circ;67{,}5^\circ;82{,}5^\circ$$
$$Y_n = -416{,}8988 \cos\{7{,}5^\circ + (n-25).15^\circ\}$$

n = 31 s/d n = 36

$$X_n = 416{,}8988 \cos\{7{,}5^\circ + (n-25).15^\circ\} \rightarrow 7{,}5^\circ;22{,}5^\circ;37{,}5^\circ;52{,}5^\circ;67{,}5^\circ;82{,}5^\circ$$
$$Y_n = 416{,}8988 \sin\{7{,}5^\circ + (n-25).15^\circ\}$$

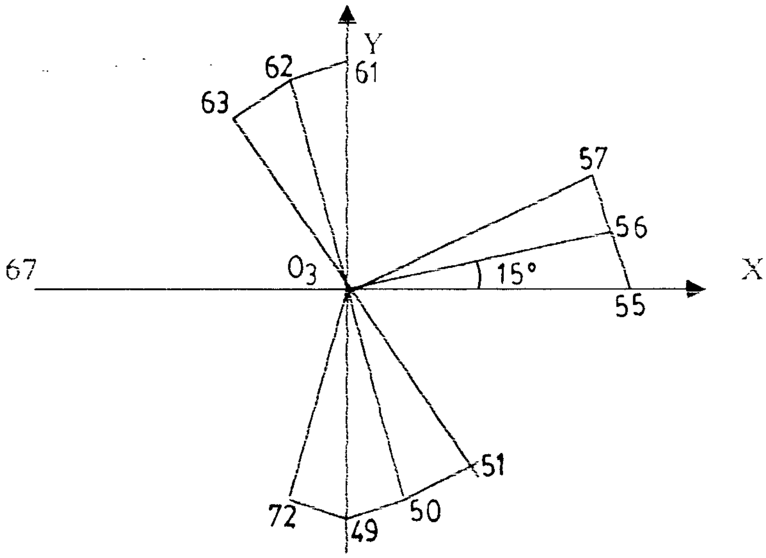
n = 37 s/d n = 42

$$X_n = -416{,}8988 \sin\{7{,}5^\circ + (n-25).15^\circ\} \rightarrow 7{,}5^\circ;22{,}5^\circ;37{,}5^\circ;52{,}5^\circ;67{,}5^\circ;82{,}5^\circ$$
$$Y_n = 416{,}8988 \cos\{7{,}5^\circ + (n-25).15^\circ\}$$

n = 43 s/d n = 48

$$X_n = -416{,}8988\cos\{7{,}5° + (n-25).15°\} \rightarrow 7{,}5°;22{,}5°;37{,}5°;52{,}5°;67{,}5°;82{,}5°$$
$$Y_n = -416{,}8988\sin\{7{,}5° + (n-25).15°\}$$

3. Koordinat O_3 (0 ; 0 ; 313,0906)



dari gambar tampak samping didapat :

472,6220 cos (17,07066° + 2.12,15489°) = 355,3760

n = 49 s/d n = 72 $\quad Z_n$ = 473,6220 .sin (17,07066 + 2.12,15489) =313,0906 inci

n = 49 s/d n = 55

$$X_n = 355{,}3760\sin\{(n-49).15°\} \rightarrow 15°,30°,45°,60°,75°,90°$$
$$Y_n = -355{,}3760\cos\{(n-49).15°\}$$

n = 56 s/d n =61

$$X_n = 355{,}3760\cos\{(n-55).15°\} \rightarrow 15°,30°,45°,60°,75°,90°$$
$$Y_n = 355{,}3760\sin\{(n-55).15°\}$$

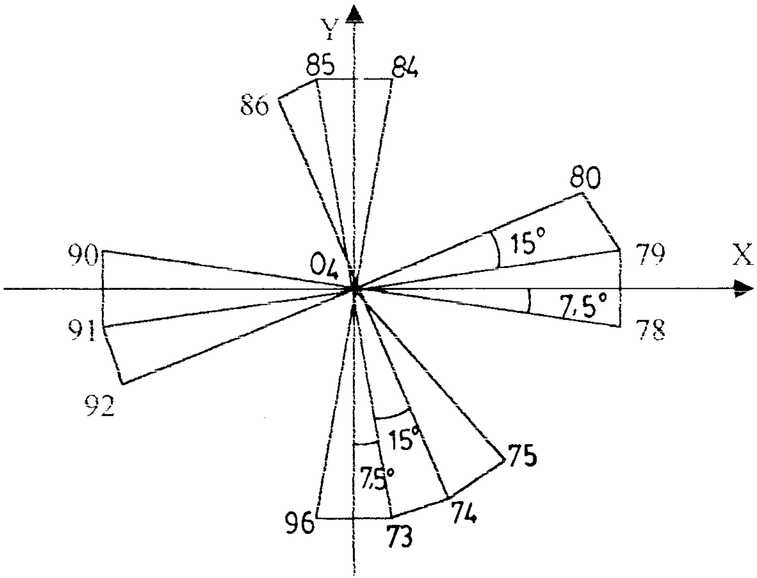
n = 62 s/d n =67

$$X_n = -355{,}3760\sin\{(n-61).15°\} \rightarrow 15°,30°,45°,60°,75°,90°$$
$$Y_n = 355{,}3760\cos\{(n-61).15°\}$$

n = 68 s/d n = 72

$$X_n = -355{,}3760\cos\{(n-67).15°\} \quad \rightarrow 15°,30°,45°,60°,75°,90°$$
$$Y_n = -355{,}3760\sin\{(n-67).15°\}$$

4. Koordinat O_4 (0 ; 0 ; 380,8980)



dari gambar tampak samping didapat :

473,6220 cos (17,07066° + 3.12,15489°) = 281,4862 inci

dari gambar diatas didapat : $\dfrac{281{,}4862}{\cos 7{,}5°} = 283{,}9154\ inci$

n = 73 s/d n = 96 Z_n = 473,6220 .sin (17,07066 + 3.12,15489) =380,8980 inci

n = 73 s/d n = 78

$$X_n = 283{,}9154\sin\{7{,}5° + (n-73).15°\} \quad \rightarrow 7{,}5°,22{,}5°,37{,}5°,52{,}5°,67{,}5°,82{,}5°$$
$$Y_n = -283{,}9154\cos\{7{,}5° + (n-73).15°\}$$

n = 79 s/d n = 84

$$X_n = 283{,}9154\cos\{7{,}5° + (n-79).15°\} \quad \rightarrow 7{,}5°;22{,}5°;37{,}5°;52{,}5°;67{,}5°;82{,}5°$$
$$Y_n = 283{,}9154\sin\{7{,}5° + (n-79).15°\}$$

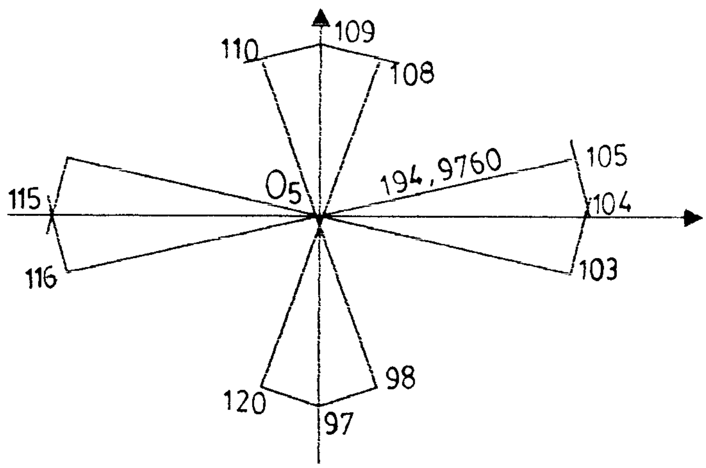
n = 85 s/d n = 90

$$X_n = -283{,}9154 \sin\{7{,}5° + (n-85).15°\} \quad \rightarrow 7{,}5°;22{,}5°;37{,}5°;52{,}5°;67{,}5°;82{,}5°$$
$$Y_n = 283{,}9154 \cos\{7{,}5° + (n-85).15°\}$$

n = 91 s/d n = 96

$$X_n = -283{,}9154 \cos\{7{,}5° + (n-91).15°\} \quad \rightarrow 7{,}5°;22{,}5°;37{,}5°;52{,}5°;67{,}5°;82{,}5°$$
$$Y_n = -283{,}9154 \sin\{7{,}5° + (n-91).15°\}$$

5. Koordinat O_5 (0 ; 0 ; 431,6276)



Dari gambar tampak samping didapat :

473,6220 cos (17,07066° + 4.12,15489°) = 194,9760 inci

n = 97 s/d n = 120 Z_n = 473,6220 .sin (17,07066 + 4.12,15489) =431,6276 inci

n = 97 s/d n = 103

$$X_n = 194{,}9760 \sin\{(n-97).15°\} \quad \rightarrow 15°,30°,45°,60°,75°,90°$$
$$Y_n = -194{,}9760 \cos\{(n-97).15°\}$$

n = 104 s/d n = 109

$$X_n = 194{,}9760 \cos\{(n-103).15°\} \quad \rightarrow 15°,30°,45°,60°,75°,90°$$
$$Y_n = 194{,}9760 \sin\{(n-103).15°\}$$

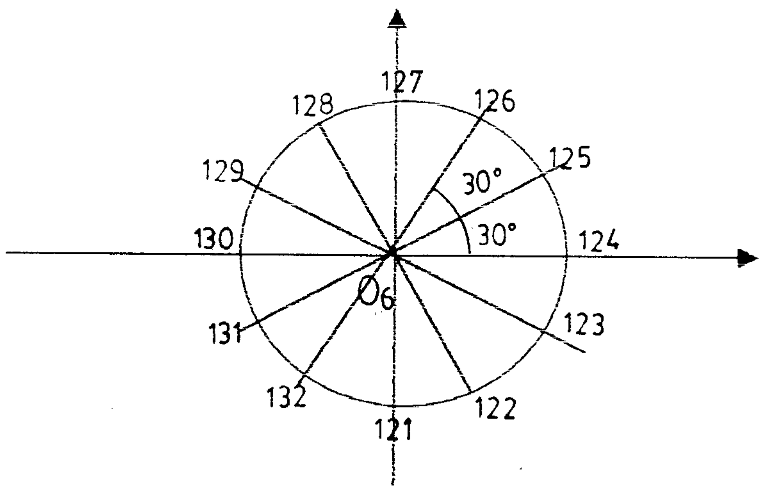
n = 110 s/d n = 115

$$X_n = -194{,}9760 \sin\{(n-109).15°\} \quad \rightarrow 15°,30°,45°,60°,75°,90°$$
$$Y_n = 194{,}9760 \cos\{(n-109).15°\}$$

n = 116 s/d n = 120

$$X_n = -194{,}9760 \cos\{(n-115).15°\} \quad \rightarrow 15°,30°,45°,60°,75°,90°$$
$$Y_n = -194{,}9760 \sin\{(n-115).15°\}$$

6. Koordinat O_6 (0 ; 0 ; 463,0043)



Dari gambar tampak samping didapat :

473,6220 cos (17,07066° + 5.12,15489°) = 99,7236 inci

n = 121 s/d n = 132 Z_n = 473,6220 .sin (17,07066 + 5.12,15489) =463,0043 inci

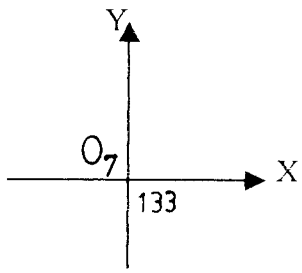
n = 121 s/d n = 124
$$X_n = 99{,}7236 \sin\{(n-121).30°\} \quad \rightarrow 30°,60°,90°$$
$$Y_n = -99{,}7236 \cos\{(n-121).30°\}$$

n = 125 s/d n = 127
$$X_n = 99{,}7236 \cos\{(n-124).30°\} \quad \rightarrow 30°,60°,90°$$
$$Y_n = 99{,}7236 \sin\{(n-124).30°\}$$

n = 128 s/d n = 130
$$X_n = -99{,}7236 \sin\{(n-127).30°\} \quad \rightarrow 30°,60°,90°$$
$$Y_n = 99{,}7236 \cos\{(n-127).30°\}$$

n = 131 s/d n = 132

$$X_n = -99{,}7236\cos\{(n-130).30°\} \rightarrow 30°, 60°$$
$$Y_n = -99{,}7236\sin\{(n-130).30°\}$$



n =133

Z_n

$X_n = 0$

$Y_n = 0$

Persamaan-persamaan diatas digunakan untuk menghitung koordinat-koordinat joint pada gambar 4.1 dan setelah mendapatkan hasilnya, dapat dilihat pada tabel 4.1.

Tabel 4.1 : Koordinat joint (Sumbu Global)

Joint	X (in)	Y (in)	Z (in)
1	2	3	4
1	0,0000	-452,7559	139,0323
2	117,1819	-437,3286	139,0323
3	226,3780	-392,0981	139,0323
4	320,1468	-320,1468	139,0323
5	392,0981	-226,3780	139,0323
6	437,3286	-117,1819	139,0323
7	452,7559	0,0000	139,0323
8	437,3286	117,1819	139,0323
9	392,0981	226,1468	139,0323
10	320,1468	320,3780	139,0323
11	226,3780	392,0981	139,0323
12	117,1819	437,3286	139,0323
13	0,0000	452,7559	139,0323
14	-117,1819	437,3286	139,0323
15	-226,3780	392,0981	139,0323
16	-320,1468	320,1468	139,0323
17	-392,0981	226,3780	139,0323
18	-437,3286	117,1819	139,0323
19	-452,7559	0,0000	139,0323
20	-437,3286	-117,1819	139,0323
21	-392,0981	-226,1468	139,0323
22	-320,1468	-320,3780	139,0323
23	-226,3780	-392,0981	139,0323
24	-117,1819	-437,3286	139,0323
25	54,4162	-413,3322	231,2453
26	159,5402	-385,1643	231,2453
27	253,7919	-330,7481	231,2453
28	330,7481	-253,7919	231,2453
29	385,1643	-159,5402	231,2453
30	413,3322	-54,4162	231,2453
31	413,3322	54,4162	231,2453
32	385,1643	159,5402	231,2453
33	330,7481	253,7919	231,2453
34	253,7919	330,7481	231,2453
35	159,5402	385,1643	231,2453
36	54,4162	413,3322	231,2453
37	-54,4162	413,3322	231,2453

1	2	3	4
38	-159,5402	385,1643	231,2453
39	-253,7919	330,7481	231,2453
40	-330,7481	253,7919	231,2453
41	-385,1643	159,5402	231,2453
42	-413,3322	54,4162	231,2453
43	-413,3322	-54,4162	231,2453
44	-385,1643	-159,5402	231,2453
45	-330,7481	-253,7919	231,2453
46	-253,7919	-330,7481	231,2453
47	-159,5402	-385,1643	231,2453
48	-54,4162	-413,3322	231,2453
49	0,0000	-355,3760	313,0906
50	91,9781	-343,2668	313,0906
51	177,6880	-307,7646	313,0906
52	251,2888	-251,2888	313,0906
53	307,7646	-177,6880	313,0906
54	343,2668	-91,9781	313,0906
55	355,3760	0,0000	313,0906
56	343,2668	91,9781	313,0906
57	307,7646	177,6880	313,0906
58	251,2888	251,2888	313,0906
59	177,6880	307,7646	313,0906
60	91,9781	343,2668	313,0906
61	0,0000	355,3760	313,0906
62	-91,9781	343,2668	313,0906
63	-177,6880	307,7646	313,0906
64	-251,2888	251,2888	313,0906
65	-307,7646	177,6880	313,0906
66	-343,2668	91,9781	313,0906
67	-355,3760	0,0000	313,0906
68	-343,2668	-91,9781	313,0906
69	-307,7646	-177,6880	313,0906
70	-251,2888	-251,2888	313,0906
71	-177,6880	-307,7646	313,0906
72	-91,9781	-343,2668	313,0906
73	37,0584	-281,4864	380,8980
74	108,6497	-262,3036	380,8980
75	172,8367	-225,2453	380,8980
76	225,2452	-172,8367	380,8980
77	262,3036	-108,6497	380,8980

1	2	3	4
78	281,4864	-37,0584	380,8980
79	281,4864	37,0584	380,8980
80	262,3036	108,6497	380,8980
81	225,2452	172,8367	380,8980
82	172,8367	225,2453	380,8980
83	108,6497	262,3036	380,8980
84	37,0584	281,4864	380,8980
85	-37,0584	281,4864	380,8980
86	-108,6497	262,3036	380,8980
87	-172,8367	225,2453	380,8980
88	-225,2452	172,8367	380,8980
89	-262,3036	108,6497	380,8980
90	-281,4864	37,0584	380,8980
91	-281,4864	-37,0584	380,8980
92	-262,3036	-108,6497	380,8980
93	-225,2452	-172,8367	380,8980
94	-172,8367	-225,2453	380,8980
95	-108,6497	-262,3036	380,8980
96	-37,0584	-281,4864	380,8980
97	0,0000	-194,9760	431,6276
98	50,4635	-188,3323	431,6276
99	97,4880	-168,8542	431,6276
100	137,8688	-137,8688	431,6276
101	168,8542	-97,4880	431,6276
102	188,3323	-50,4635	431,6276
103	194,9760	0,0000	431,6276
104	188,3323	50,4635	431,6276
105	168,8542	97,4880	431,6276
106	137,8688	137,8688	431,6276
107	97,4880	168,8542	431,6276
108	50,4635	188,3323	431,6276
109	0,0000	194,9760	431,6276
110	-50,4635	188,3323	431,6276
111	-97,4880	168,8542	431,6276
112	-137,8688	137,8688	431,6276
113	-168,8542	97,4880	431,6276
114	-188,3323	50,4635	431,6276
115	-194,9760	0,0000	431,6276
116	-188,3323	-50,4635	431,6276
117	-168,8542	-97,4880	431,6276

1	2	3	4
118	-137,8688	-137,8688	431,6276
119	-97,4880	-168,8542	431,6276
120	-50,4635	-188,3323	431,6276
121	0,0000	-99,7236	463,0043
122	49,8618	-86,3632	463,0043
123	86,3632	-49,8618	463,0043
124	99,7236	0,0000	463,0043
125	86,3632	49,8618	463,0043
126	49,8618	86,3632	463,0043
127	0,0000	99,7236	463,0043
128	-49,8618	86,3632	463,0043
129	-86,3632	49,8618	463,0043
130	-99,7236	0,0000	463,0043
131	-86,3632	-49,8618	463,0043
132	-49,8618	-86,3632	463,0043
133	0,0000	0,0000	473,6220

Luas bidang segitiga dihitung berdasarkan panjang batang-batang yang membentuknya. Panjang batang dapat dicari dengan cara sebagai berikut :

1. Untuk batang horisontal

$$P = \sqrt{(X_{n+1} - X_n)^2 + (Y_{n+1} - Y_n)^2 + (Z_{n+1} - Z_n)^2}$$

2. Untuk batang diagonal

$$P = \sqrt{(X_{24+n} - X_n)^2 + (Y_{24+n} - Y_n)^2 + (Z_{24+n} - Z_n)^2}$$

$$P = \sqrt{(X_{23+n} - X_n)^2 + (Y_{23+n} - Y_n)^2 + (Z_{23+n} - Z_n)^2}$$

Pada prinsipnya untuk semua panjang batang dihitung dengan persamaan kuadrat dibawah ini kemudian hasilnnya seperti pada tabel 4.2.

$$P = \sqrt{(Xj - Xi)^2 + (Yj - Yi)^2 + (Zj - Zi)^2}$$

dimana : i = koordinat joint awal

j = koordinat joint akhir

Tabel 4.2 : Panjang batang

Batang	Panjang (inci)
1 – 24	118,1931
25 – 48	108.8324
49 – 72	92,7718
73 – 96	74,1168
97 - 120	50,8990
121 – 132	51,6207
133 – 180	114,0990
181 – 228	114,0995
229 – 276	106,9151
277 – 324	106,9152
325 – 348	106,6891
349 – 354	100,2873
355 - 366	106.6891
367 - 372	100,2873

Luas bidang segitiga dicari dengan rumus segitiga = ½ . alas . tinggi. Untuk luas total sama dengan luas segitiga dikalikan dengan jumlah segitiga yang sebidang.

Tabel 4.3 : Luas bidang segitiga

Segitiga	Luas (inci^2)	Luas Total (inci^2)
1a	5767,9828	138431,5872
1b	5457,2320	130973,5680
2a	5457,2647	130974,3528
2b	4835,5028	116052,0672
3a	4468,2842	107238,8208
3b	3716.4832	89195.5968
4a	3716,4869	89195,6856
4b	2642,7295	63425,5080
5a	5273,6098	63283,3176
5b	2671,8874	32062,6488
6	5002,5156	30015,0936

4.3. Perhitungan Beban Mati

Beban-beban yang tergabung dalam beban mati adalah berat penutup , profil dan alat sambung.

1. Berat penutup

Berat penutup dihitung berdasarkan luas bidang-bidang segitiga yang menyusun kubah , sehingga setiap joint menerima sepertiga berat luasan segitiga tersebut. Luasan penutup yang lengkung dan terletak diatas rangka kubah ini diasumsikan sama dengan luas segitiga yang membentuk bidang kubah tersebut. Dengan berat jenis penutup yang berupa *fiber glass* adalah 1,8 t/m^3 yang dikalikan dengan luasan yang ditahan.

2. Berat profil

Berat profil termasuk berat sendiri sebesar 2,72 lb sesuai dengan AISC tabel 1.93.

3. Berat alat sambung

Berat alat sambung terdiri atas ball joint + eadcone + bolt = 8 kg bekerja pada tiap-tiap joint.

4. Berat total didapat dari berat akibat penutup + berat alat sambung.

Tabel 4.4 Perhitungan beban mati

Joint	**Luas yang ditahan (in^2)**	**Berat akibat penutup (lb)**	**Berat alat sambung (lb)**	**Berat Profil (lb)**	**Berat total beban mati (lb)**
1	**2**	**3**	**4**	**5**	**6**
1 – 24	5664,3992	5,5072E-03	0,1799	2,72	2,9054
25 – 48	10914,4099	0,0106	0,1799	2,72	2,9150
49 – 72	9467,6946	9,2049E-03	0,1799	2,72	2,9091

1	2	3	4	5	6
73 – 96	7576,2516	7,3660E-03	0,1799	2,72	2,9073
97	5116,4377	4,9744E-03	0,1799	2,72	2,9049
98	7764,9368	7,5494E-03	0,1799	2,72	2,9075
99	5116,4377	4,9744E-03	0,1799	2,72	2,9049
100	7764,9368	7,5494E-03	0,1799	2,72	2,9075
101	5116,4377	4,9744E-03	0,1799	2,72	2,9049
102	7764,9368	2,9049	0,1799	2,72	2,9075
103	5116,4377	2,9075	0,1799	2,72	2,9049
104	7764,9368	2,9049	0,1799	2,72	2,9075
105	5116,4377	2,9075	0,1799	2,72	2,9049
106	7764,9368	7,5494E-03	0,1799	2,72	2,9075
107	5116,4377	4,9744E-03	0,1799	2,72	2,9049
108	7764,9368	7,5494E-03	0,1799	2,72	2,9075
109	5116,4377	4,9744E-03	0,1799	2,72	2,9049
110	7764,9368	7,5494E-03	0,1799	2,72	2,9075
111	5116,4377	4,9744E-03	0,1799	2,72	2,9049
112	7764,9368	7,5494E-03	0,1799	2,72	2,9075
113	5116,4377	4,9744E-03	0,1799	2,72	2,9049
114	7764,9368	7,5494E-03	0,1799	2,72	2,9075
115	5116,4377	4,9744E-03	0,1799	2,72	2,9049
116	7764,9368	7,5494E-03	0,1799	2,72	2,9075
117	5116,4377	4,9744E-03	0,1799	2,72	2,9049
118	7764,9368	7,5494E-03	0,1799	2,72	2,9075
119	5116,4377	4,9744E-03	0,1799	2,72	2,9049
120	7764,9368	7,5494E-03	0,1799	2,72	2,9075
121	5206,6334	5,0621E-03	0,1799	2,72	2,9050
122	6874,1386	6,6833E-03	0,1799	2,72	2,9066
123	5206,6334	5,0621E-03	0,1799	2,72	2,9050
124	6874,1386	6,6833E-03	0,1799	2,72	2,9066
125	5206,6334	5,0621E-03	0,1799	2,72	2,9050
126	6874,1386	6,6833E-03	0,1799	2,72	2,9066
127	5206,6334	5,0621E-03	0,1799	2,72	2,9050
128	6874,1386	6,6833E-03	0,1799	2,72	2,9066
129	5206,6334	5,0621E-03	0,1799	2,72	2,9050
130	6874,1386	6,6833E-03	0,1799	2,72	2,9066
131	5206,6334	5,0621E-03	0,1799	2,72	2,9050
132	6874,1386	6,6833E-03	0,1799	2,72	2,9066
133	10005,0312	9,7273E-03	0,1799	2,72	2,9096
				Total	119,1648

4.4. Perhitungan Beban Hidup

Beban hidup yang bekerja terdiri dari beban berguna yang berupa berat alat penerangan seberat 300 kg (300 kg = 6,7446 lb) dan bekerja pada titik puncak.

4.5. Beban Angin

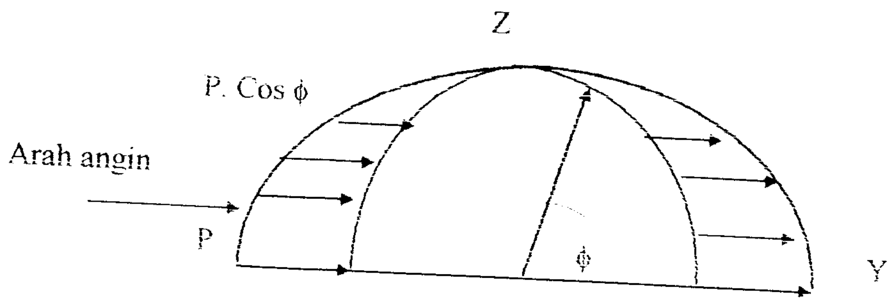
Struktur kubah didesain juga untuk menahan momen guling akibat gaya angin. Pada kenyataannya angin dapat terjadi dari arah mana saja. Gaya angin ini akan menghasilkan gaya angin tekan pada permukaan struktur yang terkena angin dan gaya angin isapan pada sisi sebaliknya. Gaya angin didistribusikan untuk setiap ketinggian struktur , selanjutnya didistribusikan lagi pada arah x , y dan z.

Berdasarkan Peraturan Pembebanan 1987 tekanan angin harus diambil minimum 25 kg/m^2 maka pada struktur kubah ini beban angin diambil sebesar 30 kg/m^2 . Perhitungan beban angin dilakukan dengan cara mengalikan tekanan angin dengan luasan yang dikenai oleh angin dan menjadi beban titik (P). Gaya P ini kemudian didistribusikan pada tiap joint yang mengenai luasan itu dengan menggunakan rumus :

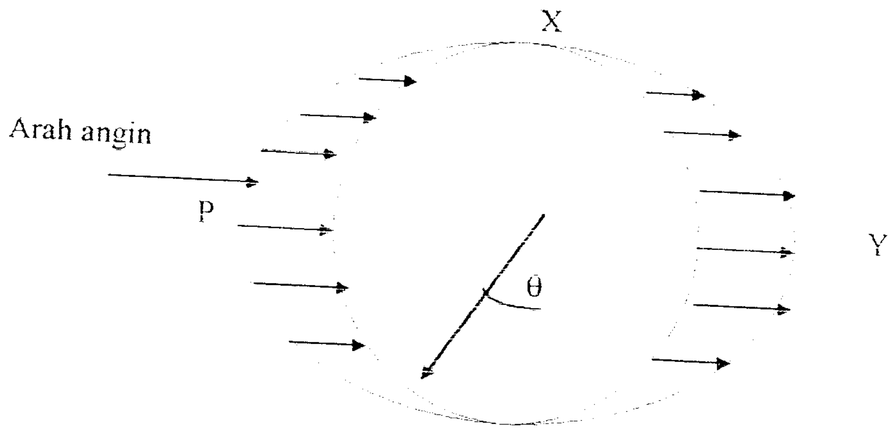
$$Pi = P.\ \text{Cos}\ \phi\ .\ \text{Sin}\ \theta$$

dimana : ϕ = sudut antara sumbu y dengan garis hubung antara joint dan titik pusat kubah

θ = sudut antara sumbu x dengan garis hubung antara joint dan titik pusat kubah.



Tampak samping



Tampak atas

Gambar 4.2 Pemodelan beban angin

Tabel 4.5 Beban angin

Joint	Luas yang ditahan (inci^2)	θ	ϕ	sin θ	cos ϕ	P (lb)
1	2	3	4	5	6	7
1	5664,3992	360	17,07	0,000	0,956	0,0000
2	5664,3992	345	17,07	-0,259	0,956	-946,0051
3	5664,3992	330	17,07	-0,500	0,956	-1138,5499
4	5664,3992	315	17,07	-0,707	0,956	-1609,9096
5	5664,3992	300	17,07	-0,866	0,956	-1971,9684
6	5664,3992	285	17,07	-0,966	0,956	-2199,6784
7	5664,3992	270	17,07	-1,000	0,956	-2277,0998

1	2	3	4	5	6	7
8	5664,3992	255	17,07	-0,966	0,956	-2199,6784
9	5664,3992	240	17,07	-0,866	0,956	-1971,9684
10	5664,3992	225	17,07	-0,707	0,956	-1609,9096
11	5664,3992	210	17,07	-0,500	0,956	-1138,5499
12	5664,3992	195	17,07	-0,259	0,956	-946,0051
13	5664,3992	180	17,07	0,000	0,956	0,0000
14	5664,3992	165	17,07	0,259	0,956	946,0051
15	5664,3992	150	17,07	0,500	0,956	1138,5499
16	5664,3992	135	17,07	0,707	0,956	1609,9096
17	5664,3992	120	17,07	0,866	0,956	1971,9684
18	5664,3992	105	17,07	0,966	0,956	2199,6784
19	5664,3992	90	17,07	1,000	0,956	2277,0998
20	5664,3992	75	17,07	0,966	0,956	2199,6784
21	5664,3992	60	17,07	0,866	0,956	1971,9684
22	5664,3992	45	17,07	0,707	0,956	1609,9096
23	5664,3992	30	17,07	0,500	0,956	1138,5499
24	5664,3992	15	17,07	0,259	0,956	946,0051
25	10914,6946	352,5	29,225	-0,131	0,873	-841,9140
26	10914,6946	337,5	29,225	-0,383	0,873	-2461,4739
27	10914,6946	322,5	29,225	-0,609	0,873	-3913,9363
28	10914,6946	307,5	29,225	-0,793	0,873	-5096,4720
29	10914,6946	292,5	29,225	-0,924	0,873	-5938,3861
30	10914,6946	277,5	29,225	-0,991	0,873	-6368,9833
31	10914,6946	262,5	29,225	-0,991	0,873	-6368,9833
32	10914,6946	247,5	29,225	-0,924	0,873	-5938,3861
33	10914,6946	232,5	29,225	-0,793	0,873	-5096,4720
34	10914,6946	217,5	29,225	-0,609	0,873	-3913,9363
35	10914,6946	202,5	29,225	-0,383	0,873	-2461,4739
36	10914,6946	187,5	29,225	-0,131	0,873	-841,9140
37	10914,6946	172,5	29,225	0,131	0,873	841,9140
38	10914,6946	157,5	29,225	0,383	0,873	2461,4739
39	10914,6946	142,5	29,225	0,609	0,873	3913,9363
40	10914,6946	127,5	29,225	0,793	0,873	5096,4720
41	10914,6946	112,5	29,225	0,924	0,873	5938,3861
42	10914,6946	97,5	29,225	0,991	0,873	6368,9833
43	10914,6946	82,5	29,225	0,991	0,873	6368,9833
44	10914,6946	67,5	29,225	0,924	0,873	5938,3861
45	10914,6946	52,5	29,225	0,793	0,873	5096,4720
46	10914,6946	37,5	29,225	0,609	0,873	3913,9363
47	10914,6946	22,5	29,225	0,383	0,873	2461,4739

1	2	3	4	5	6	7
48	10914,6946	7,5	29,225	0,131	0,873	841,9140
49	9467,6946	360	41,38	0,000	0,750	0,0000
50	9467,6946	345	41,38	-0,259	0,750	-1240,4727
51	9467,6946	330	41,38	-0,500	0,750	-2394,7350
52	9467,6946	315	41,38	-0,707	0,750	-3386,1553
53	9467,6946	300	41,38	-0,866	0,750	-4147,6810
54	9467,6946	285	41,38	-0,966	0,750	-4626,6280
55	9467,6946	270	41,38	-1,000	0,750	-4789,4700
56	9467,6946	255	41,38	-0,966	0,750	-4626,6280
57	9467,6946	240	41,38	-0,866	0,750	-4147,6810
58	9467,6946	225	41,38	-0,707	0,750	-3386,1553
59	9467,6946	210	41,38	-0,500	0,750	-2394,7350
60	9467,6946	195	41,38	-0,259	0,750	-1240,4727
61	9467,6946	180	41,38	0,000	0,750	0,0000
62	9467,6946	165	41,38	0,259	0,750	1240,4727
63	9467,6946	150	41,38	0,500	0,750	2394,7350
64	9467,6946	135	41,38	0,707	0,750	3386,1553
65	9467,6946	120	41,38	0,866	0,750	4147,6810
66	9467,6946	105	41,38	0,966	0,750	4626,6280
67	9467,6946	90	41,38	1,000	0,750	4789,4700
68	9467,6946	75	41,38	0,966	0,750	4626,6280
69	9467,6946	60	41,38	0,866	0,750	4147,6810
70	9467,6946	45	41,38	0,707	0,750	3386,1553
71	9467,6946	30	41,38	0,500	0,750	2394,7350
72	9467,6946	15	41,38	0,259	0,750	1240,4727
73	7576,2516	352,5	53,535	-0,131	0,594	-397,6437
74	7576,2516	337,5	53,535	-0,383	0,594	-1162,5766
75	7576,2516	322,5	53,535	-0,609	0,594	-1848,5878
76	7576,2516	307,5	53,535	-0,793	0,594	-2407,1102
77	7576,2516	292,5	53,535	-0,924	0,594	-2804,7539
78	7576,2516	277,5	53,535	-0,991	0,594	-3008,1289
79	7576,2516	262,5	53,535	-0,991	0,594	-3008,1289
80	7576,2516	247,5	53,535	-0,924	0,594	-2804,7539
81	7576,2516	232,5	53,535	-0,793	0,594	-2407,1102
82	7576,2516	217,5	53,535	-0,609	0,594	-1848,5878
83	7576,2516	202,5	53,535	-0,383	0,594	-1162,5766
84	7576,2516	187,5	53,535	-0,131	0,594	-397,6437
85	7576,2516	172,5	53,535	0,131	0,594	397,6437
86	7576,2516	157,5	53,535	0,383	0,594	1162,5766
87	7576,2516	142,5	53,535	0,609	0,594	1848,5878

1	2	3	4	5	6	7
88	7576,2516	127,5	53,535	0,793	0,594	2407,1102
89	7576,2516	112,5	53,535	0,924	0,594	2804,7539
90	7576,2516	97,5	53,535	0,991	0,594	3008,1289
91	7576,2516	82,5	53,535	0,991	0,594	3008,1289
92	7576,2516	67,5	53,535	0,924	0,594	2804,7539
93	7576,2516	52,5	53,535	0,793	0,594	2407,1102
94	7576,2516	37,5	53,535	0,609	0,594	1848,5878
95	7576,2516	22,5	53,535	0,383	0,594	1162,5766
96	7576,2516	7,5	53,535	0,131	0,594	397,6437
97	5116,4377	360	65,69	0,000	0,412	0,0000
98	7764,9368	345	65,69	-0,259	0,412	-558,8778
99	5116,4377	330	65,69	-0,500	0,412	-710,9137
100	7764,9368	315	65,69	-0,707	0,412	-1525,5853
101	5116,4377	300	65,69	-0,866	0,412	-1005,2319
102	7764,9368	285	65,69	-0,966	0,412	-2084,4632
103	5116,4377	270	65,69	-1,000	0,412	-1421,8273
104	7764,9368	255	65,69	-0,966	0,412	-2084,4632
105	5116,4377	240	65,69	-0,866	0,412	-1005,2319
106	7764,9368	225	65,69	-0,707	0,412	-1525,5853
107	5116,4377	210	65,69	-0,500	0,412	-710,91137
108	7764,9368	195	65,69	-0,259	0,412	-558,8778
109	5116,4377	180	65,69	0,000	0,412	0,0000
110	7764,9368	165	65,69	0,259	0,412	558,8778
111	5116,4377	150	65,69	0,500	0,412	710,9137
112	7764,9368	135	65,69	0,707	0,412	1525,5853
113	5116,4377	120	65,69	0,866	0,412	1005,2319
114	7764,9368	105	65,69	0,966	0,412	2084,4632
115	5116,4377	90	65,69	1,000	0,412	1421,8273
116	7764,9368	75	65,69	0,966	0,412	2084,4632
117	5116,4377	60	65,69	0,866	0,412	1005,2319
118	7764,9368	45	65,69	0,707	0,412	1525,5853
119	5116,4377	30	65,69	0,500	0,412	710,91137
120	7764,9368	15	65,69	0,259	0,412	558,8778
121	5206,6334	360	77,845	0,000	0,211	0,0000
122	6874,1386	330	77,845	-0,500	0,211	-489,1620
123	5206,6334	300	77,845	-0,866	0,211	-641,7107
124	6874,1386	270	77,845	-1,000	0,211	-978,3240
125	5206,6334	240	77,845	-0,866	0,211	-641,7107
126	6874,1386	210	77,845	-0,500	0,211	-489,1620
127	5206,6334	180	77,845	0,000	0,211	0,0000

1	2	3	4	5	6	7
128	6874,1386	150	77,845	0,500	0,211	489,1620
129	5206,6334	120	77,845	0,866	0,211	641,7107
130	6874,1386	90	77,845	1,000	0,211	978,3240
131	5206,6334	60	77,845	0,866	0,211	641,7107
132	6874,1386	30	77,845	0,500	0,211	489,1620
133	10005,0312	0	90	0,000	0,000	0,0000

Untuk mencari beban angin terdistribusi dengan cara sebagai berikut :

$$P_x = \frac{koordinat\ X_n}{R} x\ P \quad > \quad \text{dimana}:\ R = jari - jari\ besar = 473,6220\ inci$$

$$P_Y = \frac{koordinat\ Y_n}{R} x\ P$$

$$P_Z = \frac{koordinat\ Z_n}{R} x\ P$$

Tabel 4.6 Tabel disribusi beban angin

Joint	P (lb)	Px (lb)	Py (lb)	Pz (lb)
1	2	3	4	5
1	0,0000	0,0000	0,0000	0,0000
2	-946,0051	234,0573	-873,5133	277,7010
3	-1138,5499	544,1948	-942,5729	334,2227
4	-1609,9096	1088,252	-1088,2252	472,5909
5	-1971,9684	1632,5362	-942,5455	578,8737
6	-2199,6784	2031,1182	-544,2367	645,7182
7	-2277,0998	2176,7789	0,0000	668,4454
8	-2199,6784	2031,1182	544,2367	645,7182
9	-1971,9684	1632,53622	942,5455	578,8737
10	-1609,9096	1088,2252	1088,2252	472,5909
11	-1138,5499	544,1948	942,5729	334,2227
12	-946,0051	234,0573	873,5133	277,7010
13	0,0000	0,0000	0,0000	0,0000
14	946,0051	-234,0573	873,5133	277,7010
15	1138,5499	-544,1948	942,5729	334,2227
16	1609,9096	-1088,252	1088,2252	472,5909

1	2	3	4	5
17	1971,9684	-1632,5362	942,5455	578,8737
18	2199,6784	-2031,1182	544,2367	645,7182
19	2277,0998	-2176,7789	0,0000	668,4454
20	2199,6784	-2031,1182	-544,2367	645,7182
21	1971,9684	-1632,5362	-942,5455	578,8737
22	1609,9096	-1088,2252	-1088,2252	472,5909
23	1138,5499	-544,1948	-942,5729	334,2227
24	946,0051	-234,0573	-873,5133	277,7010
25	-841,9140	96,7306	-734,7424	411,0634
26	-2461,4739	829,1508	-2001,7480	1201,8113
27	-3913,9363	2097,2956	-2733,2493	1910,9741
28	-5096,4720	3559,0586	-2730,9612	2488,3456
29	-5938,3861	4829,2823	-2000,3533	2899,4090
30	-6368,9833	5558,2424	-731,7563	3109,6475
31	-6368,9833	5558,2424	731,,7563	3109,6475
32	-5938,3861	4829,2823	2000,3533	2899,4090
33	-5096,4720	3559,0586	2730,9612	2488,3456
34	-3913,9363	2097,2956	2733,2493	1910,9741
35	-2461,4739	829,1508	2001,7480	1201,8113
36	-841,9140	96,7306	734,7424	411,06344
37	841,9140	-96,7306	734,7424	411,0634
38	2461,4739	-829,1508	2001,7480	1201,8113
39	3913,9363	-2097,2956	2733,2493	1910,9741
40	5096,4720	-3559,0586	2730,9612	2488,3456
41	5938,3861	-4829,2823	2000,3533	2899,4090
42	6368,9833	-5558,2424	731,7563	3109,6475
43	6368,9833	-5558,2424	-731,7563	3109,6475
44	5938,3861	-4829,2823	-2000,3533	2899,4090
45	5096,4720	-3559,0586	-2730,9612	2488,3456
46	3913,9363	-2097,2956	-2733,2493	1910,9741
47	2461,4739	-829,1508	-2001,7480	1201,8113
48	841,9140	-96,7306	-734,7424	411,06344
49	0,0000	0,0000	0,0000	0,0000
50	-1240,4727	240,9017	-899,0568	820,0218
51	-2394,7350	898,4289	-1556,1242	1583,0536
52	-3386,1553	1796,5865	-1796,5865	2238,4378
53	-4147,6810	2695,2071	-1556,1242	2741,8488
54	-4626,6280	3353,2391	-899,0568	3058,4596
55	-4789,4700	3593,2391	0,0000	3166,1072
56	-4626,6280	3353,2391	899,0568	3058,4596

1	2	3	4	5
57	-4147,6810	2695,2071	1556,1242	2741,8488
58	-3386,1553	1796,5865	1796,5865	2238,4378
59	-2394,7350	898,4289	1556,1242	1583,0536
60	-1240,4727	240,9017	899,0568	820,0218
61	0,0000	0,0000	0,0000	0,0000
62	1240,4727	-240,9017	899,0568	820,0218
63	2394,7350	-898,4289	1556,1242	1583,0536
64	3386,1553	-1796,5865	1796,5865	2238,4378
65	4147,6810	-2695,2071	1556,1242	2741,8488
66	4626,6280	-3353,2391	899,0568	3058,4596
67	4789,4700	-3593,2391	0,0000	3166,1072
68	4626,6280	-3353,2391	-899,0568	3058,4596
69	4147,6810	-2695,2071	-1556,1242	2741,8488
70	3386,1553	-1796,5865	-1796,5865	2238,4378
71	2394,7350	-898,4289	-1556,1242	1583,0536
72	1240,4727	-240,9017	-899,0568	820,0218
73	-397,6437	31,1135	-236,3304	319,7945
74	-1162,5766	266,6971	-643,8637	934,9716
75	-1848,5878	674,5966	-879,1520	1486,6780
76	-2407,1102	1144,7737	-878,4157	1935,8549
77	-2804,7539	1553,3422	-643,4154	2255,6493
78	-3008,1289	1787,8126	-235,3701	2419,2083
79	-3008,1289	1787,8126	235,3701	2419,2083
80	-2804,7539	1553,3422	643,4154	2255,6493
81	-2407,1102	1144,7737	878,4157	1935,8549
82	-1848,5878	674,5966	879,1520	1486,6780
83	-1162,5766	266,6971	643,8637	934,9716
84	-397,6437	31,1135	236,3304	319,7945
85	397,6437	-31,1135	236,3304	319,7945
86	1162,5766	-266,6971	643,8637	934,9716
87	1848,5878	-674,5966	879,1520	1486,6780
88	2407,1102	-1144,7737	878,4157	1935,8549
89	2804,7539	-1553,3422	643,4154	2255,6493
90	3008,1289	-1787,8126	235,3701	2419,2083
91	3008,1289	-1787,8126	-235,3701	2419,2083
92	2804,7539	-1553,3422	-643,4154	2255,6493
93	2407,1102	-1144,7737	-878,4157	1935,8549
94	1848,5878	-674,5966	-879,1520	1486,6780
95	1162,5766	-266,6971	-643,8637	934,9716
96	397,6437	-31,1135	-236,3304	319,7945

1	2	3	4	5
97	0,0000	0,0000	0,0000	0,0000
98	-558,8778	59,5473	-828,8714	509,3241
99	-710,9137	146,3309	-358,3821	647,8795
100	-1525,5853	444,0896	-444,0896	1390,3170
101	-1005,2319	358,3821	-146,3309	916,1015
102	-2084,4632	828,8714	-59,5473	1899,6412
103	-1421,8273	585,3237	0,0000	1295,7589
104	-2084,4632	828,8714	59,5473	1899,6412
105	-1005,2319	358,3821	146,3309	916,1015
106	-1525,5853	444,0896	444,0896	1390,3170
107	-710,91137	146,3309	358,3821	647,8795
108	-558,8778	59,5473	828,8714	509,3241
109	0,0000	0,0000	0,0000	0,0000
110	558,8778	-59,5473	828,8714	509,3241
111	710,9137	-146,3309	358,3821	647,8795
112	1525,5853	-444,0896	444,0896	1390,3170
113	1005,2319	-358,3821	146,3309	916,1015
114	2084,4632	-828,8714	59,5473	1899,6412
115	1421,8273	-585,3237	0,0000	1295,7589
116	2084,4632	-828,8714	-59,5473	1899,6412
117	1005,2319	-358,3821	-146,3309	916,1015
118	1525,5853	-444,0896	-444,0896	1390,3170
119	710,91137	-146,3309	-358,3821	647,8795
120	558,8778	-59,5473	-828,8714	509,3241
121	0,0000	0,0000	0,0000	0,0000
122	-489,1620	51,4978	-117,0135	478,1959
123	-641,7107	117,0135	-51,4978	672,3248
124	-978,3240	205,9913	0,0000	956,3918
125	-641,7107	117,0135	51,4978	627,3248
126	-489,1620	51,4978	117,0135	478,1959
127	0,0000	0,0000	0,0000	0,0000
128	489,1620	-51,4978	117,0135	478,1959
129	641,7107	-117,0135	51,4978	672,3248
130	978,3240	-205,9913	0,0000	956,3918
131	641,7107	-117,0135	-51,4978	627,3248
132	489,1620	-51,4978	-117,0135	478,1959
133	0,0000	0,0000	0,0000	0,0000

4.6 Pengecekan Elemen Struktur

Gaya batang diambil dari gaya batang akibat beban tetap , bila gaya batang beban tetap + beban sementara ≥ 125 % beban tetap , maka yang diambil adalah gaya batang akibat beban tetap + beban sementara , dan angka keamanan ditingkatkan menjadi 1,25.

Hasil pengecekan elemen struktur dengan rumus-rumus AISC dapat dilihat pada tabel 4.7 dan tabel 4.8.

Keterangan :

L = panjang batang

Pmax = gaya aksial maksimum yang terjadi pada batang , dengan tanda positip (+) untuk batang tarik dan negatip (-) untuk batang desak , diambil dari beban tetap atau beban sementara bila > 1,25 beban tetap.

Mx max = momen maksimum arah x

My max = momen maksimum arah y

fa = tegangan akibat beban aksial yang terjadi

Fa = tegangan ijin desak aksial

BT = beban tetap = beban mati + beban hidup

BS = beban sementara = beban mati + beban hidup + beban angin

Tabel 4.7 : Perhitungan Gaya Batang

Tabel 4.8 : Perhitungan Baut dan Ball Joint

Tabel 4.7 : Perhitungan Gaya Batang

Btg	Panjang (in)	Pmax (Kips)		Pmax (Kips)	Profil (in)	ft (ksi)	fa (ksi)	Ft (ksi)	Fa (ksi)	Ket.
		BT	BT + BS							
1	2	3	4	5	6	7	8	9	10	11
1	118,1931	0	0	0	1,5	0	0	0	0	Aman
2	118,1931	0	0	0	1,5	0	0	0	0	Aman
3	118,1931	0	0	0	1,5	0	0	0	0	Aman
4	118,1931	0	0	0	1,5	0	0	0	0	Aman
5	118,1931	0	0	0	1,5	0	0	0	0	Aman
6	118,1931	0	0	0	1,5	0	0	0	0	Aman
7	118,1931	0	0	0	1,5	0	0	0	0	Aman
8	118,1931	0	0	0	1,5	0	0	0	0	Aman
9	118,1931	0	0	0	1,5	0	0	0	0	Aman
10	118,1931	0	0	0	1,5	0	0	0	0	Aman
11	118,1931	0	0	0	1,5	0	0	0	0	Aman
12	118,1931	0	0	0	1,5	0	0	0	0	Aman
13	118,1931	0	0	0	1,5	0	0	0	0	Aman
14	118,1931	0	0	0	1,5	0	0	0	0	Aman
15	118,1931	0	0	0	1,5	0	0	0	0	Aman
16	118,1931	0	0	0	1,5	0	0	0	0	Aman
17	118,1931	0	0	0	1,5	0	0	0	0	Aman
18	118,1931	0	0	0	1,5	0	0	0	0	Aman
19	118,1931	0	0	0	1,5	0	0	0	0	Aman
20	118,1931	0	0	0	1,5	0	0	0	0	Aman
21	118,1931	0	0	0	1,5	0	0	0	0	Aman
22	118,1931	0	0	0	1,5	0	0	0	0	Aman
23	118,1931	0	0	0	1,5	0	0	0	0	Aman
24	118,1931	0	0	0	1,5	0	0	0	0	Aman
25	108,8324	0,06114	0,07253	0,07253	1,5	0,09078	-	21,6	-	Aman
26	108,8324	0,06114	0,07207	0,07207	1,5	0,09020	-	21,6	-	Aman
27	108,8324	0,06114	0,07547	0,07547	1,5	0,09446	-	21,6	-	Aman
28	108,8324	0,06114	0,08320	0,08320	1,5	0,10413	-	21,6	-	Aman
29	108,8324	0,06114	0,08232	0,08232	1,5	0,10303	-	21,6	-	Aman
30	108,8324	0,06114	0,08461	0,08461	1,5	0,10590	-	21,6	-	Aman
31	108,8324	0,06114	0,08587	0,08587	1,5	0,10747	-	21,6	-	Aman
32	108,8324	0,06114	0,08539	0,08539	1,5	0,10687	-	21,6	-	Aman

1	2	3	4	5	6	7	8	9	10	11
33	108,8324	0,06114	0,08325	0,08325	1,5	0,10420	-	21,6	-	Aman
34	108,8324	0,06114	0,07988	0,07988	1,5	0,09998	-	21,6	-	Aman
35	108,8324	0,06114	0,07608	0,07608	1,5	0,09522	-	21,6	-	Aman
36	108,8324	0,06114	0,07316	0,07316	1,5	0,09157	-	21,6	-	Aman
37	108,8324	0,06114	0,07350	0,07350	1,5	0,09199	-	21,6	-	Aman
38	108,8324	0,06114	0,07318	0,07318	1,5	0,09159	-	21,6	-	Aman
39	108,8324	0,06114	0,07611	0,07611	1,5	0,09526	-	21,6	-	Aman
40	108,8324	0,06114	0,01995	0,01995	1,5	0,10007	-	21,6	-	Aman
41	108,8324	0,06114	0,08338	0,08338	1,5	0,10436	-	21,6	-	Aman
42	108,8324	0,06114	0,08566	0,08566	1,5	0,10721	-	21,6	-	Aman
43	108,8324	0,06114	0,08641	0,08641	1,5	0,10815	-	21,6	-	Aman
44	108,8324	0,06114	0,08552	0,08552	1,5	0,10704	-	21,6	-	Aman
45	108,8324	0,06114	0,08309	0,08309	1,5	0,10399	-	21,6	-	Aman
46	108,8324	0,06114	0,07950	0,07950	1,5	0,09950	-	21,6	-	Aman
47	108,8324	0,06114	0,07550	0,07550	1,5	0,09450	-	21,6	-	Aman
48	108,8324	0,06114	0,07240	0,07240	1,5	0,09062	-	21,6	-	Aman
49	92,7718	0,04398	0,05604	0,05604	1,5	0,07012	-	21,6	-	Aman
50	92,7718	0,04398	0,05855	0,05855	1,5	0,07328	-	21,6	-	Aman
51	92,7718	0,04398	0,05880	0,05880	1,5	0,07359	-	21,6	-	Aman
52	92,7718	0,04398	0,05957	0,05957	1,5	0,07456	-	21,6	-	Aman
53	92,7718	0,04398	0,06969	0,06969	1,5	0,08722	-	21,6	-	Aman
54	92,7718	0,04398	0,07300	0,07300	1,5	0,09144	-	21,6	-	Aman
55	92,7718	0,04398	0,07354	0,07354	1,5	0,09204	-	21,6	-	Aman
56	92,7718	0,04398	0,07210	0,07210	1,5	0,09024	-	21,6	-	Aman
57	92,7718	0,04398	0,06895	0,06895	1,5	0,08630	-	21,6	-	Aman
58	92,7718	0,04398	0,06467	0,06467	1,5	0,08094	-	21,6	-	Aman
59	92,7718	0,04398	0,06020	0,06020	1,5	0,07534	-	21,6	-	Aman
60	92,7718	0,04398	0,05687	0,05687	1,5	0,07118	-	21,6	-	Aman
61	92,7718	0,04398	0,05688	0,05688	1,5	0,07119	-	21,6	-	Aman
62	92,7718	0,04398	0,06024	0,06024	1,5	0,07540	-	21,6	-	Aman
63	92,7718	0,04398	0,06474	0,06474	1,5	0,08103	-	21,6	-	Aman
64	92,7718	0,04398	0,06908	0,06908	1,5	0,08646	-	21,6	-	Aman
65	92,7718	0,04398	0,07232	0,07232	1,5	0,09052	-	21,6	-	Aman
66	92,7718	0,04398	0,07401	0,07401	1,5	0,09263	-	21,6	-	Aman
67	92,7718	0,04398	0,07395	0,07395	1,5	0,09255	-	21,6	-	Aman
68	92,7718	0,04398	0,07220	0,07220	1,5	0,09036	-	21,6	-	Aman
69	92,7718	0,04398	0,06882	0,06882	1,5	0,08614	-	21,6	-	Aman
70	92,7718	0,04398	0,06437	0,06437	1,5	0,08056	-	21,6	-	Aman
71	92,7718	0,04398	0,05976	0,05976	1,5	0,07480	-	21,6	-	Aman

1	2	3	4	5	6	7	8	9	10	11
72	92.7718	0.04398	0.05626	0,05626	1.5	0,07042	-	21,6	-	Aman
73	74.1168	0,08604	0,10453	0,10453	1,5	0,13083	-	21,6	-	Aman
74	74,1168	0.08546	0,10059	0,10059	1,5	0,12590	-	21,6	-	Aman
75	74.1168	0,08604	0.10082	0.10082	1,5	0,12620	-	21,6	-	Aman
76	74.1168	0,08546	0.10428	0,10428	1,5	0,13052	-	21,6	-	Aman
77	74.1168	0,08604	0.09968	0,09968	1,5	0,12476	-	21,6	-	Aman
78	74,1168	0,08546	0,09758	0,09758	1,5	0,12213	-	21,6	-	Aman
79	74.1168	0,08604	0,09941	0,09941	1,5	0,12442	-	21,6	-	Aman
80	74.1168	0,08546	0,09827	0,09827	1,5	0,12300	-	21,6	-	Aman
81	74.1168	0,08604	0,10044	0,10044	1,5	0,12571	-	21,6	-	Aman
82	74,1168	0.08546	0,09898	0,09898	1,5	0,12388	-	21,6	-	Aman
83	74.1168	0,08604	0,10071	0,10071	1,5	0,12605	-	21,6	-	Aman
84	74,1168	0,08546	0,10132	0,10132	1,5	0,12681	-	21,6	-	Aman
85	74,1168	0,08604	0,10533	0,10533	1,5	0,13183	-	21,6	-	Aman
86	74,1168	0,08546	0,10138	0,10138	1,5	0,12688	-	21,6	-	Aman
87	74,1168	0,08604	0,10085	0,10085	1,5	0,12622	-	21,6	-	Aman
88	74,1168	0,08546	0,09922	0,09922	1,5	0,12418	-	21,6	-	Aman
89	74,1168	0,08604	0,10084	0,10084	1,5	0,12621	-	21,6	-	Aman
90	74,1168	0,08546	0,09904	0,09904	1,5	0,12446	-	21,6	-	Aman
91	74,1168	0,08604	0,10037	0,10037	1,5	0,12562	-	21,6	-	Aman
92	74,1168	0,08546	0,09875	0,09875	1,5	0,12360	-	21,6	-	Aman
93	74,1168	0,08604	0,10053	0,10053	1,5	0,12582	-	21,6	-	Aman
94	74,1168	0,08546	0,09876	0,09876	1,5	0,12361	-	21,6	-	Aman
95	74,1168	0,08604	0,10025	0,10025	1,5	0,12547	-	21,6	-	Aman
96	74,1168	0,08546	0,10066	0.10066	1,5	0,12598	-	21,6	-	Aman
97	50,8990	0,13818	0,15797	0,15797	1,5	0,19771	-	21,6	-	Aman
98	50,8990	0.13818	0,15807	0,15807	1,5	0,19784	-	21,6	-	Aman
99	50,8990	0,13818	0,15440	0,15440	1,5	0,19324	-	21,6	-	Aman
100	50,8990	0,13818	0,15437	0,15437	1,5	0,19321	-	21,6	-	Aman
101	50,8990	0,13818	0,15018	0,15018	1,5	0,18796	-	21,6	-	Aman
102	50,8990	0,13818	0.15063	0.15063	1,5	0.18853	-	21,6	-	Aman
103	50,8990	0,13818	0,15055	0,15055	1,5	0,18843	-	21,6	-	Aman
104	50,8990	0,13818	0.15004	0.15327	1,5	0,18779	-	21,6	-	Aman
105	50,8990	0,13818	0,15327	0,15319	1,5	0,19183	-	21,6	-	Aman
106	50,8990	0,13818	0,15319	0,15796	1,5	0,19173	-	21,6	-	Aman
107	50,8990	0.13818	0.15785	0.15347	1,5	0,19756	-	21,6	-	Aman
108	50,8990	0.13818	0.15813	0.15361	1,5	0.19791	-	21,6	-	Aman
109	50,8990	0.13818	0.15822	0.15047	1,5	0,19803	-	21,6	-	Aman
110	50,8990	0.13818	0.15796	0.15117	1,5	0.19770	-	21,6	-	Aman

1	2	3	4	5	6	7	8	9	10	11
111	50,8990	0,13818	0,15347	0,15347	1,5	0,19208	-	21,6	-	Aman
112	50,8990	0,13818	0,15361	0,15361	1,5	0,19225	-	21,6	-	Aman
113	50,8990	0,13818	0,15047	0,15047	1,5	0,18833	-	21,6	-	Aman
114	50,8990	0,13818	0,15117	0,15117	1,5	0,18920	-	21,6	-	Aman
115	50,8990	0,13818	0,15104	0,15104	1,5	0,18904	-	21,6	-	Aman
116	50,8990	0,13818	0,15034	0,15034	1,5	0,18816	-	21,6	-	Aman
117	50,8990	0,13818	0,15322	0,15322	1,5	0,19177	-	21,6	-	Aman
118	50,8990	0,13818	0,15298	0,15298	1,5	0,19147	-	21,6	-	Aman
119	50,8990	0,13818	0,15744	0,15744	1,5	0,19705	-	21,6	-	Aman
120	50,8990	0,13818	0,15766	0,15766	1,5	0,19732	-	21,6	-	Aman
121	51,6207	0,68778	0,70431	0,70431	1,5	0,88149	-	21,6	-	Aman
122	51,6207	0,68778	0,69454	0,69454	1,5	0,86926	-	21,6	-	Aman
123	51,6207	0,68778	0,68506	0,68778	1,5	0,86080	-	21,6	-	Aman
124	51,6207	0,68778	0,68475	0,68778	1,5	0,86080	-	21,6	-	Aman
125	51,6207	0,68778	0,69378	0,69378	1,5	0,86831	-	21,6	-	Aman
126	51,6207	0,68778	0,70710	0,70710	1,5	0,88498	-	21,6	-	Aman
127	51,6207	0,68778	0,70428	0,70428	1,5	0,88145	-	21,6	-	Aman
128	51,6207	0,68778	0,69423	0,69423	1,5	0,86887	-	21,6	-	Aman
129	51,6207	0,68778	0,68519	0,68778	1,5	0,86080	-	21,6	-	Aman
130	51,6207	0,68778	0,68498	0,68778	1,5	0,86080	-	21,6	-	Aman
131	51,6207	0,68778	0,69371	0,69371	1,5	0,86822	-	21,6	-	Aman
132	51,6207	0,68778	0,70386	0,70386	1,5	0,88093	-	21,6	-	Aman
133	114,0990	-0,02556	-0,02351	-0,02556	1,5	-	0,03199	-	4,5288	Aman
134	114,0990	-0,02556	-0,02919	-0,02919	1,5	-	0,03653	-	4,5288	Aman
135	114,0990	-0,02556	-0,01382	-0,02556	1,5	-	0,03199	-	4,5288	Aman
136	114,0990	-0,02556	-0,02730	-0,02730	1,5	-	0,03417	-	4,5288	Aman
137	114,0990	-0,02556	-0,00902	-0,02556	1,5	-	0,03199	-	4,5288	Aman
138	114,0990	-0,02556	-0,02483	-0,02556	1,5	-	0,03199	-	4,5288	Aman
139	114,0990	-0,02556	-0,00499	-0,02556	1,5	-	0,03199	-	4,5288	Aman
140	114,0990	-0,02556	-0,02213	-0,02556	1,5	-	0,03199	-	4,5288	Aman
141	114,0990	-0,02556	-0,00463	-0,02556	1,5	-	0,03199	-	4,5288	Aman
142	114,0990	-0,02556	-0,01643	-0,02556	1,5	-	0,03199	-	4,5288	Aman
143	114,0990	-0,02556	-0,00686	-0,02556	1,5	-	0,03199	-	4,5288	Aman
144	114,0990	-0,02556	-0,01213	-0,02556	1,5	-	0,03199	-	4,5288	Aman
145	114,0990	-0,02556	-0,01049	-0,02556	1,5	-	0,03199	-	4,5288	Aman
146	114,0990	-0,02556	-0,00879	-0,02556	1,5	-	0,03199	-	4,5288	Aman
147	114,0990	-0,02556	-0,01486	-0,02556	1,5	-	0,03199	-	4,5288	Aman
148	114,0990	-0,02556	-0,00682	-0,02556	1,5	-	0,03199	-	4,5288	Aman
149	114,0990	-0,02556	-0,01950	-0,02556	1,5	-	0,03199	-	4,5288	Aman

1	2	3	4	5	6	7	8	9	10	11
150	114,0990	-0,02556	-0,00675	-0,02556	1,5	-	0,03199	-	4,5288	Aman
151	114,0990	-0,02556	-0,02385	-0,02556	1,5	-	0,03199	-	4,5288	Aman
152	114,0990	-0,02556	-0,00901	-0,02556	1,5	-	0,03199	-	4,5288	Aman
153	114,0990	-0,02556	-0,02743	-0,02743	1,5	-	0,03433	-	4,5288	Aman
154	114,0990	-0,02556	-0,01432	-0,02556	1,5	-	0,03199	-	4,5288	Aman
155	114,0990	-0,02556	-0,02964	-0,02964	1,5	-	0,03710	-	4,5288	Aman
156	114,0990	-0,02556	-0,02381	-0,02556	1,5	-	0,03199	-	4,5288	Aman
157	114,0990	-0,02556	-0,02367	-0,02556	1,5	-	0,03199	-	4,5288	Aman
158	114,0990	-0,02556	-0,02979	-0,02979	1,5	-	0,03730	-	4,5288	Aman
159	114,0990	-0,02556	-0,01417	-0,02556	1,5	-	0,03199	-	4,5288	Aman
160	114,0990	-0,02556	-0,02759	-0,02759	1,5	-	0,03453	-	4,5288	Aman
161	114,0990	-0,02556	-0,00884	-0,02556	1,5	-	0,03199	-	4,5288	Aman
162	114,0990	-0,02556	-0,02405	-0,02556	1,5	-	0,03199	-	4,5288	Aman
163	114,0990	-0,02556	-0,00654	-0,02556	1,5	-	0,03199	-	4,5288	Aman
164	114,0990	-0,02556	-0,01978	-0,02556	1,5	-	0,03199	-	4,5288	Aman
165	114,0990	-0,02556	-0,00654	-0,02556	1,5	-	0,03199	-	4,5288	Aman
166	114,0990	-0,02556	-0,01529	-0,02556	1,5	-	0,03199	-	4,5288	Aman
167	114,0990	-0,02556	-0,00841	-0,02556	1,5	-	0,03199	-	4,5288	Aman
168	114,0990	-0,02556	-0,01117	-0,02556	1,5	-	0,03199	-	4,5288	Aman
169	114,0990	-0,02556	-0,01160	-0,02556	1,5	-	0,03199	-	4,5288	Aman
170	114,0990	-0,02556	-0,00792	-0,02556	1,5	-	0,03199	-	4,5288	Aman
171	114,0990	-0,02556	-0,01565	-0,02556	1,5	-	0,03199	-	4,5288	Aman
172	114,0990	-0,02556	-0,00602	-0,02556	1,5	-	0,03199	-	4,5288	Aman
173	114,0990	-0,02556	-0,02004	-0,02556	1,5	-	0,03199	-	4,5288	Aman
174	114,0990	-0,02556	-0,00600	-0,02556	1,5	-	0,03199	-	4,5288	Aman
175	114,0990	-0,02556	-0,02420	-0,02556	1,5	-	0,03199	-	4,5288	Aman
176	114,0990	-0,02556	-0,00830	-0,02556	1,5	-	0,03199	-	4,5288	Aman
177	114,0990	-0,02556	-0,02762	-0,02762	1,5	-	0,03457	-	4,5288	Aman
178	114,0990	-0,02556	-0,01364	-0,02556	1,5	-	0,03199	-	4,5288	Aman
179	114,0990	-0,02556	-0,02966	-0,02966	1,5	-	0,03712	-	4,5288	Aman
180	114,0990	-0,02556	-0,02315	-0,02556	1,5	-	0,03199	-	4,5288	Aman
181	114,0995	-0,02677	-0,03246	-0,03246	1,5	-	0,04063	-	4,5288	Aman
182	114,0995	-0,02677	-0,02411	-0,02677	1,5	-	0,03351	-	4,5288	Aman
183	114,0995	-0,02677	-0,02742	-0,02742	1,5	-	0,03432	-	4,5288	Aman
184	114,0995	-0,02677	-0,01855	-0,02677	1,5	-	0,03351	-	4,5288	Aman
185	114,0995	-0,02677	-0,02063	-0,02677	1,5	-	0,03351	-	4,5288	Aman
186	114,0995	-0,02677	-0,01932	-0,02677	1,5	-	0,03351	-	4,5288	Aman
187	114,0995	-0,02677	-0,02906	-0,02906	1,5	-	0,03637	-	4,5288	Aman
188	114,0995	-0,02677	-0,00508	-0,02677	1,5	-	0,03551	-	4,5288	Aman

1	2	3	4	5	6	7	8	9	7	9
189	114,0995	-0,02677	-0,01901	-0,02677	1,5	-	0,03351	-	4,5288	Aman
190	114,0995	-0,02677	-0,00956	-0,02677	1,5	-	0,03351	-	4,5288	Aman
191	114,0995	-0,02677	-0,01527	-0,02677	1,5	-	0,03351	-	4,5288	Aman
192	114,0995	-0,02677	-0,01163	-0,02677	1,5	-	0,03351	-	4,5288	Aman
193	114,0995	-0,02677	-0,01311	-0,02677	1,5	-	0,03351	-	4,5288	Aman
194	114,0995	-0,02677	-0,01411	-0,02677	1,5	-	0,03351	-	4,5288	Aman
195	114,0995	-0,02677	-0,01212	-0,02677	1,5	-	0,03351	-	4,5288	Aman
196	114,0995	-0,02677	-0,01715	-0,02677	1,5	-	0,03351	-	4,5288	Aman
197	114,0995	-0,02677	-0,01256	-0,02677	1,5	-	0,03351	-	4,5288	Aman
198	114,0995	-0,02677	-0,02059	-0,02677	1,5	-	0,03351	-	4,5288	Aman
199	114,0995	-0,02677	-0,01460	-0,02677	1,5	-	0,03351	-	4,5288	Aman
200	114,0995	-0,02677	-0,02423	-0,02677	1,5	-	0,03351	-	4,5288	Aman
201	114,0995	-0,02677	-0,01853	-0,02677	1,5	-	0,03351	-	4,5288	Aman
202	114,0995	-0,02677	-0,02813	-0,02813	1,5	-	0,03351	-	4,5288	Aman
203	114,0995	-0,02677	-0,02459	-0,02677	1,5	-	0,03521	-	4,5288	Aman
204	114,0995	-0,02677	-0,03283	-0,03283	1,5	-	0,03351	-	4,5288	Aman
205	114,0995	-0,02677	-0,03300	-0,03300	1,5	-	0,04109	-	4,5288	Aman
206	114,0995	-0,02677	-0,02443	-0,02677	1,5	-	0,04130	-	4,5288	Aman
207	114,0995	-0,02677	-0,02832	-0,02832	1,5	-	0,03351	-	4,5288	Aman
208	114,0995	-0,02677	-0,01837	-0,02677	1,5	-	0,03545	-	4,5288	Aman
209	114,0995	-0,02677	-0,02445	-0,02677	1,5	-	0,03351	-	4,5288	Aman
210	114,0995	-0,02677	-0,01442	-0,02677	1,5	-	0,03351	-	4,5288	Aman
211	114,0995	-0,02677	-0,02086	-0,02677	1,5	-	0,03351	-	4,5288	Aman
212	114,0995	-0,02677	-0,01237	-0,02677	1,5	-	0,03351	-	4,5288	Aman
213	114,0995	-0,02677	-0,01751	-0,02677	1,5	-	0,03351	-	4,5288	Aman
214	114,0995	-0,02677	-0,01193	-0,02677	1,5	-	0,03351	-	4,5288	Aman
215	114,0995	-0,02677	-0,01462	-0,02677	1,5	-	0,03351	-	4,5288	Aman
216	114,0995	-0,02677	-0,01292	-0,02677	1,5	-	0,03351	-	4,5288	Aman
217	114,0995	-0,02677	-0,01248	-0,02677	1,5	-	0,03351	-	4,5288	Aman
218	114,0995	-0,02677	-0,01501	-0,02677	1,5	-	0,03351	-	4,5288	Aman
219	114,0995	-0,02677	-0,01147	-0,02677	1,5	-	0,03351	-	4,5288	Aman
220	114,0995	-0,02677	-0,01780	-0,02677	1,5	-	0,03351	-	4,5288	Aman
221	114,0995	-0,02677	-0,01190	-0,02677	1,5	-	0,03351	-	4,5288	Aman
222	114,0995	-0,02677	-0,02103	-0,02677	1,5	-	0,03351	-	4,5288	Aman
223	114,0995	-0,02677	-0,01396	-0,02677	1,5	-	0,03351	-	4,5288	Aman
224	114,0995	-0,02677	-0,02447	-0,02677	1,5	-	0,03351	-	4,5288	Aman
225	114,0995	-0,02677	-0,01794	-0,02677	1,5	-	0,03351	-	4,5288	Aman
226	114,0995	-0,02677	-0,02818	-0,02818	1,5	-	0,03527	-	4,5288	Aman
227	114,0995	-0,02677	-0,02405	-0,02677	1,5	-	0,03351	-	4,5288	Aman

1	2	3	4	5	6	7	8	9	10	11
228	114,0995	-0,02677	-0,03266	-0,03266	1,5	-	0,04088	-	4,5288	Aman
229	106,9151	-0,02798	-0,03432	-0,03432	1,5	-	0,04295	-	5,1579	Aman
230	106,9151	-0,02798	-0,02692	-0,02798	1,5	-	0,03502	-	5,1579	Aman
231	106,9151	-0,02798	-0,02961	-0,02961	1,5	-	0,03706	-	5,1579	Aman
232	106,9151	-0,02798	-0,02368	-0,02798	1,5	-	0,03502	-	5,1579	Aman
233	106,9151	-0,02798	-0,02154	-0,02798	1,5	-	0,03502	-	5,1579	Aman
234	106,9151	-0,02798	-0,02648	-0,02798	1,5	-	0,03502	-	5,1579	Aman
235	106,9151	-0,02798	-0,03143	-0,03143	1,5	-	0,03934	-	5,1579	Aman
236	106,9151	-0,02798	-0,01120	-0,02798	1,5	-	0,03502	-	5,1579	Aman
237	106,9151	-0,02798	-0,02099	-0,02798	1,5	-	0,03502	-	5,1579	Aman
238	106,9151	-0,02798	-0,01625	-0,02798	1,5	-	0,03502	-	5,1579	Aman
239	106,9151	-0,02798	-0,01787	-0,02798	1,5	-	0,03502	-	5,1579	Aman
240	106,9151	-0,02798	-0,01744	-0,02798	1,5	-	0,03502	-	5,1579	Aman
241	106,9151	-0,02798	-0,01695	-0,02798	1,5	-	0,03502	-	5,1579	Aman
242	106,9151	-0,02798	-0,01855	-0,02798	1,5	-	0,03502	-	5,1579	Aman
243	106,9151	-0,02798	-0,01716	-0,02798	1,5	-	0,03502	-	5,1579	Aman
244	106,9151	-0,02798	-0,02063	-0,02798	1,5	-	0,03502	-	5,1579	Aman
245	106,9151	-0,02798	-0,01792	-0,02798	1,5	-	0,03502	-	5,1579	Aman
246	106,9151	-0,02798	-0,02351	-0,02798	1,5	-	0,03502	-	5,1579	Aman
247	106,9151	-0,02798	-0,01949	-0,02798	1,5	-	0,03502	-	5,1579	Aman
248	106,9151	-0,02798	-0,02710	-0,02798	1,5	-	0,03502	-	5,1579	Aman
249	106,9151	-0,02798	-0,02218	-0,02798	1,5	-	0,03502	-	5,1579	Aman
250	106,9151	-0,02798	-0,03128	-0,03128	1,5	-	0,03915	-	5,1579	Aman
251	106,9151	-0,02798	-0,02662	-0,02798	1,5	-	0,03502	-	5,1579	Aman
252	106,9151	-0,02798	-0,03503	-0,03503	1,5	-	0,04384	-	5,1579	Aman
253	106,9151	-0,02798	-0,03484	-0,03484	1,5	-	0,04361	-	5,1579	Aman
254	106,9151	-0,02798	-0,02683	-0,02798	1,5	-	0,03502	-	5,1579	Aman
255	106,9151	-0,02798	-0,03109	-0,03109	1,5	-	0,03502	-	5,1579	Aman
256	106,9151	-0,02798	-0,02242	-0,02798	1,5	-	0,03502	-	5,1579	Aman
257	106,9151	-0,02798	-0,02692	-0,02798	1,5	-	0,03502	-	5,1579	Aman
258	106,9151	-0,02798	-0,01978	-0,02798	1,5	-	0,03502	-	5,1579	Aman
259	106,9151	-0,02798	-0,02333	-0,02798	1,5	-	0,03502	-	5,1579	Aman
260	106,9151	-0,02798	-0,01828	-0,02798	1,5	-	0,03502	-	5,1579	Aman
261	106,9151	-0,02798	-0,02046	-0,02798	1,5	-	0,03502	-	5,1579	Aman
262	106,9151	-0,02798	-0,01747	-0,02798	1,5	-	0,03502	-	5,1579	Aman
263	106,9151	-0,02798	-0,01861	-0,02798	1,5	-	0,03502	-	5,1579	Aman
264	106,9151	-0,02798	-0,01735	-0,02798	1,5	-	0,03502	-	5,1579	Aman
265	106,9151	-0,02798	-0,01781	-0,02798	1,5	-	0,03502	-	5,1579	Aman
266	106,9151	-0,02798	-0,01807	-0,02798	1,5	-	0,03502	-	5,1579	Aman

1	2	3	4	5	6	7	8	9	10	11
267	106,9151	-0,02798	-0,01791	-0,02798	1,5	-	0,03502	-	5,1579	Aman
268	106,9151	-0,02798	-0,02003	-0,02798	1,5	-	0,03502	-	5,1579	Aman
269	106,9151	-0,02798	-0,01850	-0,02798	1,5	-	0,03502	-	5,1579	Aman
270	106,9151	-0,02798	-0,02290	-0,02798	1,5	-	0,03502	-	5,1579	Aman
271	106,9151	-0,02798	-0,01987	-0,02798	1,5	-	0,03502	-	5,1579	Aman
272	106,9151	-0,02798	-0,02654	-0,02798	1,5	-	0,03502	-	5,1579	Aman
273	106,9151	-0,02798	-0,02234	-0,02798	1,5	-	0,03502	-	5,1579	Aman
274	106,9151	-0,02798	-0,03082	-0,03082	1,5	-	0,03857	-	5,1579	Aman
275	106,9151	-0,02798	-0,02651	-0,02798	1,5	-	0,03502	-	5,1579	Aman
276	106,9151	-0,02798	-0,03475	-0,03475	1,5	-	0,04350	-	5,1579	Aman
277	106,9152	-0,03555	-0,04006	-0,04006	1,5	-	0,05014	-	5,1579	Aman
278	106,9152	-0,03312	-0,03716	-0,03716	1,5	-	0,04651	-	5,1579	Aman
279	106,9152	-0,03311	-0,02885	-0,03311	1,5	-	0,04144	-	5,1579	Aman
280	106,9152	-0,03556	-0,04060	-0,04060	1,5	-	0,05082	-	5,1579	Aman
281	106,9152	-0,03556	-0,02977	-0,03556	1,5	-	0,04451	-	5,1579	Aman
282	106,9152	-0,03311	-0,03520	-0,03520	1,5	-	0,04406	-	5,1579	Aman
283	106,9152	-0,03312	-0,02108	-0,03312	1,5	-	0,04145	-	5,1579	Aman
284	106,9152	-0,03555	-0,03877	-0,03877	1,5	-	0,04852	-	5,1579	Aman
285	106,9152	-0,03555	-0,02711	-0,03555	1,5	-	0,04449	-	5,1579	Aman
286	106,9152	-0,03312	-0,02701	-0,03312	1,5	-	0,04145	-	5,1579	Aman
287	106,9152	-0,03311	-0,02197	-0,03311	1,5	-	0,0414	-	5,1579	Aman
288	106,9152	-0,03556	-0,03035	-0,03556	1,5	-	0,04451	-	5,1579	Aman
289	106,9152	-0,03556	-0,03011	-0,03556	1,5	-	0,04151	-	5,1579	Aman
290	106,9152	-0,03311	-0,02245	-0,03311	1,5	-	0,04144	-	5,1579	Aman
291	106,9152	-0,03312	-0,02649	-0,03312	1,5	-	0,04145	-	5,1579	Aman
292	106,9152	-0,03555	-0,02837	-0,03555	1,5	-	0,04449	-	5,1579	Aman
293	106,9152	-0,03555	-0,03726	-0,03726	1,5	-	0,04663	-	5,1579	Aman
294	106,9152	-0,03312	-0,02099	-0,03312	1,5	-	0,04145	-	5,1579	Aman
295	106,9152	-0,03311	-0,03485	-0,03485	1,5	-	0,04237	-	5,1579	Aman
296	106,9152	-0,03556	-0,02820	-0,03556	1,5	-	0,04451	-	5,1579	Aman
297	106,9152	-0,03556	-0,04187	-0,04187	1,5	-	0,05240	-	5,1579	Aman
298	106,9152	-0,03311	-0,02780	-0,03311	1,5	-	0,04144	-	5,1579	Aman
299	106,9152	-0,03312	-0,03820	-0,03820	1,5	-	0,04781	-	5,1579	Aman
300	106,9152	-0,03555	-0,03956	-0,03956	1,5	-	0,04952	-	5,1579	Aman
301	106,9152	-0,03555	-0,03982	-0,03982	1,5	-	0,04984	-	5,1579	Aman
302	106,9152	-0,03312	-0,03796	-0,03796	1,5	-	0,04751	-	5,1579	Aman
303	106,9152	-0,03311	-0,02808	-0,03311	1,5	-	0,04144	-	5,1579	Aman
304	106,9152	-0,03556	-0,04167	-0,04167	1,5	-	0,05215	-	5,1579	Aman
305	106,9152	-0,03556	-0,02849	-0,03556	1,5	-	0,04451	-	5,1579	Aman

1	2	3	4	5	6	7	8	9	10	11
306	106,9152	-0,03311	-0,03470	-0,03470	1,5	-	0,04343	-	5,1579	Aman
307	106,9152	-0,03312	-0,02126	-0,03312	1,5	-	0,04145	-	5,1579	Aman
308	106,9152	-0,03555	-0,03722	-0,03722	1,5	-	0,04658	-	5,1579	Aman
309	106,9152	-0,03555	-0,02857	-0,03555	1,5	-	0,04449	-	5,1579	Aman
310	106,9152	-0,03312	-0,02648	-0,03312	1,5	-	0,04145	-	5,1579	Aman
311	106,9152	-0,03311	-0,02266	-0,03311	1,5	-	0,04144	-	5,1579	Aman
312	106,9152	-0,03556	-0,03052	-0,03556	1,5	-	0,04451	-	5,1579	Aman
313	106,9152	-0,03556	-0,03016	-0,03556	1,5	-	0,04451	-	5,1579	Aman
314	106,9152	-0,03311	-0,02291	-0,03311	1,5	-	0,04144	-	5,1579	Aman
315	106,9152	-0,03312	-0,02618	-0,03312	1,5	-	0,04145	-	5,1579	Aman
316	106,9152	-0,03555	-0,02889	-0,03555	1,5	-	0,04449	-	5,1579	Aman
317	106,9152	-0,03555	-0,03679	-0,03679	1,5	-	0,04605	-	5,1579	Aman
318	106,9152	-0,03312	-0,02141	-0,03312	1,5	-	0,04145	-	5,1579	Aman
319	106,9152	-0,03311	-0,03438	-0,03438	1,5	-	0,04303	-	5,1579	Aman
320	106,9152	-0,03556	-0,02843	-0,03556	1,5	-	0,04451	-	5,1579	Aman
321	106,9152	-0,03556	-0,04151	-0,04151	1,5	-	0,05195	-	5,1579	Aman
322	106,9152	-0,03311	-0,02776	-0,03311	1,5	-	0,04144	-	5,1579	Aman
323	106,9152	-0,03312	-0,03807	-0,03807	1,5	-	0,04765	-	5,1579	Aman
324	106,9152	-0,03555	-0,03917	-0,03917	1,5	-	0,04902	-	5,1579	Aman
325	106,6891	-0,04848	-0,04479	-0,04848	1,5	-	0,06068	-	5,1579	Aman
326	106,6891	-0,04849	-0,05565	-0,05565	1,5	-	0,06965	-	5,1795	Aman
327	106,6891	-0,04849	-0,03563	-0,04849	1,5	-	0,06069	-	5,1795	Aman
328	106,6891	-0,04848	-0,05572	-0,05572	1,5	-	0,06974	-	5,1795	Aman
329	106,6891	-0,04848	-0,03643	-0,04848	1,5	-	0,06068	-	5,1795	Aman
330	106,6891	-0,04849	-0,04695	-0,04849	1,5	-	0,06069	-	5,1795	Aman
331	106,6891	-0,04849	-0,04631	-0,04849	1,5	-	0,06069	-	5,1795	Aman
332	106,6891	-0,04848	-0,03701	-0,04848	1,5	-	0,06068	-	5,1795	Aman
333	106,6891	-0,04848	-0,05539	-0,05539	1,5	-	0,06933	-	5,1795	Aman
334	106,6891	-0,04849	-0,03524	-0,04849	1,5	-	0,06069	-	5,1795	Aman
335	106,6891	-0,04849	-0,05637	-0,05637	1,5	-	0,07055	-	5,1795	Aman
336	106,6891	-0,04848	-0,04404	-0,04848	1,5	-	0,06068	-	5,1795	Aman
337	106,6891	-0,04848	-0,04440	-0,04848	1,5	-	0,06068	-	5,1795	Aman
338	106,6891	-0,04849	-0,05608	-0,05608	1,5	-	0,07019	-	5,1795	Aman
339	106,6891	-0,04849	-0,03549	-0,04849	1,5	-	0,06069	-	5,1795	Aman
340	106,6891	-0,04848	-0,05533	-0,05533	1,5	-	0,06925	-	5,1795	Aman
341	106,6891	-0,04848	-0,03694	-0,04848	1,5	-	0,06068	-	5,1795	Aman
342	106,6891	-0,04849	-0,04670	-0,04849	1,5	-	0,06069	-	5,1795	Aman
343	106,6891	-0,04849	-0,04627	-0,04849	1,5	-	0,06069	-	5,1795	Aman
344	106,6891	-0,04848	-0,03728	-0,04848	1,5	-	0,06068	-	5,1795	Aman

1	2	3	4	5	6	7	8	9	10	11
345	106,6891	-0,04848	-0,05506	-0,05506	1,5	-	0,06891	-	5,1795	Aman
346	106,6891	-0,04849	-0,03549	-0,04849	1,5	-	0,06069	-	5,1795	Aman
347	106,6891	-0,04849	-0,05628	-0,05628	1,5	-	0,07044	-	5,1795	Aman
348	106,6891	-0,04848	-0,04386	-0,04848	1,5	-	0,06068	-	5,1795	Aman
349	106,6891	-0,53317	-0,53748	-0,53748	1,5	-	0,67270	-	9,6360	Aman
350	100,2873	-0,53317	-0,52141	-0,53317	1,5	-	0,66730	-	9,6360	Aman
351	100,2873	-0,53317	-0,53707	-0,53707	1,5	-	0,67218	-	9,6360	Aman
352	100,2873	-0,53317	-0,53732	-0,53732	1,5	-	0,67250	-	9,6360	Aman
353	100,2873	-0,53317	-0,52157	-0,53317	1,5	-	0,66730	-	9,6360	Aman
354	100,2873	-0,53317	-0,53694	-0,53694	1,5	-	0,67202	-	9,6360	Aman
355	106,6891	-0,09856	-0,11088	-0,11088	1,5	-	0,13877	-	5,1795	Aman
356	106,6891	-0,09856	-0,10260	-0,10260	1,5	-	0,12841	-	5,1795	Aman
357	106,6891	-0,09856	-0,09709	-0,09856	1,5	-	0,12335	-	5,1795	Aman
358	106,6891	-0,09856	-0,09154	-0,09856	1,5	-	0,12335	-	5,1795	Aman
359	106,6891	-0,09856	-0,09678	-0,09856	1,5	-	0,12335	-	5,1795	Aman
360	106,6891	-0,09856	-0,10155	-0,10155	1,5	-	0,12710	-	5,1795	Aman
361	106,6891	-0,09856	-0,11110	-0,11110	1,5	-	0,13905	-	5,1795	Aman
362	106,6891	-0,09856	-0,10168	-0,10168	1,5	-	0,12726	-	5,1795	Aman
363	106,6891	-0,09856	-0,09695	-0,09856	1,5	-	0,12335	-	5,1795	Aman
364	106,6891	-0,09856	-0,09186	-0,09856	1,5	-	0,12335	-	5,1795	Aman
365	106,6891	-0,09856	-0,09678	-0,09856	1,5	-	0,12335	-	5,1795	Aman
366	106,6891	-0,09856	-0,10136	-0,10136	1,5	-	0,12686	-	5,1795	Aman
367	100,2873	-0,53316	-0,54647	-0,54647	1,5	-	0,68394	-	9,6360	Aman
368	100,2873	-0,53316	-0,52850	-0,53316	1,5	-	0,66728	-	9,6360	Aman
369	100,2873	-0,53316	-0,52807	-0,53316	1,5	-	0,66728	-	9,6360	Aman
370	100,2873	-0,53316	-0,54657	-0,54657	1,5	-	0,68407	-	9,6360	Aman
371	100,2873	-0,53316	-0,52842	-0,53316	1,5	-	0,66728	-	9,6360	Aman
372	100,2873	-0,53316	-0,52813	-0,53316	1,5	-	0,66728	-	9,6360	Aman

Tabel 4.8 : Perhitungan Sambungan Baut

Joint	P max (Kips)	D (in)	A (in^2)	ft (ksi)	Ft (ksi)	Chek
1 – 24	0,02979	0,625	0,3068	0,03730	20,0	Aman
25 – 48	0,08641	0,625	0,3068	0,10815	20,0	Aman
49 – 72	0,07401	0,625	0,3068	0,09263	20,0	Aman
73 – 96	0,10533	0,625	0,3068	0,13183	20,0	Aman
97 – 120	0,15797	0,625	0,3068	0,19771	20,0	Aman
121 –132	0,70710	0,625	0,3068	0,88498	20,0	Aman
133	0,54657	0,625	0,3068	0,68407	20,0	Aman

BAB V

PEMBAHASAN

5.1. Pengecekan Kapasitas Batang

Berdasarkan perhitungan gaya batang dari program SAP 90 , dilakukan pengecekan kapasitas batang . Pengecekan itu dilakukan dengan menggunakan rumus-rumus AISC dan mengganti profil untuk batang-batang yang tidak aman.

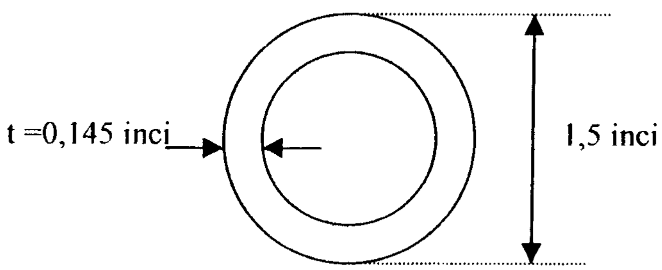
Dengan K = 1

E = 29500 Ksi

Fy = 36 Ksi

Fa = 0,6.Fy

∅ = 1,5 inci untuk semua batang



Untuk semua batang ukuran diameter ∅1,5 inci , A = 0,799 in^2 , r = 0,623 in

$P_t = 0,6\ F_y\ A_g =\ 0,6.\ 36.\ 0,799 = 17,2584$ Kips

$F_a = 0,6\ F_y = 0,6.\ 36 = 21,6$ Ksi

$$C_c = \sqrt{\frac{2\pi^2 E}{F_y}} = \sqrt{\frac{2\pi^2\ 29500}{36}} = 127{,}1817$$

a. Batang H_{tarik} pada batang 43, P = 86,41 lbs = 0,08641 Kips

$$f_a = \frac{P}{A_g} = \frac{0{,}08641}{0{,}799} = 0{,}10815\ Ksi$$

fa < Fa ⟶ Aman

b. Batang H_{tarik} pada batang 66, P = 74,01 lbs = Kips

$$f_a = \frac{P}{A_g} = \frac{0{,}07401}{0{,}799} = 0{,}09263\ Ksi$$

fa < Fa ⟶ Aman

c. Batang H_{tarik} pada batang 85, P = 105,33 lbs = 0,10533 Kips

$$f_a = \frac{P}{A_g} = \frac{0{,}10533}{0{,}799} = 0{,}13183\ Ksi$$

fa < Fa ⟶ Aman

d. Batang H_{tarik} pada batang 97, P = 157,97 lbs = 0,15797 Kips

$$f_a = \frac{P}{A_g} = \frac{0{,}15797}{0{,}799} = 0{,}19771\ Ksi$$

fa < Fa ⟶ Aman

e. Batang H_{tarik} pada batang 126, P = 707,10 lbs = 0,70710 Kips

$$f_a = \frac{P}{A_g} = \frac{0{,}70710}{0{,}799} = 0{,}88498\ Ksi$$

fa < Fa ⟶ Aman

f. Batang D_{desak} pada batang 159, P = 29,79 lbs = 0,02979Kips ;

L = 114,0990 inci

$$\frac{Kl}{r} = \frac{1.114,0990}{0,623} = 183,1445$$

$$\frac{Kl}{r} > C_c$$

$$F_a = \frac{\pi^2 . E}{(23/12).\left(Kl/_r\right)^2} = \frac{\pi^2 . 29500}{(23/12).(183,1445)^2} = 4,5288 \quad Ksi$$

$$f_a = \frac{P}{A_g} = \frac{0,02979}{0,799} = 0,0373 \; Ksi$$

fa < Fa ⟶ Aman

g. Batang D_{desak} pada batang 205, P = 33,00 lbs = 0,03300 Kips ;

L = 114,0995 inci

$$\frac{Kl}{r} = \frac{1.114,0995}{0,623} = 183,1453$$

$$\frac{Kl}{r} > C_c$$

$$F_a = \frac{\pi^2 . E}{(23/12).\left(Kl/_r\right)^2} = \frac{\pi^2 . 29500}{(23/12).(183,1453)^2} = 4,5288 \quad Ksi$$

$$f_a = \frac{P}{A_g} = \frac{0,03300}{0,799} = 0,04130 \quad Ksi$$

fa < Fa ⟶ Aman

h. Batang D_{desak} pada batang 253, P = 34,84 lbs = 0,03484 Kips ;

L = 106,9151 inci

$$\frac{Kl}{r} = \frac{1.106,9151}{0,623} = 171,6133$$

$$\frac{Kl}{r} > C_c$$

$$F_a = \frac{\pi^2 . E}{(23/12).\left(Kl/_r\right)^2} = \frac{\pi^2 . 29500}{(23/12).(171{,}6133)^2} = 5{,}1579 \quad Ksi$$

$$f_a = \frac{P}{A_g} = \frac{0{,}03484}{0{,}799} = 0{,}04361 \quad Ksi$$

fa < Fa ⟶ Aman

i. Batang D_{desak} pada batang 304, P = 41,67 lbs = 0,04167 Kips ;

L = 106,9152 inci

$$\frac{Kl}{r} = \frac{1.106{,}9152}{0{,}623} = 171{,}6135$$

$$\frac{Kl}{r} > C_c$$

$$F_a = \frac{\pi^2 . E}{(23/12).\left(Kl/_r\right)^2} = \frac{\pi^2 . 29500}{(23/12).(171{,}6135)^2} = 5{,}1579 \quad Ksi$$

$$f_a = \frac{P}{A_g} = \frac{0{,}04167}{0{,}799} = 0{,}05215 \quad Ksi$$

fa < Fa ⟶ Aman

j. Batang D_{desak} pada batang 335, P = 56,37 lbs = 0,05637 Kips ;

L = 106,6891 inci

$$\frac{Kl}{r} = \frac{1.106{,}6891}{0{,}623} = 171{,}2506$$

$$\frac{Kl}{r} > C_c$$

$$F_a = \frac{\pi^2 . E}{(23/12).\left(\frac{Kl}{r}\right)^2} = \frac{\pi^2 . 29500}{(23/12).(171,5160)^2} = 5,1795 \quad Ksi$$

$$f_a = \frac{P}{A_g} = \frac{0,05637}{0,799} = 0,07055 \quad Ksi$$

fa < Fa ⟶ Aman

k. Batang D_{desak} pada batang 349, P = 537,48 lbs = 0,53748 Kips ;

L = 100,2873 inci

$$\frac{Kl}{r} = \frac{1.100,2873}{0,623} = 125,5160$$

$$\frac{Kl}{r} < C_c$$

$$FS = \frac{5}{3} + \left[\frac{3}{8}\frac{\left(\frac{Kl}{r}\right)}{C_c}\right] - \left[\frac{1}{8}\frac{\left(\frac{Kl}{r}\right)^3}{C_c^3}\right]$$

$$= \frac{5}{3} + \left[\frac{3}{8}.\frac{125,5160}{127,1817}\right] - \left[\frac{1}{8}.\frac{(125,5160)^3}{(127,1817)^3}\right] = 1,9166$$

$$F_a = \frac{F_y}{FS}\left[1 - \frac{\left(\frac{Kl}{r}\right)^2}{2C_c^2}\right] = \frac{36}{1,9166}\left[1 - \frac{(125,5160)^2}{2(127,1817)^2}\right] = 9,6360 \quad Ksi$$

$$f_a = \frac{P}{A_g} = \frac{0,53748}{0,799} = 0,67270 \; Ksi$$

fa < Fa ⟶ Aman

l. Batang D_{desak} pada batang 361, P = 111,10 lbs = 0,11110 Kips ;

L = 106,6891 inci

$$\frac{Kl}{r} = \frac{1.106,6891}{0,623} = 171,2506$$

$$\frac{Kl}{r} > C_c$$

$$F_a = \frac{\pi^2 . E}{(23/12).\left(Kl/_r\right)^2} = \frac{\pi^2 . 29500}{(23/12).(171{,}5160)^2} = 5{,}1795 \quad Ksi$$

$$f_a = \frac{P}{A_g} = \frac{0{,}11110}{0{,}799} = 0{,}13905 \quad Ksi$$

fa < Fa ⟶ Aman

m. Batang D_{desak} pada batang 370, P = 546,57 lbs = 0,54657 Kips ;

L = 100,2873 inci

$$\frac{Kl}{r} = \frac{1.100{,}2873}{0{,}623} = 125{,}5160$$

$$\frac{Kl}{r} < C_c$$

$$FS = \frac{5}{3} + \left[\frac{3}{8}\frac{\left(Kl/_r\right)}{C_c}\right] - \left[\frac{1}{8}\frac{\left(Kl/_r\right)^3}{C_c^3}\right]$$

$$= \frac{5}{3} + \left[\frac{3}{8}.\frac{125{,}5160}{127{,}1817}\right] - \left[\frac{1}{8}.\frac{(125{,}5160)^3}{(127{,}1817)^3}\right] = 1{,}9166$$

$$F_a = \frac{F_y}{FS}\left[1 - \frac{\left(KL/_r\right)^2}{2C_c^2}\right] = \frac{36}{1{,}9166}\left[1 - \frac{(125{,}5160)^2}{2(127{,}1817)^2}\right] = 9{,}6360 \quad Ksi$$

$$f_a = \frac{P}{A_g} = \frac{0{,}54657}{0{,}799} = 0{,}68407 \ Ksi$$

fa < Fa ⟶ Aman

5.2 Perhitungan Alat Sambung

Untuk kemudahan pabrikasi maka pada setiap lapis dari kubah digunakan diameter baut dan *ball joint* yang sama. Baut yang digunakan adalah baut A307 dalam AISC tabel 4.3.1.a.

Perhitungan dilakukan dengan mengambil nilai :

Tegangan leleh baut = 36 ksi

Tegangan aksial baja = 0,33 x Fu = 20 ksi

Ball joint yang digunakan adalah bola baja dengan tegangan leleh 4480 kg/cm^2. Sehingga tidak perlu dilakukan pengecekan kekuatan *ball joint* , karena tegangan lelehnya jauh lebih besar daripada tegangan leleh baut. Oleh karena itu *ball joint* dianggap kuat.

Alat sambung yang digunakan batang berulir yang diasumsikan batang tarik sehingga diameter minimum batang dibatasi sebesar 3/8 inci. Untuk mencari diameter batang tarik berulir tersebut dicari dengan cara sebagai berikut :

a. Batang 125 sebagai batang tarik

P = 707,10 lbs = 0,70710 Kips

$$A_{perlu} = \frac{P}{0{,}33\,F_u} = \frac{0{,}70710}{0{,}33.58} = 0{,}03695 \qquad inci^2$$

didapat diameter batang ulir 5/8 inci dengan luas A= 0,3068 inci^2

b. Batang 159 sebagai batang tarik

P = 29,79 lbs = 0,02979 Kips

$$A_{perlu} = \frac{P}{0{,}33\,F_u} = \frac{0{,}02979}{0{,}33.58} = 1{,}55643E\text{-}03 \ i$$

didapat diameter batang ulir 5/8 inci dengan luas A = 0,3068 inci

kemudian dicari kekuatan las pada sambungan batang berulir tersebut dengan batang dari rangka dengan cara sebagai berikut :

$$F_t = 0{,}30\,F_u = 0{,}30 \,.\, 58 = 17{,}4 \quad Ksi$$

A_{perlu} disini adalah luas bagian yang akan dilas sama dengan luas dari permukaan batang tarik dengan diameter 1,5 inci maka luasnya adalah 0,4418 inci^2.

$$P_t = A_{perlu} \,.\, F_t = 0{,}4418 \,.\, 17{,}4 = 7{,}68732 \quad Kips$$

Jadi setelah dihitung semua sambungan menggunakan alat sambung baut berulir dengan ukuran diameter 5/8 inci .

BAB VI

KESIMPULAN DAN SARAN

6.1 KESIMPULAN

Dari hasil perencanaan struktur ruang bentuk kubah dapat ditarik kesimpulan sebagai berikut:

1. Struktur kubah ini menggunakan profil pipa yang berbeda, karena disesuaikan dengan kebutuhan batangnya.
2. Karena kubah yang direncanakan memiliki bentang yang relatif kecil dan jenis penutup yang ringan maka kubah satu lapis lebih efektif.
3. Untuk perhitungan gaya batang struktur ruang, program SAP 90 dapat digunakan.
4. Karena menggunakan pendekatan SPACE TRUSS maka hanya gaya aksial saja yang bekerja.
5. Dimensi batang yang digunakan baik untuk batang horisontal dan batang diagonal semuanya menggunakan diameter ukuran 1,5 inch.
6. Tidak disertakannya beban gempa dalam perencanaan ini karena berat keseluruhan kubah relatif kecil sehingga pengaruh beban gempa terhadap struktur kubah dapat diabaikan. Sedangkan beban gempa diperhitungkan bila merencanakan balok dan kolom struktur secara keseluruhan atau bila berat total struktur kubah cukup besar.
7. Alat sambung Mero memiliki kekuatan yang besar dan proses pemasangan yang mudah.

6.2. SARAN

1. Dalam pemilihan konfigurasi batang sebaiknya digunakan dengan panjang bentang dan jenis penutup yang akan digunakan. Dan untuk perencanaannya diupayakan sedemikian rupa sehingga setiap joint menerima beban yang besarnya cenderung seragam.
2. Dari perbedaan gaya batang yang terjadi diperoleh dimensi batang yang berbeda pada batang horisontal maupun batang diagonal. Namun guna kemudahan pelaksanaan pemasangan disarankan menggunakan profil dengan dimensi yang sama dan memenuhi syarat keamanan.
3. Asumsi awal batang dilakukan dengan mempertimbangkan panjang batang, luas daerah pembebanan dan mutu baja, disamping berdasarkan pengalaman pada proyek struktur ruang yang ada.
4. Agar perhitungan beban penutup lebih akurat, perlu dipertimbangkan juga posisi penutup yang berada diatas rangka kubah, karena pada kenyataannya luas penutup tersebut tidak sama dengan luas bidang segitiga yang membentuk rangka kubah.

DAFTAR PUSTAKA

1. Arbabi, F., 1991, ***Structural Analysis and Behavior***, International Edition, Civil Engineering Series, McGraw-Hill, Inc.,
2. Bresler , B., 1968 , ***Design of Steel Structure***, Second Edition, Wiley Int.
3. Haddori Amma dan Liana Sari, 1998, ***Desain Struktur ruang Bentuk Kubah Satu Lapis***, Tugas Akhir, Universitas Islam Indonesia, Yogyakarta.
4. Ilman Noor, Ir., MSCE., ***Diktat Kuliah Struktur Baja I***, Fakultas Teknik Sipil dan Perencanaan, Universitas Islam Indonesia, Yogyakarta.
5. John F. Fleming, 1989, ***Computer Analysis of Structural System***, International Edition, Computer Science Series, McGraw-Hill, Inc.
6. John F. Fleming, 1991, ***Analysis of Structural System***, International Edition, Prentice-Hall International, Inc.
7. Leonard Spiegel dan George F. Limbrunner, 1991, ***Desain Baja Struktural Terapan***, Penerbit PT. Eresco, Bandung.
8. Makowaski, Z.S., 1988, ***Konstruksi Ruang Baja***, Penerbit ITB, Bandung.
9. Makowaski, Z.S., 1984, ***Analysis, Design and Construction of Braced Domes***, Nichols Publishing Company, New York.
10. Salmon, C.G., 1990, ***Struktur Baja, Desain dan Perilaku***, Penerbit Erlangga, Jakarta.
11. Susastrawan, Ir., MS., ***Diktat Kuliah Mekanika Rekayasa IV***, Fakultas Teknik Sipil dan Perencanaan, Universitas Islam Indonesia, Yogyakarta.

12. Timoshenko, S.P. dan Young, D.H., 1965, ***Theory of Structures***, Second Edition, International Student Edition, McGraw-Hill, Inc.

13. Wilson, Edward L. And Habibullah, Ashraf, 1990, ***SAP 90™ A Series of Computer Programs for The Static and Dynamics Finite Element Analysis of Structures User Manual***, Computer & Structures, Inc. 1918 University Avenue, California, USA.

14. _____________, 1989, ***Manual of Steel Construction, Allowable Strees Design***, American Institute of Steel Construction Inc., Chicago.

15. _____________, 1987, ***Pedoman Perencanaan Pembebanan untuk Rumah dan Gedung***, Departemen Pekerjaan Umum, Jakarta.

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PIPE
Dimensions and properties

Dimensions				Weight per Ft	Properties				Schedule No.
Nominal Diameter In.	Outside Diameter In.	Inside Diameter In.	Wall Thickness In.	Lbs. Plain Ends	A In.^{2}	I In.^{4}	S In.^{3}	r In.	
Standard Weight									
½	.840	.622	.109	.85	.250	.017	.041	.261	40
¾	1.050	.824	.113	1.13	.333	.037	.071	.334	40
1	1.315	1.049	.133	1.68	.494	.087	.133	.421	40
1¼	1.660	1.380	.140	2.27	.669	.195	.235	.540	40
1½	1.900	1.610	.145	2.72	.799	.310	.326	.623	40
2	2.375	2.067	.154	3.65	1.07	.666	.561	.787	40
2½	2.875	2.469	.203	5.79	1.70	1.53	1.06	.947	40
3	3.500	3.068	.216	7.58	2.23	3.02	1.72	1.16	40
3½	4.000	3.548	.226	9.11	2.68	4.79	2.39	1.34	40
4	4.500	4.026	.237	10.79	3.17	7.23	3.21	1.51	40
5	5.563	5.047	.258	14.62	4.30	15.2	5.45	1.88	40
6	6.625	6.065	.280	18.97	5.58	28.1	8.50	2.25	40
8	8.625	7.981	.322	28.55	8.40	72.5	16.8	2.94	40
10	10.750	10.020	.365	40.48	11.9	161	29.9	3.67	40
12	12.750	12.000	.375	49.56	14.6	279	43.8	4.38	—
Extra Strong									
½	.840	.546	.147	1.09	.320	.020	.048	.250	80
¾	1.050	.742	.154	1.47	.433	.045	.085	.321	80
1	1.315	.957	.179	2.17	.639	.106	.161	.407	80
1¼	1.660	1.278	.191	3.00	.881	.242	.291	.524	80
1½	1.900	1.500	.200	3.63	1.07	.391	.412	.605	80
2	2.375	1.939	.218	5.02	1.48	.868	.731	.766	80
2½	2.875	2.323	.276	7.66	2.25	1.92	1.34	.924	80
3	3.500	2.900	.300	10.25	3.02	3.89	2.23	1.14	80
3½	4.000	3.364	.318	12.50	3.68	6.28	3.14	1.31	80
4	4.500	3.826	.337	14.98	4.41	9.61	4.27	1.48	80
5	5.563	4.813	.375	20.78	6.11	20.7	7.43	1.84	80
6	6.625	5.761	.432	28.57	8.40	40.5	12.2	2.19	80
8	8.625	7.625	.500	43.39	12.8	106	24.5	2.88	80
10	10.750	9.750	.500	54.74	16.1	212	39.4	3.63	80
12	12.750	11.750	.500	65.42	19.2	362	56.7	4.33	—
Double-Extra Strong									
2	2.375	1.503	.436	9.03	2.66	1.31	1.10	.703	—
2½	2.875	1.771	.552	13.69	4.03	2.87	2.00	.844	—
3	3.500	2.300	.600	18.58	5.47	5.99	3.42	1.05	—
4	4.500	3.152	.674	27.54	8.10	15.3	6.79	1.37	—
5	5.563	4.063	.750	38.55	11.3	33.6	12.1	1.72	—
6	6.625	4.897	.864	53.16	15.6	66.3	20.0	2.06	—
8	8.625	6.875	.875	72.42	21.3	162	37.6	2.76	—

The listed sections are available in conformance with ASTM Specification A53 Grade B or A501. Other sections are made to these specifications. Consult with pipe manufacturers or distributors for availability.

STRUCTURAL TUBING
Square
Dimensions and properties

Dimensions				Properties**					
Nominal* Size	Wall Thickness		Weight per Ft	Area	I	S	r	J	Z
In.	In.		Lb.	In.^{2}	In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}
16×16	0.6250	⅝	127.37	37.4	1450	182	6.23	2320	214
	0.5000	½	103.30	30.4	1200	150	6.29	1890	175
	0.3750	⅜	78.52	23.1	931	116	6.35	1450	134
	0.3125	5/16	65.87	19.4	789	98.6	6.38	1220	113
14×14	0.6250	⅝	110.36	32.4	952	136	5.42	1530	161
	0.5000	½	89.68	26.4	791	113	5.48	1250	132
	0.3750	⅜	68.31	20.1	615	87.9	5.54	963	102
	0.3125	5/16	57.36	16.9	522	74.6	5.57	812	86.1
12×12	0.6250	⅝	93.34	27.4	580	96.7	4.60	943	116
	0.5000	½	76.07	22.4	485	80.9	4.66	777	95.4
	0.3750	⅜	58.10	17.1	380	63.4	4.72	599	73.9
	0.3125	5/16	48.86	14.4	324	54.0	4.75	506	62.6
	0.2500	¼	39.43	11.6	265	44.1	4.78	410	50.8
	0.1875	3/16	29.84	8.77	203	33.8	4.81	312	38.7
10×10	0.6250	⅝	76.33	22.4	321	64.2	3.78	529	77.6
	0.5625	9/16	69.48	20.4	297	59.4	3.81	485	71.3
	0.5000	½	62.46	18.4	271	54.2	3.84	439	64.6
	0.3750	⅜	47.90	14.1	214	42.9	3.90	341	50.4
	0.3125	5/16	40.35	11.9	183	36.7	3.93	289	42.8
	0.2500	¼	32.63	9.59	151	30.1	3.96	235	34.9
	0.1875	3/16	24.73	7.27	116	23.2	3.99	179	26.6
9×9	0.6250	⅝	67.82	19.9	227	50.4	3.37	377	61.5
	0.5625	9/16	61.83	18.2	211	46.8	3.40	347	56.6
	0.5000	½	55.66	16.4	193	42.9	3.43	315	51.4
	0.3750	⅜	42.79	12.6	154	34.1	3.49	246	40.3
	0.3125	5/16	36.10	10.6	132	29.3	3.53	209	34.3
	0.2500	¼	29.23	8.59	109	24.1	3.56	170	28.0
	0.1875	3/16	22.18	6.52	83.8	18.6	3.59	130	21.4

*Outside dimensions across flat sides.
**Properties are based upon a nominal outside corner radius equal to two times the wall thickness.

BOLTS, THREADED PARTS AND RIVETS
Tension
Allowable loads in kips

TABLE I-A. BOLTS AND RIVETS
Tension on gross (nominal) area

ASTM Designation	F_t Ksi	Nominal Diameter d, In.							
		5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
		Area (Based on Nominal Diameter), In.^{2}							
		0.3068	0.4418	0.6013	0.7854	0.9940	1.227	1.485	1.767
A307 bolts	20.0	6.1	8.8	12.0	15.7	19.9	24.5	29.7	35.3
A325 bolts	44.0	13.5	19.4	26.5	34.6	43.7	54.0	65.3	77.7
A490 bolts	54.0	16.6	23.9	32.5	42.4	53.7	66.3	80.2	95.4
A502-1 rivets	23.0	7.1	10.2	13.8	18.1	22.9	28.2	34.2	40.6
A502-2,3 rivets	29.0	8.9	12.8	17.4	22.8	28.8	35.6	43.1	51.2

The above table lists ASTM specified materials that generally are intended for use as structural fasteners.
For dynamic and fatigue loading, only A325 or A490 high-strength bolts should be specified. See AISC Specification. Appendix K4.
For allowable combined shear and tension loads, see AISC ASD Specification Sects. J3.5 and J3.6.

TABLE I-B. THREADED FASTENERS
Tension on gross (nominal) area

ASTM Designation	F_y Ksi	F_u ksi	F_t ksi	Nominal Diameter d, In.							
				5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
				Area (Based on Nominal Diameter), In.^{2}							
				0.3068	0.4418	0.6013	0.7854	0.9940	1.227	1.485	1.767
A36	36	58	19.1	5.9	8.4	11.5	15.0	19.0	23.4	28.4	33.7
A572, Gr. 50	50	65	21.5	6.6	9.5	12.9	16.9	21.4	26.4	31.9	38.0
A588	50	70	23.1	7.1	10.2	13.9	18.1	23.0	28.3	34.3	40.8
A449 $d \leq 1$	92	120	39.6	12.1	17.5	23.8	31.1	—	—	—	—
A449 $1 < d \leq 1\frac{1}{2}$	81	105	34.7	—	—	—	—	34.5	42.6	51.5	61.3

The above table lists ASTM specified materials available in round bar stock that are generally intended for use in threaded applications such as tie rods, cross bracing and similar uses.
The tensile capacity of the threaded portion of an upset rod shall be larger than the body area times $0.6F_y$.
F_u = specified minimum tensile strength of the fastener material.
F_t = $0.33F_u$ = allowable tensile stress in threaded fastener.

BOLTS AND THREADED PARTS
ASTM Specifications

TABLE I-C. MATERIAL FOR ANCHOR BOLTS AND TIE RODS

	ASTM Specification	Strength, Ksi: Proof Load	Strength, Ksi: Yield (Min.)	Strength, Ksi: Tensile (Min.)	Maximum Diameter In.	Type of Material[b]	Headed or Unheaded
Bolts and Studs	A307	—	—	60	4	C	H
Bolts and Studs	A325[a]	85 74	92 81	120 105	1/2 to 1, Incl. 1 1/8 to 1 1/2 Incl.	C, QT	H
Bolts and Studs	A354 Gr. BD	120 105	130 115	150 140	1/4 to 2 1/2 Incl. over 2 1/2 to 4 Incl.	A, QT	H, U
Bolts and Studs	A354 Gr. BC	105 95	109 99	125 115	1/4 to 2 1/2 incl. over 2 1/2 to 4 Incl.	A, QT	H, U
Bolts and Studs	A449	85 74 55	92 81 58	120 105 90	1/4 to 1 Incl. 1 1/8 to 1 1/2 Incl. 1 3/4 to 3 Incl.	C, QT	H, U
Bolts and Studs	A490	120	—	150	1/2 to 1 1/2 Incl.	A, QT	H
Bolts and Studs	A687	—	105	150[c]	5/8 to 3 Incl.	A, QT, NT	U
Threaded Round Stock	A36	—	36	58	8	C	U
Threaded Round Stock	A572 Gr. 50	—	50	65	2	HSLA	U
Threaded Round Stock	A572 Gr. 42	—	42	60	6	HSLA	U
Threaded Round Stock	A588	— — —	50 46 42	70 67 63	To 4 Incl. over 4 to 5 Incl. over 5 to 8 Incl.	HSLA, ACR	U

[a]Available with weathering (atmospheric corrosion resistance) characteristics comparable to ASTM A242 and A588 steel.

[b]C = carbon
QT = quenched and tempered
A = alloy
NT = notch tough (Charpy V-notch 15 ft-lb. @ −20°F)
HSLA = high-strength low alloy
ACR = atmospheric corrosion-resistant

[c]Maximum (ultimate tensile strength)

Notes:
ASTM specified material for anchor bolts, tie rods and similar applications can be obtained from either specifications for threaded bolts and studs normally used as connectors or for structural material available in round stock that may then be threaded. The material supplier should be consulted for availability of size and length.
Suitable nuts by grade may be obtained from ASTM Specification A563.
Anchor bolt material that is quenched and tempered should not be welded or heated.
Threaded rod with properties meeting A325, A490 or A449 Specifications may be obtained by the use of an appropriate steel (such as AISI C1040 or C4140), quenched and tempered after fabrication.

```
         $$$$$$$$      $$$$$$$$$$    $$$$$$$      $$$$$$$$       $$$$$$$
       $$$$$$$$$$    $$$$$$$$$$    $$$$$$$$$$   $$$$$$$$$$$    $$$$$$$$$$
      $$           $$       $$    $$       $$   $$       $$    $$       $$
     $$           $$       $$    $$       $$   $$       $$    $$       $$
     $$$$$$$$    $$$$$$$$$$    $$$$$$$$$$     $$$$$$$$$$    $$       $$
           $$   $$       $$   $$                     $$    $$       $$
          $$   $$       $$   $$                     $$    $$       $$
 $$$$$$$$$$   $$       $$   $$           $$$$$$$$$$    $$$$$$$$$$
 $$$$$$$$    $$       $$   $$            $$$$$$$$       $$$$$$$
```

STRUCTURAL ANALYSIS PROGRAMS

VERSION P5.40

```
K3D-UNITS LBS-IN
SYSTEM
L=3

JOINTS
500      X=0          Y=0           Z=0
501      X=0          Y=0           Z=551.1811
1        X=0.0000     Y=-452.7559   Z=139.0323   A=500,501,1,23,1,15
25       X=54.4162    Y=-413.3322   Z=231.2453   A=500,501,25,23,1,15
49       X=0.0000     Y=-355.3760   Z=313.0906   A=500,501,49,23,1,15
73       X=37.0584    Y=-281.4864   Z=380.8980   A=500,501,73,23,1,15
97       X=0.0000     Y=-194.9760   Z=431.6276   A=500,501,97,23,1,15
121      X=0.0000     Y=-99.7236    Z=463.0043   A=500,501,121,11,1,30
133      X=0.0000     Y=0.0000      Z=473.6220

RESTRAINTS
1        133     1   R=0,0,0,1,1,1     : ALL JOINTS ARE THE X-Y-Z PLANE
1        24      1   R=1,1,1,0,0,0     : DUKUNGAN SENDI

FRAME
NM=1
C MATERIAL PROPERTY
1        SH=P     T=1.900,0.145        E=29500000
C LOCATION ELEMENT
1        1      2      M=1    LP=1,0   LR=1,1,0,1,1,1
24       24     1      M=1    LP=1,0   LR=1,1,0,1,1,1   G=22,1,1,1
25       48     25     M=1    LP=1,0   LR=1,1,0,1,1,1
26       25     26     M=1    LP=1,0   LR=1,1,0,1,1,1
49       49     50     M=1    LP=1,0   LR=1,1,0,1,1,1   G=22,1,1,1
72       72     49     M=1    LP=1,0   LR=1,1,0,1,1,1   G=22,1,1,1
73       96     73     M=1    LP=1,0   LR=1,1,0,1,1,1
74       73     74     M=1    LP=1,0   LR=1,1,0,1,1,1
97       97     98     M=1    LP=1,0   LR=1,1,0,1,1,1   G=22,1,1,1
120      120    97     M=1    LP=1,0   LR=1,1,0,1,1,1   G=22,1,1,1
121      121    122    M=1    LP=1,0   LR=1,1,0,1,1,1
132      132    121    M=1    LP=1,0   LR=1,1,0,1,1,1   G=10,1,1,1
133      1      25     M=1    LP=1,0   LR=1,1,0,1,1,1
134      2      25     M=1    LP=1,0   LR=1,1,0,1,1,1   G=23,2,1,1
180      1      48     M=1    LP=1,0   LR=1,1,0,1,1,1   G=22,2,1,1
181      25     49     M=1    LP=1,0   LR=1,1,0,1,1,1
182      25     50     M=1    LP=1,0   LR=1,1,0,1,1,1   G=23,2,1,1
228      48     49     M=1    LP=1,0   LR=1,1,0,1,1,1   G=22,2,1,1
229      49     73     M=1    LP=1,0   LR=1,1,0,1,1,1
230      50     73     M=1    LP=1,0   LR=1,1,0,1,1,1   G=23,2,1,1
276      49     96     M=1    LP=1,0   LR=1,1,0,1,1,1   G=22,2,1,1
277      73     97     M=1    LP=1,0   LR=1,1,0,1,1,1
278      73     98     M=1    LP=1,0   LR=1,1,0,1,1,1   G=23,2,1,1
324      96     97     M=1    LP=1,0   LR=1,1,0,1,1,1   G=22,2,1,1
325      98     121    M=1    LP=1,0   LR=1,1,0,1,1,1
326      98     122    M=1    LP=1,0   LR=1,1,0,1,1,1
327      100    122    M=1    LP=1,0   LR=1,1,0,1,1,1
328      100    123    M=1    LP=1,0   LR=1,1,0,1,1,1
329      102    123    M=1    LP=1,0   LR=1,1,0,1,1,1
33                     M=1    LP=1,0   LR=1,1,0,1,1,1
33
33
3
3
?
```

```
349     122     133     M=1     LP=1,0     LR=1,1,0,1,1,1
350     124     133     M=1     LP=1,0     LR=1,1,0,1,1,1
351     126     133     M=1     LP=1,0     LR=1,1,0,1,1,1
352     128     133     M=1     LP=1,0     LR=1,1,0,1,1,1
353     130     133     M=1     LP=1,0     LR=1,1,0,1,1,1
354     132     133     M=1     LP=1,0     LR=1,1,0,1,1,1
355     97      121     M=1     LP=1,0     LR=1,1,0,1,1,1
356     99      122     M=1     LP=1,0     LR=1,1,0,1,1,1
357     101     123     M=1     LP=1,0     LR=1,1,0,1,1,1
358     103     124     M=1     LP=1,0     LR=1,1,0,1,1,1
359     105     125     M=1     LP=1,0     LR=1,1,0,1,1,1
360     107     126     M=1     LP=1,0     LR=1,1,0,1,1,1
361     109     127     M=1     LP=1,0     LR=1,1,0,1,1,1
362     111     128     M=1     LP=1,0     LR=1,1,0,1,1,1
363     113     129     M=1     LP=1,0     LR=1,1,0,1,1,1
364     115     130     M=1     LP=1,0     LR=1,1,0,1,1,1
365     117     131     M=1     LP=1,0     LR=1,1,0,1,1,1
366     119     132     M=1     LP=1,0     LR=1,1,0,1,1,1
367     121     133     M=1     LP=1,0     LR=1,1,0,1,1,1
368     123     133     M=1     LP=1,0     LR=1,1,0,1,1,1
369     125     133     M=1     LP=1,0     LR=1,1,0,1,1,1
370     127     133     M=1     LP=1,0     LR=1,1,0,1,1,1
371     129     133     M=1     LP=1,0     LR=1,1,0,1,1,1
372     131     133     M=1     LP=1,0     LR=1,1,0,1,1,1
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25      48      1       L=1     F=0,0,-2.9150
49      72      1       L=1     F=0,0,-2.9091
73      96      1       L=1     F=0,0,-2.9073
97      119     2       L=1     F=0,0,-2.9049
98      120     2       L=1     F=0,0,-2.9075
121     131     2       L=1     F=0,0,-2.9050
122     132     2       L=1     F=0,0,-2.9066
133                     L=1     F=0,0,-2.9096
C BEBAN HIDUP
133     L=2     F=0,0,-674.46
C BEBAN ANGIN DIDISTRIBUSIKAN PADA JOINTS
25      L=3     F=96.7306,-734.7424,411.0634
26              F=829.1508,-2001.7480,1201.8113
27              F=2097.2956,-2733.2493,1910.9741
28              F=3559.0586,-2730.9612,2488.3456
29              F=4829.2823,-2000.3533,2899.4090
30              F=5558.2424,-731.7563,3109.6475
31              F=5558.2424,731.7563,3109.6475
32              F=4829.2823,2000.3533,2899.4090
33              F=3559.0586,2730.9612,2488.3456
34              F=2097.2956,2733.2493,1910.9741
35              F=829.1508,2001.7480,1201.8113
        L=3     F=96.7306,734.7424,411.0634
                F=-96.7306,734.7424,411.0634
                F=-829.1508,2001.7480,1201.8113
                F=-2097.2956,2733.2493,1910.9741
                F=-3559.0586,2730.9612,2488.3456
                F=-[illegible]
```

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F=-31.1135,236.3304,319.7945,0,0,0
F=-266.6971,643.8637,934.9716,0,0,0
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F=-146.3309,358.3821,647.8795,0,0,0
F=-444.0896,444.0896,1390.3170,0,0,0
F=-358.3821,146.3309,916.1015,0,0,0
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132 F=-51.4978,-117.0135,478.1959,0,0,0
133 F=0,0,0,0,0,0

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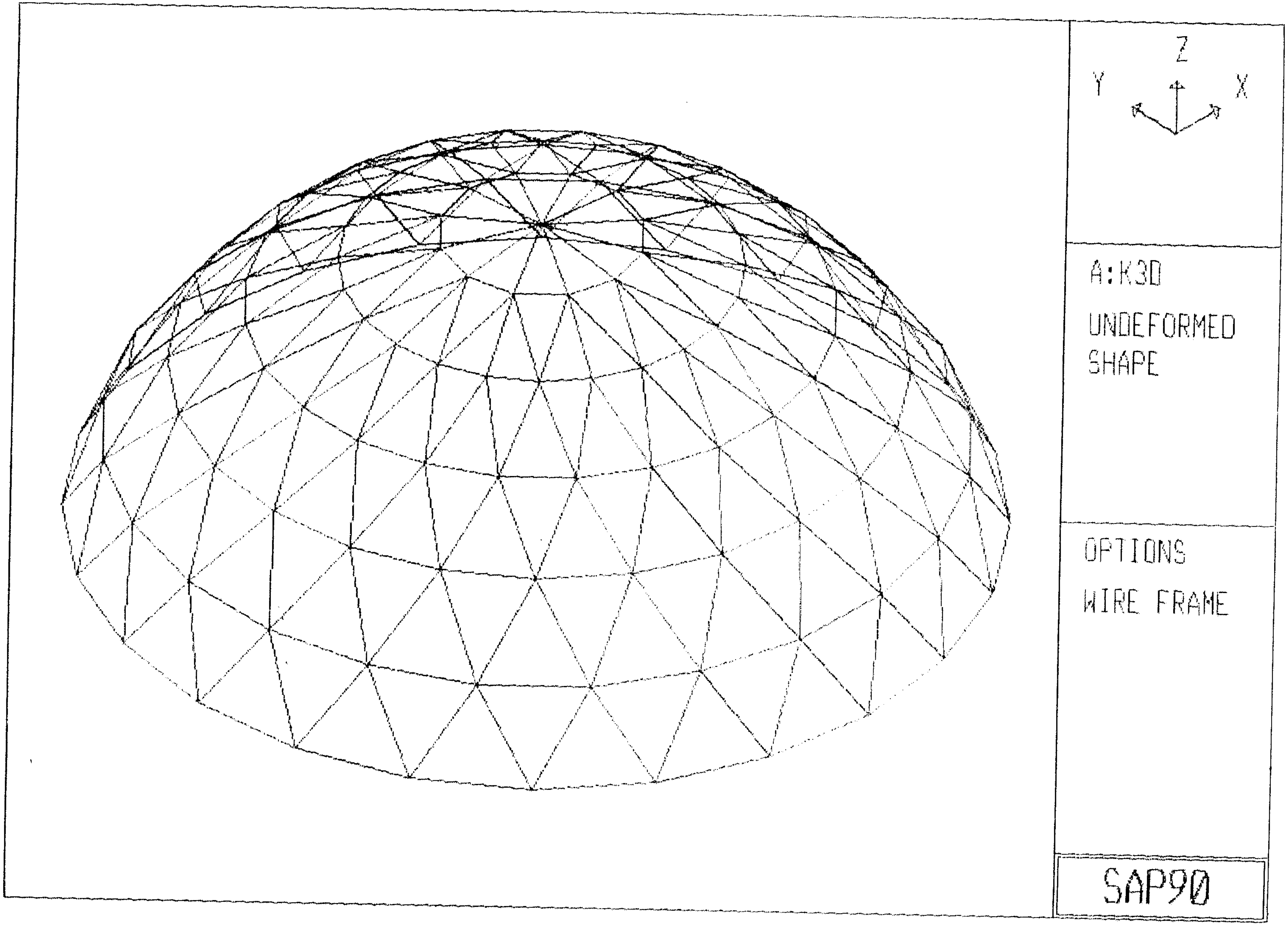
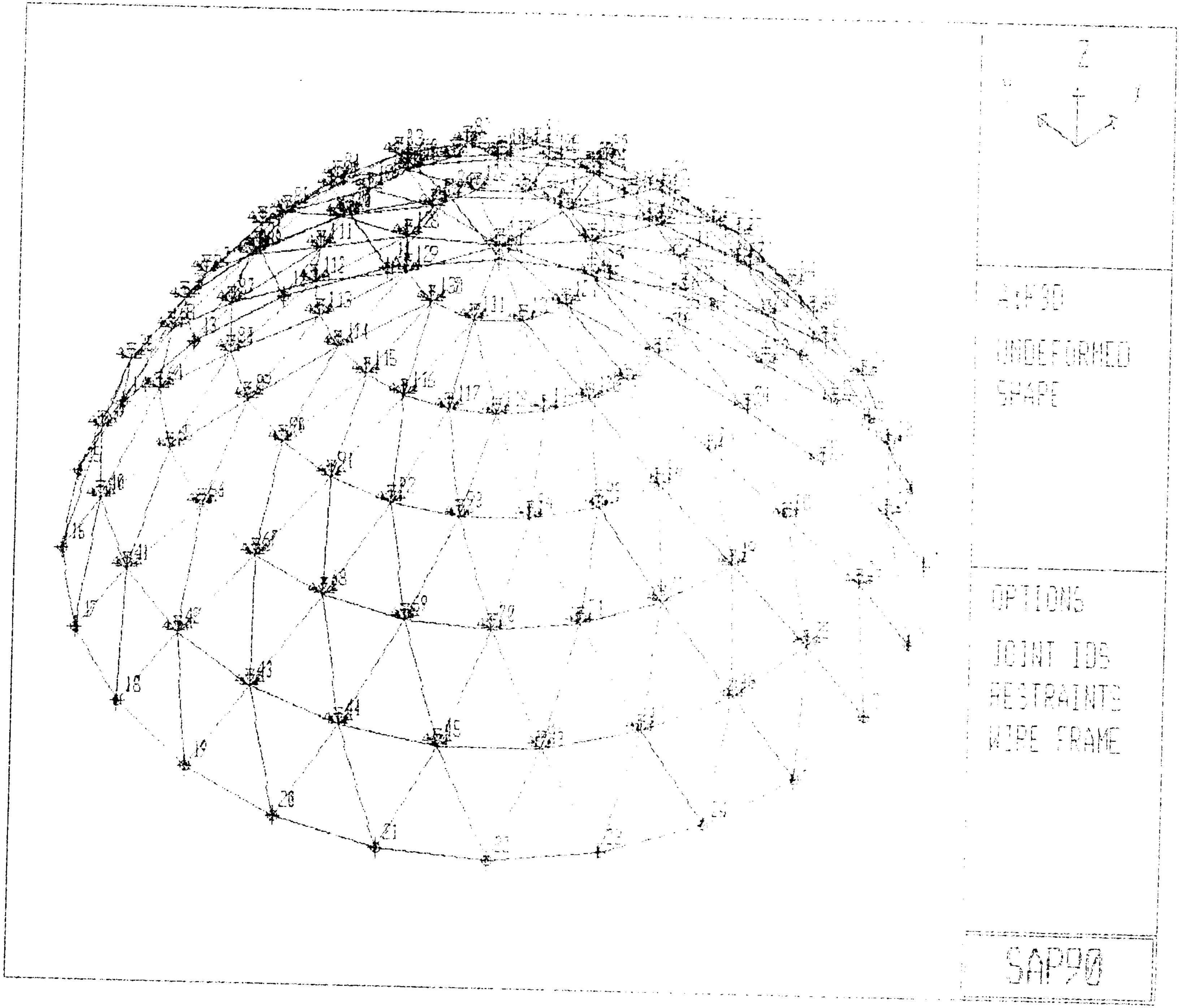
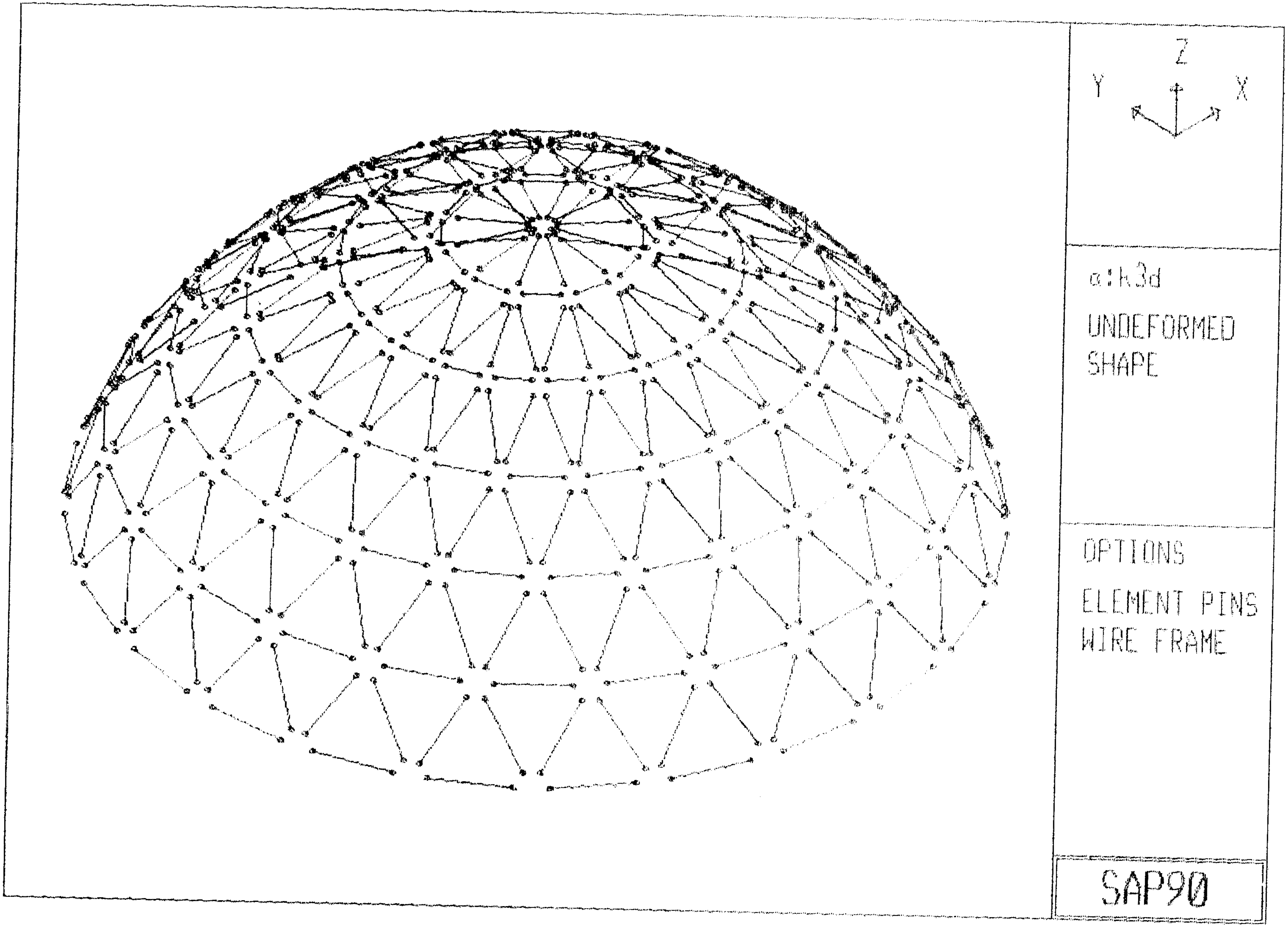


Z
Y
X
A:K3D
UNDEFORMED
SHAPE
OPTIONS
WIRE FRAME
SAP90


Z
SAP90
UNDEFORMED
SHAPE
OPTIONS
JOINT IDS
RESTRAINTS
WIRE FRAME
SAP90


Z
Y
X
a:k3d
UNDEFORMED
SHAPE
OPTIONS
ELEMENT PINS
WIRE FRAME
SAP90

```
        $$$$$$$$     $$$$$$$$$$    $$$$$$$        $$$$$$$$       $$$$$$$
      $$$$$$$$$$    $$$$$$$$$$    $$$$$$$$$$    $$$$$$$$$$$    $$$$$$$$$$
     $$            $$      $$    $$        $$   $$       $$    $$       $$
    $$            $$      $$    $$        $$   $$       $$    $$       $$
    $$$$$$$$     $$$$$$$$$$    $$$$$$$$$$     $$$$$$$$$$    $$       $$
          $$    $$      $$    $$                     $$    $$       $$
         $$    $$      $$    $$                     $$    $$       $$
$$$$$$$$$$    $$      $$    $$             $$$$$$$$$$     $$$$$$$$$$
$$$$$$$$     $$      $$    $$              $$$$$$$$        $$$$$$$
```

STRUCTURAL ANALYSIS PROGRAMS

VERSION 5.20

D-UNITS LBS-IN

PROGRAM:SAP90/FILE:K3D.SOL

OINT DISPLACEMENTS

OAD COMBINATION 1 - DISPLACEMENTS "U" AND ROTATIONS "R"

OINT	U(X)	U(Y)	U(Z)	R(X)	R(Y)	R(Z)
1	.000000	.000000	.000000	.000000	.000000	.000000
2	.000000	.000000	.000000	.000000	.000000	.000000
3	.000000	.000000	.000000	.000000	.000000	.000000
4	.000000	.000000	.000000	.000000	.000000	.000000
5	.000000	.000000	.000000	.000000	.000000	.000000
6	.000000	.000000	.000000	.000000	.000000	.000000
7	.000000	.000000	.000000	.000000	.000000	.000000
8	.000000	.000000	.000000	.000000	.000000	.000000
9	.000000	.000000	.000000	.000000	.000000	.000000
10	.000000	.000000	.000000	.000000	.000000	.000000
11	.000000	.000000	.000000	.000000	.000000	.000000
12	.000000	.000000	.000000	.000000	.000000	.000000
13	.000000	.000000	.000000	.000000	.000000	.000000
14	.000000	.000000	.000000	.000000	.000000	.000000
15	.000000	.000000	.000000	.000000	.000000	.000000
16	.000000	.000000	.000000	.000000	.000000	.000000
17	.000000	.000000	.000000	.000000	.000000	.000000
18	.000000	.000000	.000000	.000000	.000000	.000000
19	.000000	.000000	.000000	.000000	.000000	.000000
20	.000000	.000000	.000000	.000000	.000000	.000000
21	.000000	.000000	.000000	.000000	.000000	.000000
22	.000000	.000000	.000000	.000000	.000000	.000000
23	.000000	.000000	.000000	.000000	.000000	.000000
24	.000000	.000000	.000000	.000000	.000000	.000000
25	.3106E-05	-.2359E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
26	.9105E-05	-.2198E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
27	.1448E-04	-.1888E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
28	.1888E-04	-.1448E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
29	.2198E-04	-.9105E-05	.4049E-05	.0000E+00	.0000E+00	.0000E+00
30	.2359E-04	-.3106E-05	.4049E-05	.0000E+00	.0000E+00	.0000E+00
31	.2359E-04	.3106E-05	.4049E-05	.0000E+00	.0000E+00	.0000E+00
32	.2198E-04	.9105E-05	.4049E-05	.0000E+00	.0000E+00	.0000E+00
33	.1888E-04	.1448E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
34	.1448E-04	.1888E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
35	.9105E-05	.2198E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
36	.3106E-05	.2359E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
37	-.3106E-05	.2359E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
38	-.9105E-05	.2198E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
39	-.1448E-04	.1888E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
40	-.1888E-04	.1448E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
41	-.2198E-04	.9105E-05	.4049E-05	.0000E+00	.0000E+00	.0000E+00
42	-.2359E-04	.3106E-05	.4049E-05	.0000E+00	.0000E+00	.0000E+00
43	-.2359E-04	-.3106E-05	.4049E-05	.0000E+00	.0000E+00	.0000E+00
44	-.2198E-04	-.9105E-05	.4049E-05	.0000E+00	.0000E+00	.0000E+00
45	-.1888E-04	-.1448E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
46	-.1448E-04	-.1888E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
47	-.9105E-05	-.2198E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
48	-.3106E-05	-.2359E-04	.4049E-05	.0000E+00	.0000E+00	.0000E+00
49	.0000E+00	-.8898E-05	-.1286E-04	.0000E+00	.0000E+00	.0000E+00
50	.2308E-05	-.8612E-05	-.1285E-04	.0000E+00	.0000E+00	.0000E+00
51	.4449E-05	-.7707E-05	-.1286E-04	.0000E+00	.0000E+00	.0000E+00

O I N T   D I S P L A C E M E N T S

ᵓAD COMBINATION 1 - DISPLACEMENTS "U" AND ROTATIONS "R"

OINT	U(X)	U(Y)	U(Z)	R(X)	R(Y)	R(Z)
52	.6304E-05	-.6304E-05	-.1285E-04	.0000E+00	.0000E+00	.0000E+00
53	.7706E-05	-.4449E-05	-.1286E-04	.0000E+00	.0000E+00	.0000E+00
54	.8612E-05	-.2308E-05	-.1285E-04	.0000E+00	.0000E+00	.0000E+00
55	.8899E-05	.0000E+00	-.1286E-04	.0000E+00	.0000E+00	.0000E+00
56	.8612E-05	.2308E-05	-.1285E-04	.0000E+00	.0000E+00	.0000E+00
57	.7706E-05	.4449E-05	-.1286E-04	.0000E+00	.0000E+00	.0000E+00
58	.6304E-05	.6304E-05	-.1285E-04	.0000E+00	.0000E+00	.0000E+00
59	.4449E-05	.7707E-05	-.1286E-04	.0000E+00	.0000E+00	.0000E+00
60	.2308E-05	.8612E-05	-.1285E-04	.0000E+00	.0000E+00	.0000E+00
61	.0000E+00	.8898E-05	-.1286E-04	.0000E+00	.0000E+00	.0000E+00
62	-.2308E-05	.8612E-05	-.1285E-04	.0000E+00	.0000E+00	.0000E+00
63	-.4449E-05	.7707E-05	-.1286E-04	.0000E+00	.0000E+00	.0000E+00
64	-.6304E-05	.6304E-05	-.1285E-04	.0000E+00	.0000E+00	.0000E+00
65	-.7706E-05	.4449E-05	-.1286E-04	.0000E+00	.0000E+00	.0000E+00
66	-.8612E-05	.2308E-05	-.1285E-04	.0000E+00	.0000E+00	.0000E+00
67	-.8899E-05	.0000E+00	-.1286E-04	.0000E+00	.0000E+00	.0000E+00
68	-.8612E-05	-.2308E-05	-.1285E-04	.0000E+00	.0000E+00	.0000E+00
69	-.7706E-05	-.4449E-05	-.1286E-04	.0000E+00	.0000E+00	.0000E+00
70	-.6304E-05	-.6304E-05	-.1285E-04	.0000E+00	.0000E+00	.0000E+00
71	-.4449E-05	-.7707E-05	-.1286E-04	.0000E+00	.0000E+00	.0000E+00
72	-.2308E-05	-.8612E-05	-.1285E-04	.0000E+00	.0000E+00	.0000E+00
73	.1524E-05	-.1154E-04	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
74	.4450E-05	-.1076E-04	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
75	.7090E-05	-.9232E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
76	.9230E-05	-.7088E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
77	.1075E-04	-.4449E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
78	.1154E-04	-.1524E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
79	.1154E-04	.1524E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
80	.1075E-04	.4449E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
81	.9230E-05	.7088E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
82	.7090E-05	.9232E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
83	.4450E-05	.1076E-04	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
84	.1524E-05	.1154E-04	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
85	-.1524E-05	.1154E-04	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
86	-.4450E-05	.1076E-04	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
87	-.7090E-05	.9232E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
88	-.9230E-05	.7088E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
89	-.1075E-04	.4449E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
90	-.1154E-04	.1524E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
91	-.1154E-04	-.1524E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
92	-.1075E-04	-.4449E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
93	-.9230E-05	-.7088E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
94	-.7090E-05	-.9232E-05	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
95	-.4450E-05	-.1076E-04	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
96	-.1524E-05	-.1154E-04	-.1507E-04	.0000E+00	.0000E+00	.0000E+00
97	.0000E+00	-.6094E-05	-.3131E-04	.0000E+00	.0000E+00	.0000E+00
98	.1870E-05	-.6975E-05	-.2914E-04	.0000E+00	.0000E+00	.0000E+00
99	.3060E-05	-.5299E-05	-.3127E-04	.0000E+00	.0000E+00	.0000E+00
100	.5105E-05	-.5106E-05	-.2914E-04	.0000E+00	.0000E+00	.0000E+00
101	.5278E-05	-.3047E-05	-.3131E-04	.0000E+00	.0000E+00	.0000E+00
02	.6975E-05	-.1868E-05	-.2914E-04	.0000E+00	.0000E+00	.0000E+00

3D-UNITS LBS-IN

J O I N T   D I S P L A C E M E N T S

LOAD COMBINATION 1 - DISPLACEMENTS "U" AND ROTATIONS "R"

JOINT	U(X)	U(Y)	U(Z)	R(X)	R(Y)	R(Z)
103	.6119E-05	-.2003E-11	-.3127E-04	.0000E+00	.0000E+00	.0000E+00
104	.6975E-05	.1868E-05	-.2914E-04	.0000E+00	.0000E+00	.0000E+00
105	.5278E-05	.3047E-05	-.3131E-04	.0000E+00	.0000E+00	.0000E+00
106	.5105E-05	.5106E-05	-.2914E-04	.0000E+00	.0000E+00	.0000E+00
107	.3060E-05	.5299E-05	-.3127E-04	.0000E+00	.0000E+00	.0000E+00
108	.1870E-05	.6975E-05	-.2914E-04	.0000E+00	.0000E+00	.0000E+00
109	.1211E-11	.6094E-05	-.3131E-04	.0000E+00	.0000E+00	.0000E+00
110	-.1870E-05	.6975E-05	-.2914E-04	.0000E+00	.0000E+00	.0000E+00
111	-.3060E-05	.5299E-05	-.3127E-04	.0000E+00	.0000E+00	.0000E+00
112	-.5105E-05	.5106E-05	-.2914E-04	.0000E+00	.0000E+00	.0000E+00
113	-.5278E-05	.3047E-05	-.3131E-04	.0000E+00	.0000E+00	.0000E+00
114	-.6975E-05	.1868E-05	-.2914E-04	.0000E+00	.0000E+00	.0000E+00
115	-.6119E-05	.0000E+00	-.3127E-04	.0000E+00	.0000E+00	.0000E+00
116	-.6975E-05	-.1868E-05	-.2914E-04	.0000E+00	.0000E+00	.0000E+00
117	-.5278E-05	-.3047E-05	-.3131E-04	.0000E+00	.0000E+00	.0000E+00
118	-.5105E-05	-.5106E-05	-.2914E-04	.0000E+00	.0000E+00	.0000E+00
119	-.3060E-05	-.5299E-05	-.3127E-04	.0000E+00	.0000E+00	.0000E+00
120	-.1870E-05	-.6975E-05	-.2914E-04	.0000E+00	.0000E+00	.0000E+00
121	.0000E+00	-.2606E-04	.1214E-04	.0000E+00	.0000E+00	.0000E+00
122	.1300E-04	-.2253E-04	.1195E-04	.0000E+00	.0000E+00	.0000E+00
123	.2257E-04	-.1303E-04	.1214E-04	.0000E+00	.0000E+00	.0000E+00
124	.2601E-04	-.2135E-11	.1195E-04	.0000E+00	.0000E+00	.0000E+00
125	.2257E-04	.1303E-04	.1214E-04	.0000E+00	.0000E+00	.0000E+00
126	.1300E-04	.2253E-04	.1195E-04	.0000E+00	.0000E+00	.0000E+00
127	.1348E-11	.2606E-04	.1214E-04	.0000E+00	.0000E+00	.0000E+00
128	-.1300E-04	.2253E-04	.1195E-04	.0000E+00	.0000E+00	.0000E+00
129	-.2257E-04	.1303E-04	.1214E-04	.0000E+00	.0000E+00	.0000E+00
130	-.2601E-04	.1119E-11	.1195E-04	.0000E+00	.0000E+00	.0000E+00
131	-.2257E-04	-.1303E-04	.1214E-04	.0000E+00	.0000E+00	.0000E+00
132	-.1300E-04	-.2253E-04	.1195E-04	.0000E+00	.0000E+00	.0000E+00
133	.0000E+00	-.1566E-11	-.4517E-03	.0000E+00	.0000E+00	.0000E+00
500	.000000	.000000	.000000	.000000	.000000	.000000
501	.000000	.000000	.000000	.000000	.000000	.000000

D-UNITS LBS-IN

OINT DISPLACEMENTS

LOAD COMBINATION 2 - DISPLACEMENTS "U" AND ROTATIONS "R"

OINT	U(X)	U(Y)	U(Z)	R(X)	R(Y)	R(Z)
1	.000000	.000000	.000000	.000000	.000000	.000000
2	.000000	.000000	.000000	.000000	.000000	.000000
3	.000000	.000000	.000000	.000000	.000000	.000000
4	.000000	.000000	.000000	.000000	.000000	.000000
5	.000000	.000000	.000000	.000000	.000000	.000000
6	.000000	.000000	.000000	.000000	.000000	.000000
7	.000000	.000000	.000000	.000000	.000000	.000000
8	.000000	.000000	.000000	.000000	.000000	.000000
9	.000000	.000000	.000000	.000000	.000000	.000000
10	.000000	.000000	.000000	.000000	.000000	.000000
11	.000000	.000000	.000000	.000000	.000000	.000000
12	.000000	.000000	.000000	.000000	.000000	.000000
13	.000000	.000000	.000000	.000000	.000000	.000000
14	.000000	.000000	.000000	.000000	.000000	.000000
15	.000000	.000000	.000000	.000000	.000000	.000000
16	.000000	.000000	.000000	.000000	.000000	.000000
17	.000000	.000000	.000000	.000000	.000000	.000000
18	.000000	.000000	.000000	.000000	.000000	.000000
19	.000000	.000000	.000000	.000000	.000000	.000000
20	.000000	.000000	.000000	.000000	.000000	.000000
21	.000000	.000000	.000000	.000000	.000000	.000000
22	.000000	.000000	.000000	.000000	.000000	.000000
23	.000000	.000000	.000000	.000000	.000000	.000000
24	.000000	.000000	.000000	.000000	.000000	.000000
25	.2708E-04	-.2574E-05	-.6811E-05	.0000E+00	.0000E+00	.0000E+00
26	.1159E-03	-.1153E-03	.7803E-04	.0000E+00	.0000E+00	.0000E+00
27	.2537E-03	-.2093E-03	.1587E-03	.0000E+00	.0000E+00	.0000E+00
28	.4134E-03	-.2163E-03	.2271E-03	.0000E+00	.0000E+00	.0000E+00
29	.5075E-03	-.1506E-03	.2684E-03	.0000E+00	.0000E+00	.0000E+00
30	.5806E-03	-.5162E-04	.2940E-03	.0000E+00	.0000E+00	.0000E+00
31	.5830E-03	.6871E-04	.2947E-03	.0000E+00	.0000E+00	.0000E+00
32	.5157E-03	.1730E-03	.2721E-03	.0000E+00	.0000E+00	.0000E+00
33	.3962E-03	.2289E-03	.2276E-03	.0000E+00	.0000E+00	.0000E+00
34	.2561E-03	.2200E-03	.1651E-03	.0000E+00	.0000E+00	.0000E+00
35	.1269E-03	.1465E-03	.8763E-04	.0000E+00	.0000E+00	.0000E+00
36	.3095E-04	.2659E-04	-.6386E-06	.0000E+00	.0000E+00	.0000E+00
37	-.3227E-04	.2629E-04	-.6961E-06	.0000E+00	.0000E+00	.0000E+00
38	-.1281E-03	.1455E-03	.8745E-04	.0000E+00	.0000E+00	.0000E+00
39	-.2571E-03	.2183E-03	.1647E-03	.0000E+00	.0000E+00	.0000E+00
40	-.3966E-03	.2264E-03	.2270E-03	.0000E+00	.0000E+00	.0000E+00
41	-.5155E-03	.1693E-03	.2711E-03	.0000E+00	.0000E+00	.0000E+00
42	-.5823E-03	.6365E-04	.2933E-03	.0000E+00	.0000E+00	.0000E+00
43	-.5813E-03	-.5917E-04	.2930E-03	.0000E+00	.0000E+00	.0000E+00
44	-.5125E-03	-.1636E-03	.2699E-03	.0000E+00	.0000E+00	.0000E+00
45	-.3923E-03	-.2184E-03	.2249E-03	.0000E+00	.0000E+00	.0000E+00
46	-.2526E-03	-.2072E-03	.1619E-03	.0000E+00	.0000E+00	.0000E+00
47	-.1249E-03	-.1309E-03	.8385E-04	.0000E+00	.0000E+00	.0000E+00
48	-.3167E-04	-.7663E-05	-.5214E-05	.0000E+00	.0000E+00	.0000E+00
49	-.4797E-05	.2505E-03	-.2501E-03	.0000E+00	.0000E+00	.0000E+00
50	.7689E-04	.1048E-04	-.2735E-04	.0000E+00	.0000E+00	.0000E+00
51	.1966E-03	-.1227E-03	.1182E-03	.0000E+00	.0000E+00	.0000E+00

J-UNITS LBS-IN

JOINT DISPLACEMENTS

LOAD COMBINATION 2 - DISPLACEMENTS "U" AND ROTATIONS "R"

OINT	U(X)	U(Y)	U(Z)	R(X)	R(Y)	R(Z)
52	.8700E-04	.1197E-03	-.1200E-03	.0000E+00	.0000E+00	.0000E+00
53	.5713E-03	-.1717E-03	.3718E-03	.0000E+00	.0000E+00	.0000E+00
54	.6653E-03	-.9872E-04	.4180E-03	.0000E+00	.0000E+00	.0000E+00
55	.6806E-03	.1676E-04	.4169E-03	.0000E+00	.0000E+00	.0000E+00
56	.6378E-03	.1307E-03	.3941E-03	.0000E+00	.0000E+00	.0000E+00
57	.5256E-03	.2065E-03	.3345E-03	.0000E+00	.0000E+00	.0000E+00
58	.3757E-03	.2182E-03	.2446E-03	.0000E+00	.0000E+00	.0000E+00
59	.2156E-03	.1470E-03	.1196E-03	.0000E+00	.0000E+00	.0000E+00
60	.8315E-04	.1381E-07	-.3713E-04	.0000E+00	.0000E+00	.0000E+00
61	-.1405E-05	-.2361E-03	-.2535E-03	.0000E+00	.0000E+00	.0000E+00
62	-.8587E-04	-.1080E-05	-.3739E-04	.0000E+00	.0000E+00	.0000E+00
63	-.2179E-03	.1444E-03	.1187E-03	.0000E+00	.0000E+00	.0000E+00
64	-.3772E-03	.2141E-03	.2431E-03	.0000E+00	.0000E+00	.0000E+00
65	-.5250E-03	.2001E-03	.3312E-03	.0000E+00	.0000E+00	.0000E+00
66	-.6329E-03	.1217E-03	.3875E-03	.0000E+00	.0000E+00	.0000E+00
67	-.6673E-03	.4726E-05	.4033E-03	.0000E+00	.0000E+00	.0000E+00
68	-.6325E-03	-.1119E-03	.3874E-03	.0000E+00	.0000E+00	.0000E+00
69	-.5237E-03	-.1895E-03	.3308E-03	.0000E+00	.0000E+00	.0000E+00
70	-.3757E-03	-.2021E-03	.2426E-03	.0000E+00	.0000E+00	.0000E+00
71	-.2173E-03	-.1311E-03	.1187E-03	.0000E+00	.0000E+00	.0000E+00
72	-.8676E-04	.1578E-04	-.3666E-04	.0000E+00	.0000E+00	.0000E+00
73	.2594E-04	.6868E-04	-.1183E-03	.0000E+00	.0000E+00	.0000E+00
74	.9141E-04	.1989E-04	-.5808E-04	.0000E+00	.0000E+00	.0000E+00
75	.1850E-03	-.4318E-04	.6229E-04	.0000E+00	.0000E+00	.0000E+00
76	.2903E-03	-.6057E-04	.1376E-03	.0000E+00	.0000E+00	.0000E+00
77	.3398E-03	-.3614E-04	.1243E-03	.0000E+00	.0000E+00	.0000E+00
78	.3769E-03	-.3479E-05	.1460E-03	.0000E+00	.0000E+00	.0000E+00
79	.3781E-03	.4157E-04	.1484E-03	.0000E+00	.0000E+00	.0000E+00
80	.3435E-03	.7713E-04	.1289E-03	.0000E+00	.0000E+00	.0000E+00
81	.2759E-03	.9385E-04	.9010E-04	.0000E+00	.0000E+00	.0000E+00
82	.1851E-03	.6742E-04	.2255E-04	.0000E+00	.0000E+00	.0000E+00
83	.9990E-04	.1823E-04	-.4736E-04	.0000E+00	.0000E+00	.0000E+00
84	.2970E-04	-.3943E-04	-.1109E-03	.0000E+00	.0000E+00	.0000E+00
85	-.3397E-04	-.4018E-04	-.1111E-03	.0000E+00	.0000E+00	.0000E+00
86	-.1040E-03	.1607E-04	-.4785E-04	.0000E+00	.0000E+00	.0000E+00
87	-.1887E-03	.6365E-04	.2168E-04	.0000E+00	.0000E+00	.0000E+00
88	-.2791E-03	.8855E-04	.8918E-04	.0000E+00	.0000E+00	.0000E+00
89	-.3474E-03	.7076E-04	.1300E-03	.0000E+00	.0000E+00	.0000E+00
90	-.3780E-03	.3161E-04	.1450E-03	.0000E+00	.0000E+00	.0000E+00
91	-.3774E-03	-.1647E-04	.1442E-03	.0000E+00	.0000E+00	.0000E+00
92	-.3435E-03	-.5377E-04	.1243E-03	.0000E+00	.0000E+00	.0000E+00
93	-.2770E-03	-.7151E-04	.8567E-04	.0000E+00	.0000E+00	.0000E+00
94	-.1875E-03	-.4536E-04	.1824E-04	.0000E+00	.0000E+00	.0000E+00
95	-.1037E-03	.4324E-05	-.5171E-04	.0000E+00	.0000E+00	.0000E+00
96	-.3520E-04	.6366E-04	-.1158E-03	.0000E+00	.0000E+00	.0000E+00
97	-.2903E-05	.9158E-04	-.2274E-03	.0000E+00	.0000E+00	.0000E+00
98	.5879E-04	-.3638E-04	.2167E-04	.0000E+00	.0000E+00	.0000E+00
99	.9423E-04	-.5191E-05	-.6529E-04	.0000E+00	.0000E+00	.0000E+00
100	.1729E-03	-.4731E-04	.3556E-04	.0000E+00	.0000E+00	.0000E+00
101	.1801E-03	-.6587E-05	-.1017E-03	.0000E+00	.0000E+00	.0000E+00
102	.2614E-03	-.1035E-04	.3300E-04	.0000E+00	.0000E+00	.0000E+00

O I N T   D I S P L A C E M E N T S

OAD COMBINATION 2 - DISPLACEMENTS "U" AND ROTATIONS "R"

INT	U(X)	U(Y)	U(Z)	R(X)	R(Y)	R(Z)
103	.2706E-03	.1730E-04	-.6480E-05	.0000E+00	.0000E+00	.0000E+00
104	.2621E-03	.4487E-04	.3093E-04	.0000E+00	.0000E+00	.0000E+00
105	.1785E-03	.3982E-04	-.1205E-03	.0000E+00	.0000E+00	.0000E+00
106	.1686E-03	.7546E-04	.2855E-05	.0000E+00	.0000E+00	.0000E+00
107	.9381E-04	.3412E-04	-.8561E-04	.0000E+00	.0000E+00	.0000E+00
108	.5920E-04	.6607E-04	.2089E-04	.0000E+00	.0000E+00	.0000E+00
109	-.3087E-05	-.6376E-04	-.2204E-03	.0000E+00	.0000E+00	.0000E+00
110	-.6542E-04	.6490E-04	.2165E-04	.0000E+00	.0000E+00	.0000E+00
111	-.9959E-04	.3129E-04	-.8503E-04	.0000E+00	.0000E+00	.0000E+00
112	-.1746E-03	.7199E-04	.5523E-05	.0000E+00	.0000E+00	.0000E+00
113	-.1832E-03	.3435E-04	-.1197E-03	.0000E+00	.0000E+00	.0000E+00
114	-.2686E-03	.3914E-04	.3654E-04	.0000E+00	.0000E+00	.0000E+00
115	-.2757E-03	.1005E-04	-.2803E-05	.0000E+00	.0000E+00	.0000E+00
116	-.2681E-03	-.1872E-04	.3492E-04	.0000E+00	.0000E+00	.0000E+00
117	-.1827E-03	-.1362E-04	-.1229E-03	.0000E+00	.0000E+00	.0000E+00
118	-.1727E-03	-.4907E-04	-.3254E-05	.0000E+00	.0000E+00	.0000E+00
119	-.9874E-04	-.8015E-05	-.9284E-04	.0000E+00	.0000E+00	.0000E+00
120	-.6407E-04	-.3747E-04	.9347E-05	.0000E+00	.0000E+00	.0000E+00
121	-.3019E-05	-.3309E-05	-.1239E-03	.0000E+00	.0000E+00	.0000E+00
122	.5092E-04	-.1274E-04	-.1752E-03	.0000E+00	.0000E+00	.0000E+00
123	.6684E-04	.1131E-04	-.4238E-03	.0000E+00	.0000E+00	.0000E+00
124	.8029E-04	.1550E-04	-.5061E-03	.0000E+00	.0000E+00	.0000E+00
125	.6549E-04	.1861E-04	-.4418E-03	.0000E+00	.0000E+00	.0000E+00
126	.5003E-04	.4079E-04	-.1924E-03	.0000E+00	.0000E+00	.0000E+00
127	-.3550E-05	.3090E-04	-.1207E-03	.0000E+00	.0000E+00	.0000E+00
128	-.5733E-04	.4007E-04	-.1856E-03	.0000E+00	.0000E+00	.0000E+00
129	-.7281E-04	.1654E-04	-.4321E-03	.0000E+00	.0000E+00	.0000E+00
130	-.8659E-04	.1216E-04	-.5031E-03	.0000E+00	.0000E+00	.0000E+00
131	-.7157E-04	.8587E-05	-.4417E-03	.0000E+00	.0000E+00	.0000E+00
132	-.5610E-04	-.1336E-04	-.1987E-03	.0000E+00	.0000E+00	.0000E+00
133	-.000003	.000014	-.001039	.000000	.000000	.000000
500	.000000	.000000	.000000	.000000	.000000	.000000
501	.000000	.000000	.000000	.000000	.000000	.000000

K3D-UNITS LBS-IN PROGRAM:SAP90/FILE:K3D.SOL

R E A C T I O N S   A N D   A P P L I E D   F O R C E S

LOAD COMBINATION 1 - FORCES "F" AND MOMENTS "M"

POINT	F(X)	F(Y)	F(Z)	M(X)	M(Y)	M(Z)
1	.0000	.4852	1.1349	.0000	.0000	.0000
2	-.1256	.4687	1.1349	.0000	.0000	.0000
3	-.2426	.4202	1.1349	.0000	.0000	.0000
4	-.3431	.3431	1.1349	.0000	.0000	.0000
5	-.4202	.2426	1.1349	.0000	.0000	.0000
6	-.4687	.1256	1.1349	.0000	.0000	.0000
7	-.4852	.0000	1.1349	.0000	.0000	.0000
8	-.4687	-.1256	1.1349	.0000	.0000	.0000
9	-.4202	-.2426	1.1349	.0000	.0000	.0000
10	-.3431	-.3431	1.1349	.0000	.0000	.0000
11	-.2426	-.4202	1.1349	.0000	.0000	.0000
12	-.1256	-.4687	1.1349	.0000	.0000	.0000
13	.0000	-.4852	1.1349	.0000	.0000	.0000
14	.1256	-.4687	1.1349	.0000	.0000	.0000
15	.2426	-.4202	1.1349	.0000	.0000	.0000
16	.3431	-.3431	1.1349	.0000	.0000	.0000
17	.4202	-.2426	1.1349	.0000	.0000	.0000
18	.4687	-.1256	1.1349	.0000	.0000	.0000
19	.4852	.0000	1.1349	.0000	.0000	.0000
20	.4687	.1256	1.1349	.0000	.0000	.0000
21	.4202	.2426	1.1349	.0000	.0000	.0000
22	.3431	.3431	1.1349	.0000	.0000	.0000
23	.2426	.4202	1.1349	.0000	.0000	.0000
24	.1256	.4687	1.1349	.0000	.0000	.0000
25	.0000	.0000	-.1905	.0000	.0000	.0000
26	.0000	.0000	-.1905	.0000	.0000	.0000
27	.0000	.0000	-.1905	.0000	.0000	.0000
28	.0000	.0000	-.1905	.0000	.0000	.0000
29	.0000	.0000	-.1905	.0000	.0000	.0000
30	.0000	.0000	-.1905	.0000	.0000	.0000
31	.0000	.0000	-.1905	.0000	.0000	.0000
32	.0000	.0000	-.1905	.0000	.0000	.0000
33	.0000	.0000	-.1905	.0000	.0000	.0000
34	.0000	.0000	-.1905	.0000	.0000	.0000
35	.0000	.0000	-.1905	.0000	.0000	.0000
36	.0000	.0000	-.1905	.0000	.0000	.0000
37	.0000	.0000	-.1905	.0000	.0000	.0000
38	.0000	.0000	-.1905	.0000	.0000	.0000
39	.0000	.0000	-.1905	.0000	.0000	.0000
40	.0000	.0000	-.1905	.0000	.0000	.0000
41	.0000	.0000	-.1905	.0000	.0000	.0000
42	.0000	.0000	-.1905	.0000	.0000	.0000
43	.0000	.0000	-.1905	.0000	.0000	.0000
44	.0000	.0000	-.1905	.0000	.0000	.0000
45	.0000	.0000	-.1905	.0000	.0000	.0000
46	.0000	.0000	-.1905	.0000	.0000	.0000
47	.0000	.0000	-.1905	.0000	.0000	.0000
48	.0000	.0000	-.1905	.0000	.0000	.0000
49	.0000	.0000	-.1891	.0000	.0000	.0000
50	.0000	.0000	-.1891	.0000	.0000	.0000
51	.0000	.0000	-.1891	.0000	.0000	.0000

R E A C T I O N S   A N D   A P P L I E D   F O R C E S

OAD COMBINATION 1 - FORCES "F" AND MOMENTS "M"

INT	F(X)	F(Y)	F(Z)	M(X)	M(Y)	M(Z)
52	.0000	.0000	-.1891	.0000	.0000	.0000
53	.0000	.0000	-.1891	.0000	.0000	.0000
54	.0000	.0000	-.1891	.0000	.0000	.0000
55	.0000	.0000	-.1891	.0000	.0000	.0000
56	.0000	.0000	-.1891	.0000	.0000	.0000
57	.0000	.0000	-.1891	.0000	.0000	.0000
58	.0000	.0000	-.1891	.0000	.0000	.0000
59	.0000	.0000	-.1891	.0000	.0000	.0000
60	.0000	.0000	-.1891	.0000	.0000	.0000
61	.0000	.0000	-.1891	.0000	.0000	.0000
62	.0000	.0000	-.1891	.0000	.0000	.0000
63	.0000	.0000	-.1891	.0000	.0000	.0000
64	.0000	.0000	-.1891	.0000	.0000	.0000
65	.0000	.0000	-.1891	.0000	.0000	.0000
66	.0000	.0000	-.1891	.0000	.0000	.0000
67	.0000	.0000	-.1891	.0000	.0000	.0000
68	.0000	.0000	-.1891	.0000	.0000	.0000
69	.0000	.0000	-.1891	.0000	.0000	.0000
70	.0000	.0000	-.1891	.0000	.0000	.0000
71	.0000	.0000	-.1891	.0000	.0000	.0000
72	.0000	.0000	-.1891	.0000	.0000	.0000
73	.0000	.0000	-.1891	.0000	.0000	.0000
74	.0000	.0000	-.1873	.0000	.0000	.0000
75	.0000	.0000	-.1873	.0000	.0000	.0000
76	.0000	.0000	-.1873	.0000	.0000	.0000
77	.0000	.0000	-.1873	.0000	.0000	.0000
78	.0000	.0000	-.1873	.0000	.0000	.0000
79	.0000	.0000	-.1873	.0000	.0000	.0000
80	.0000	.0000	-.1873	.0000	.0000	.0000
81	.0000	.0000	-.1873	.0000	.0000	.0000
82	.0000	.0000	-.1873	.0000	.0000	.0000
83	.0000	.0000	-.1873	.0000	.0000	.0000
84	.0000	.0000	-.1873	.0000	.0000	.0000
85	.0000	.0000	-.1873	.0000	.0000	.0000
86	.0000	.0000	-.1873	.0000	.0000	.0000
87	.0000	.0000	-.1873	.0000	.0000	.0000
88	.0000	.0000	-.1873	.0000	.0000	.0000
89	.0000	.0000	-.1873	.0000	.0000	.0000
90	.0000	.0000	-.1873	.0000	.0000	.0000
91	.0000	.0000	-.1873	.0000	.0000	.0000
92	.0000	.0000	-.1873	.0000	.0000	.0000
93	.0000	.0000	-.1873	.0000	.0000	.0000
94	.0000	.0000	-.1873	.0000	.0000	.0000
95	.0000	.0000	-.1873	.0000	.0000	.0000
96	.0000	.0000	-.1873	.0000	.0000	.0000
97	.0000	.0000	-.1849	.0000	.0000	.0000
98	.0000	.0000	-.1875	.0000	.0000	.0000
99	.0000	.0000	-.1849	.0000	.0000	.0000
100	.0000	.0000	-.1875	.0000	.0000	.0000
101	.0000	.0000	-.1849	.0000	.0000	.0000
02	.0000	.0000	-.1875	.0000	.0000	.0000

R E A C T I O N S   A N D   A P P L I E D   F O R C E S

OAD COMBINATION 1 - FORCES "F" AND MOMENTS "M"

POINT	F(X)	F(Y)	F(Z)	M(X)	M(Y)	M(Z)
103	.0000	.0000	-.1849	.0000	.0000	.0000
104	.0000	.0000	-.1875	.0000	.0000	.0000
105	.0000	.0000	-.1849	.0000	.0000	.0000
106	.0000	.0000	-.1875	.0000	.0000	.0000
107	.0000	.0000	-.1849	.0000	.0000	.0000
108	.0000	.0000	-.1875	.0000	.0000	.0000
109	.0000	.0000	-.1849	.0000	.0000	.0000
110	.0000	.0000	-.1875	.0000	.0000	.0000
111	.0000	.0000	-.1849	.0000	.0000	.0000
112	.0000	.0000	-.1875	.0000	.0000	.0000
113	.0000	.0000	-.1849	.0000	.0000	.0000
114	.0000	.0000	-.1875	.0000	.0000	.0000
115	.0000	.0000	-.1849	.0000	.0000	.0000
116	.0000	.0000	-.1875	.0000	.0000	.0000
117	.0000	.0000	-.1849	.0000	.0000	.0000
118	.0000	.0000	-.1875	.0000	.0000	.0000
119	.0000	.0000	-.1849	.0000	.0000	.0000
120	.0000	.0000	-.1875	.0000	.0000	.0000
121	.0000	.0000	-.1850	.0000	.0000	.0000
122	.0000	.0000	-.1866	.0000	.0000	.0000
123	.0000	.0000	-.1850	.0000	.0000	.0000
124	.0000	.0000	-.1866	.0000	.0000	.0000
125	.0000	.0000	-.1850	.0000	.0000	.0000
126	.0000	.0000	-.1866	.0000	.0000	.0000
127	.0000	.0000	-.1850	.0000	.0000	.0000
128	.0000	.0000	-.1866	.0000	.0000	.0000
129	.0000	.0000	-.1850	.0000	.0000	.0000
130	.0000	.0000	-.1866	.0000	.0000	.0000
131	.0000	.0000	-.1850	.0000	.0000	.0000
132	.0000	.0000	-.1866	.0000	.0000	.0000
133	.0000	.0000	-6.9342	.0000	.0000	.0000
500	.0000	.0000	.0000	.0000	.0000	.0000
501	.0000	.0000	.0000	.0000	.0000	.0000

R E A C T I O N S   A N D   A P P L I E D   F O R C E S

LOAD COMBINATION 2 - FORCES "F" AND MOMENTS "M"

JOINT	F(X)	F(Y)	F(Z)	M(X)	M(Y)	M(Z)
1	.1697	-1.0544	-2.4662	.0000	.0000	.0000
2	-6.4783	-4.1351	-5.4206	.0000	.0000	.0000
3	-5.2384	-8.3691	-10.8266	.0000	.0000	.0000
4	-1.8324	-11.5549	-16.0804	.0000	.0000	.0000
5	2.6941	-11.1946	-18.5497	.0000	.0000	.0000
6	7.6384	-6.7707	-21.3564	.0000	.0000	.0000
7	9.3609	-.7817	-21.8955	.0000	.0000	.0000
8	7.9501	5.1307	-21.0678	.0000	.0000	.0000
9	3.9780	9.2782	-18.9090	.0000	.0000	.0000
10	-1.0955	10.4387	-15.4531	.0000	.0000	.0000
11	-5.3135	8.3648	-10.7301	.0000	.0000	.0000
12	-6.5433	3.8127	-4.6528	.0000	.0000	.0000
13	.0674	.7716	-1.8047	.0000	.0000	.0000
14	6.6786	3.8500	-4.6553	.0000	.0000	.0000
15	5.4508	8.4465	-10.7349	.0000	.0000	.0000
16	1.2348	10.5809	-15.4579	.0000	.0000	.0000
17	-3.8430	9.5087	-18.9051	.0000	.0000	.0000
18	-7.8358	5.4973	-21.0315	.0000	.0000	.0000
19	-9.3095	-.2076	-21.7752	.0000	.0000	.0000
20	-7.7734	-5.8993	-21.1339	.0000	.0000	.0000
21	-3.7330	-9.8762	-19.1121	.0000	.0000	.0000
22	1.3715	-10.9054	-15.7686	.0000	.0000	.0000
23	5.5934	-8.7339	-11.1503	.0000	.0000	.0000
24	6.8084	-4.1187	-5.1839	.0000	.0000	.0000
25	.2133	-1.6198	.7157	.0000	.0000	.0000
26	1.8279	-4.4131	2.4590	.0000	.0000	.0000
27	4.6237	-6.0257	4.0224	.0000	.0000	.0000
28	7.8463	-6.0207	5.2953	.0000	.0000	.0000
29	10.6466	-4.4100	6.2015	.0000	.0000	.0000
30	12.2537	-1.6132	6.6650	.0000	.0000	.0000
31	12.2537	1.6132	6.6650	.0000	.0000	.0000
32	10.6466	4.4100	6.2015	.0000	.0000	.0000
33	7.8463	6.0207	5.2953	.0000	.0000	.0000
34	4.6237	6.0257	4.0224	.0000	.0000	.0000
35	1.8279	4.4131	2.4590	.0000	.0000	.0000
36	.2133	1.6198	.7157	.0000	.0000	.0000
37	-.2133	1.6198	.7157	.0000	.0000	.0000
38	-1.8279	4.4131	2.4590	.0000	.0000	.0000
39	-4.6237	6.0257	4.0224	.0000	.0000	.0000
40	-7.8463	6.0207	5.2953	.0000	.0000	.0000
41	-10.6466	4.4100	6.2015	.0000	.0000	.0000
42	-12.2537	1.6132	6.6650	.0000	.0000	.0000
43	-12.2537	-1.6132	6.6650	.0000	.0000	.0000
44	-10.6466	-4.4100	6.2015	.0000	.0000	.0000
45	-7.8463	-6.0207	5.2953	.0000	.0000	.0000
46	-4.6237	-6.0257	4.0224	.0000	.0000	.0000
47	-1.8279	-4.4131	2.4590	.0000	.0000	.0000
48	-.2133	-1.6198	.7157	.0000	.0000	.0000
49	.0000	.0000	.7157	.0000	.0000	.0000
50	.5311	-1.9821	-.1891	.0000	.0000	.0000
51	1.9807	-3.4306	3.3009	.0000	.0000	.0000

K3D-UNITS LBS-IN

PROGRAM:SAP90/FILE:K3D.SOL

R E A C T I O N S   A N D   A P P L I E D   F O R C E S

LOAD COMBINATION 2 - FORCES "F" AND MOMENTS "M"

JOINT	F(X)	F(Y)	F(Z)	M(X)	M(Y)	M(Z)
52	3.9608	3.9608	4.7458	.0000	.0000	.0000
53	5.9419	-3.4306	5.8556	.0000	.0000	.0000
54	7.3926	-1.9799	6.5536	.0000	.0000	.0000
55	7.9227	.0000	6.7909	.0000	.0000	.0000
56	7.3925	1.9799	6.5536	.0000	.0000	.0000
57	5.9419	3.4306	5.8556	.0000	.0000	.0000
58	3.9608	3.9608	4.7449	.0000	.0000	.0000
59	1.9807	3.4306	3.3009	.0000	.0000	.0000
60	.5311	1.9799	1.6187	.0000	.0000	.0000
61	.0000	.0000	-.1891	.0000	.0000	.0000
62	-.5311	1.9821	1.6187	.0000	.0000	.0000
63	-1.9807	3.4306	3.3009	.0000	.0000	.0000
64	-3.9608	3.9608	4.7458	.0000	.0000	.0000
65	-5.9419	3.4306	5.8556	.0000	.0000	.0000
66	-7.3926	1.9799	6.5536	.0000	.0000	.0000
67	-7.9227	.0000	6.7909	.0000	.0000	.0000
68	-7.3925	-1.9799	6.5536	.0000	.0000	.0000
69	-5.9419	-3.4306	5.8556	.0000	.0000	.0000
70	-3.9608	-3.9608	4.7449	.0000	.0000	.0000
71	-1.9807	-3.4306	3.3009	.0000	.0000	.0000
72	-.5311	-1.9799	1.6187	.0000	.0000	.0000
73	.0686	-.5210	.5177	.0000	.0000	.0000
74	.5880	-1.4195	1.8739	.0000	.0000	.0000
75	1.4872	-1.9382	3.0902	.0000	.0000	.0000
76	2.5238	-1.9366	4.0805	.0000	.0000	.0000
77	3.4245	-1.4185	4.7855	.0000	.0000	.0000
78	3.9414	-.5189	5.1461	.0000	.0000	.0000
79	3.9414	.5189	5.1461	.0000	.0000	.0000
80	3.4245	1.1980	4.7855	.0000	.0000	.0000
81	2.5238	1.9366	4.0805	.0000	.0000	.0000
82	1.4872	1.9382	3.0902	.0000	.0000	.0000
83	.5880	1.4195	1.8739	.0000	.0000	.0000
84	.0686	.5210	.5177	.0000	.0000	.0000
85	-.0686	.5210	.5177	.0000	.0000	.0000
86	-.5880	1.4195	1.8739	.0000	.0000	.0000
87	-1.4872	1.9382	3.0902	.0000	.0000	.0000
88	-2.5238	1.9366	4.0805	.0000	.0000	.0000
89	-3.4245	1.4185	4.7855	.0000	.0000	.0000
90	-3.9414	.5189	5.1461	.0000	.0000	.0000
91	-3.9414	-.5189	5.1461	.0000	.0000	.0000
92	-3.4245	-1.1980	4.7855	.0000	.0000	.0000
93	-2.5238	-1.9366	4.0805	.0000	.0000	.0000
94	-1.4872	-1.9382	3.0902	.0000	.0000	.0000
95	-.5880	-1.4195	1.8739	.0000	.0000	.0000
96	-.0686	-.5210	.5177	.0000	.0000	.0000
97	.0000	.0000	-.1849	.0000	.0000	.0000
98	.1313	-1.8273	.9354	.0000	.0000	.0000
99	.3226	-.7901	1.2434	.0000	.0000	.0000
100	.9790	-.9790	2.8776	.0000	.0000	.0000
101	.7901	-.3226	1.8347	.0000	.0000	.0000
102	1.8273	-.1313	4.0004	.0000	.0000	.0000

R E A C T I O N S   A N D   A P P L I E D   F O R C E S

LOAD COMBINATION 2 - FORCES "F" AND MOMENTS "M"

JOINT	F(X)	F(Y)	F(Z)	M(X)	M(Y)	M(Z)
103	1.2904	.0000	2.6717	.0000	.0000	.0000
104	1.8273	.1313	4.0004	.0000	.0000	.0000
105	.7901	.3226	1.8347	.0000	.0000	.0000
106	.9790	.9790	2.8776	.0000	.0000	.0000
107	.3226	.7901	1.2434	.0000	.0000	.0000
108	.1313	1.8273	.9354	.0000	.0000	.0000
109	.0000	.0000	-.1849	.0000	.0000	.0000
110	-.1313	1.8273	.9354	.0000	.0000	.0000
111	-.3226	.7901	1.2434	.0000	.0000	.0000
112	-.9790	.9790	2.8776	.0000	.0000	.0000
113	-.7901	.3226	1.8347	.0000	.0000	.0000
114	-1.8273	.1313	4.0004	.0000	.0000	.0000
115	-1.2904	.0000	2.6717	.0000	.0000	.0000
116	-1.8273	-.1313	4.0004	.0000	.0000	.0000
117	-.7901	-.3226	1.8347	.0000	.0000	.0000
118	-.9790	-.9790	2.8776	.0000	.0000	.0000
119	-.3226	-.7901	1.2434	.0000	.0000	.0000
120	-.1313	-1.8273	.9354	.0000	.0000	.0000
121	.0000	.0000	-.1850	.0000	.0000	.0000
122	.1135	-.2580	.8676	.0000	.0000	.0000
123	.2580	-.1135	1.1980	.0000	.0000	.0000
124	.4541	.0000	1.8557	.0000	.0000	.0000
125	.2580	.1135	1.1980	.0000	.0000	.0000
126	.1135	.2580	.8676	.0000	.0000	.0000
127	.0000	.0000	-.1850	.0000	.0000	.0000
128	-.1135	.2580	.8676	.0000	.0000	.0000
129	-.2580	.1135	1.1980	.0000	.0000	.0000
130	-.4541	.0000	1.8557	.0000	.0000	.0000
131	-.2580	-.1135	1.1980	.0000	.0000	.0000
132	-.1135	-.2580	.8676	.0000	.0000	.0000
133	.0000	.0000	-6.9342	.0000	.0000	.0000
500	.0000	.0000	.0000	.0000	.0000	.0000
501	.0000	.0000	.0000	.0000	.0000	.0000

```
        $$$$$$$$      $$$$$$$$$$    $$$$$$$        $$$$$$$$       $$$$$$$
      $$$$$$$$$$     $$$$$$$$$$    $$$$$$$$$$    $$$$$$$$$$$    $$$$$$$$$$
     $$             $$      $$    $$       $$   $$       $$    $$       $$
    $$             $$      $$    $$       $$   $$       $$    $$       $$
    $$$$$$$$      $$$$$$$$$$    $$$$$$$$$$     $$$$$$$$$$    $$       $$
          $$     $$      $$    $$                     $$    $$       $$
         $$     $$      $$    $$                     $$    $$       $$
$$$$$$$$$$    $$       $$    $$             $$$$$$$$$$     $$$$$$$$$$
$$$$$$$$     $$       $$    $$              $$$$$$$$        $$$$$$$
```

STRUCTURAL ANALYSIS PROGRAMS

VERSION 5.20

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
1								
	1	.00						
	2	.00						
2								
	1	.00						
	2	.00						
3								
	1	.00						
	2	.00						
4								
	1	.00						
	2	.00						
5								
	1	.00						
	2	.00						
6								
	1	.00						
	2	.00						
7								
	1	.00						
	2	.00						
8								
	1	.00						
	2	.00						
9								
	1	.00						
	2	.00						
10								
	1	.00						
	2	.00						
11								
	1	.00						
	2	.00						
12								
	1	.00						
	2	.00						
13								
	1	.00						
	2	.00						
14								
	1	.00						
	2	.00						
15								
	1	.00						
	2	.00						
16								
	1	.00						
	2	.00						
17								
	1	.00						
	2	.00						

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
18								
	1	.00						
	2	.00						
19								
	1	.00						
	2	.00						
20								
	1	.00						
	2	.00						
21								
	1	.00						
	2	.00						
22								
	1	.00						
	2	.00						
23								
	1	.00						
	2	.00						
24								
	1	.00						
	2	.00						
25								
	1	1.35						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	12.73						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
26								
	1	1.35						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	12.27						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
27								
	1	1.35						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	15.68						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
28								
	1	1.35						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	23.40						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
29								
	1	1.35						
			.0	.00	.00	.00	.00	

3D-UNITS LBS-IN

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			108.8	.00	.00	.00	.00	
	2	22.53	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
30	1	1.35	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	24.81	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
31	1	1.35	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	26.07	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
32	1	1.35	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	25.59	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
33	1	1.35	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	23.45	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
34	1	1.35	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	20.08	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
35	1	1.35	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	16.28	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
36	1	1.35	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	13.37	.0	.00	.00	.00	.00	

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			108.8	.00	.00	.00	.00	
37								
	1	1.35	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	13.70	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
38								
	1	1.35	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	13.38	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
39								
	1	1.35	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	16.31	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
40								
	1	1.35	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	20.15	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
41								
	1	1.35	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	23.58	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
42								
	1	1.35	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	25.87	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
43								
	1	1.35	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	26.61	.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
44								
	1	1.35						

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	25.72						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
45								
	1	1.35						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	23.29						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
46								
	1	1.35						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	19.70						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
47								
	1	1.35						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	15.70						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
48								
	1	1.35						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
	2	12.60						
			.0	.00	.00	.00	.00	
			108.8	.00	.00	.00	.00	
49								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	12.62						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
50								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	15.16						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
51								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	15.41						

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
52								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	16.17						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
53								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	26.30						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
54								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	29.61						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
55								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	30.15						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
56								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	28.71						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
57								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	25.56						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
58								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	21.27						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
59								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	16.81						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
60								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	13.48						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
61								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	13.49						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
62								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	16.85						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
63								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	21.35						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
64								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	25.69						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
65								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	28.92						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
66								
	1	.59						
			.0	.00	.00	.00	.00	

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			92.8	.00	.00	.00	.00	
	2	30.61						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
67								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	30.56						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
68								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	28.80						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
69								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	25.43						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
70								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	20.97						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
71								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	16.36						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
72								
	1	.59						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
	2	12.87						
			.0	.00	.00	.00	.00	
			92.8	.00	.00	.00	.00	
73								
	1	.97						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	19.46						
			.0	.00	.00	.00	.00	

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			74.1	.00	.00	.00	.00	
74								
	1	.96						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	16.10						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
75								
	1	.97						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	15.75						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
76								
	1	.96						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	19.79						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
77								
	1	.97						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	14.61						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
78								
	1	.96						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	13.09						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
79								
	1	.97						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	14.34						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
80								
	1	.96						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	13.78						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
81								
	1	.97						

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	15.37						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
82								
	1	.96						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	14.49						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
83								
	1	.97						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	15.64						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
84								
	1	.96						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	16.83						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
85								
	1	.97						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	20.26						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
86								
	1	.96						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	16.89						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
87								
	1	.97						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	15.78						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
88								
	1	.96						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	14.73						

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
89								
	1	.97						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	15.77						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
90								
	1	.96						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	14.54						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
91								
	1	.97						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	15.30						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
92								
	1	.96						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	14.26						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
93								
	1	.97						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	15.46						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
94								
	1	.96						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	14.27						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
95								
	1	.97						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	15.18						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
96								
	1	.96						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
	2	16.17						
			.0	.00	.00	.00	.00	
			74.1	.00	.00	.00	.00	
97								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	20.60						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
98								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	20.70						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
99								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	17.03						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
100								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	17.00						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
101								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	12.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
102								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	13.26						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
103								
	1	.81						
			.0	.00	.00	.00	.00	

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			50.9	.00	.00	.00	.00	
	2	13.18						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
104								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	12.67						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
105								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	15.89						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
106								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	15.82						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
107								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	20.48						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
108								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	20.76						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
109								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	20.85						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
110								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	20.59						
			.0	.00	.00	.00	.00	

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			50.9	.00	.00	.00	.00	
111								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	16.10						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
112								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	16.24						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
113								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	13.10						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
114								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	13.80						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
115								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	13.67						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
116								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	12.97						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
117								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	15.85						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
118								
	1	.81						

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	15.61						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
119								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	20.07						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
120								
	1	.81						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
	2	20.29						
			.0	.00	.00	.00	.00	
			50.9	.00	.00	.00	.00	
121								
	1	6.16						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
	2	22.69						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
122								
	1	6.16						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
	2	12.91						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
123								
	1	6.16						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
	2	3.44						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
124								
	1	6.16						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
	2	3.12						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
125								
	1	6.16						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
	2	12.16						

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
126								
	1	6.16						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
	2	22.48						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
127								
	1	6.16						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
	2	22.65						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
128								
	1	6.16						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
	2	12.60						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
129								
	1	6.16						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
	2	3.56						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
130								
	1	6.16						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
	2	3.35						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
131								
	1	6.16						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
	2	12.09						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
132								
	1	6.16						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	
	2	22.24						
			.0	.00	.00	.00	.00	
			51.6	.00	.00	.00	.00	

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
133								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	1.35						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
135								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	11.04						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
137								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	15.84						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
139								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	19.87						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
141								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	20.23						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
143								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	18.00						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
145								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	14.37						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
147								
	1	-.70						
			.0	.00	.00	.00	.00	

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			114.1	.00	.00	.00	.00	
	2	10.00						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
149								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	5.36						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
151								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	1.01						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
153								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-2.57						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
155								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-4.78						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
157								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	1.19						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
159								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	10.69						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
161								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	16.02						
			.0	.00	.00	.00	.00	

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			114.1	.00	.00	.00	.00	
163								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	18.32						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
165								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	18.31						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
167								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	16.45						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
169								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	13.25						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
171								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	9.21						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
173								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	4.81						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
175								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	.65						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
177								
	1	-.70						

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-2.76						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
179								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-4.81						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
134								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-4.33						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
136								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-2.45						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
138								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	.02						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
140								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	2.72						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
142								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	8.43						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
144								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	12.73						

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
146								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	16.07						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
148								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	18.04						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
150								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	18.11						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
152								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	15.85						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
154								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	10.54						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
156								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	1.05						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
158								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-4.93						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
160								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-2.74						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
162								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	.80						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
164								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	5.08						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
166								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	9.57						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
168								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	13.69						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
170								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	16.94						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
172								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	18.83						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
174								
	1	-.70						
			.0	.00	.00	.00	.00	

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			114.1	.00	.00	.00	.00	
	2	18.86						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
176								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	16.56						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
178								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	11.22						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
180								
	1	-.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	1.70						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
181								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-6.36						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
183								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-1.31						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
185								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	5.48						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
187								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-2.95						
			.0	.00	.00	.00	.00	

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			114.1	.00	.00	.00	.00	
189	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	7.09	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
191	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	10.84	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
193	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	13.00	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
195	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	13.98	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
197	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	13.54	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
199	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	11.51	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
201	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	7.57	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
203	1	-.66						

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	1.51						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
205								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-6.89						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
207								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-2.21						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
209								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	1.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
211								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	5.24						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
213								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	8.60						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
215								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	11.49						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
217								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	13.63						

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
219								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	14.64						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
221								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	14.21						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
223								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	12.15						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
225								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	8.17						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
227								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	2.06						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
182								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	2.00						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
184								
	1	-.66						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	7.56						
			.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
186								
	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	6.79	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
188								
	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	21.03	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
190								
	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	16.55	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
192								
	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	14.48	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
194								
	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	12.00	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
196								
	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	8.96	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
198								
	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	5.52	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
200								
	1	-.66	.0	.00	.00	.00	.00	

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			114.1	.00	.00	.00	.00	
	2	1.88	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
202	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-2.02	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
204	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-6.72	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
206	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	1.68	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
208	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	7.74	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
210	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	11.69	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
212	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	13.74	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
214	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	14.17	.0	.00	.00	.00	.00	

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			114.1	.00	.00	.00	.00	
216								
	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	13.18	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
218								
	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	11.10	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
220								
	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	8.31	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
222								
	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	5.08	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
224								
	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	1.64	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
226								
	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-2.07	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
228								
	1	-.66	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
	2	-6.55	.0	.00	.00	.00	.00	
			114.1	.00	.00	.00	.00	
229								
	1	-.60						

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
245								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	9.46						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
247								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	7.90						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
249								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	5.21						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
251								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	.77						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
253								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-7.45						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
255								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-3.70						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
257								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	.47						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
259								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	4.06						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
261								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	6.92						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
263								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	8.78						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
265								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	9.58						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
267								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	9.47						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
269								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	8.88						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
271								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	7.51						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
273								
	1	-.60						
			.0	.00	.00	.00	.00	

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			106.9	.00	.00	.00	.00	
	2	5.04						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
275								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	.88						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
230								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	.46						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
232								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	3.70						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
234								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	.90						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
236								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	16.18						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
238								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	11.13						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
240								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	9.94						
			.0	.00	.00	.00	.00	

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			106.9	.00	.00	.00	.00	
242								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	8.83						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
244								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	6.76						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
246								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	3.88						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
248								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	.28						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
250								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-3.90						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
252								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-7.65						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
254								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	.55						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
256								
	1	-.60						

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	4.96						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
258								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	7.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
260								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	9.11						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
262								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	9.91						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
264								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	10.04						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
266								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	9.31						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
268								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	7.35						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
270								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	4.49						

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
272								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	.85						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
274								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-3.44						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
276								
	1	-.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-7.37						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
277								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-5.12						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
279								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	3.67						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
281								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	5.17						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
283								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	11.45						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
285								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	7.83						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
287								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	10.56						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
289								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	4.83						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
291								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	6.03						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
293								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-2.31						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
295								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-2.32						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
297								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-6.93						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
299								
	1	-.59						
			.0	.00	.00	.00	.00	

K3D-UNITS LBS-IN

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			106.9	.00	.00	.00	.00	
	2	-5.67						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
301								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-4.88						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
303								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	4.45						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
305								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	6.46						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
307								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	11.27						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
309								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	6.37						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
311								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	9.87						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
313								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	4.79						
			.0	.00	.00	.00	.00	

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			106.9	.00	.00	.00	.00	
315								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	6.35						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
317								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-1.85						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
319								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-1.85						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
321								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-6.57						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
323								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-5.54						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
278								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-4.63						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
280								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-5.65						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
282								
	1	-.59						

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-2.67						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
284								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-3.83						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
286								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	5.51						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
288								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	4.60						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
290								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	10.08						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
292								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	6.57						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
294								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	11.54						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
296								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	6.74						

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
298								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	4.73						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
300								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-4.62						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
302								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-5.43						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
304								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-6.72						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
306								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-2.18						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
308								
	1	-.61						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-2.28						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
310								
	1	-.59						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	6.04						
			.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
312								
	1	-.61	.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	4.43	.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
314								
	1	-.59	.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	9.62	.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
316								
	1	-.61	.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	6.05	.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
318								
	1	-.59	.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	11.12	.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
320								
	1	-.61	.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	6.51	.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
322								
	1	-.59	.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	4.77	.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
324								
	1	-.61	.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
	2	-4.23	.0	.00	.00	.00	.00	
			106.9	.00	.00	.00	.00	
325								
	1	-.62	.0	.00	.00	.00	.00	

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			106.7	.00	.00	.00	.00	
	2	3.07						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
326								
	1	-.63						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	-7.79						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
327								
	1	-.63						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	12.23						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
328								
	1	-.62						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	-7.86						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
329								
	1	-.62						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	11.43						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
330								
	1	-.63						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	.90						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
331								
	1	-.63						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	1.55						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
332								
	1	-.62						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	10.85						
			.0	.00	.00	.00	.00	

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			106.7	.00	.00	.00	.00	
333	1	-.62	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	-7.54	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
334	1	-.63	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	12.62	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
335	1	-.63	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	-8.51	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
336	1	-.62	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	3.81	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
337	1	-.62	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	3.46	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
338	1	-.63	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	-8.22	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
339	1	-.63	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	12.37	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
340	1	-.62						

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
	2	-7.48	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
341	1	-.62	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	10.92	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
342	1	-.63	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	1.16	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
343	1	-.63	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	1.58	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
344	1	-.62	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	10.57	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
345	1	-.62	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	-7.20	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
346	1	-.63	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	12.37	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
347	1	-.63	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	-8.42	.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
348								
	1	-.62						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
	2	3.99						
			.0	.00	.00	.00	.00	
			106.7	.00	.00	.00	.00	
349								
	1	-5.46						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-9.77						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
350								
	1	-5.46						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	6.30						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
351								
	1	-5.46						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-9.37						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
352								
	1	-5.46						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-9.61						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
353								
	1	-5.46						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	6.13						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
354								
	1	-5.46						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-9.24						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	

F R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
355	1	-1.26	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-13.58	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
356	1	-1.26	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-4.71	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
357	1	-1.26	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	.20	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
358	1	-1.26	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	5.76	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
359	1	-1.26	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	.59	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
360	1	-1.26	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-4.26	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
361	1	-1.26	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-13.81	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
362	1	-1.26	.0	.00	.00	.00	.00	

...R A M E   E L E M E N T   F O R C E S

ELT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			100.3	.00	.00	.00	.00	
	2	-4.38						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
363								
	1	-1.26						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	.35						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
364								
	1	-1.26						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	5.43						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
365								
	1	-1.26						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	.51						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
366								
	1	-1.26						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-4.06						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
367								
	1	-5.45						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-18.76						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
368								
	1	-5.45						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-.80						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
369								
	1	-5.45						
			.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-.36						
			.0	.00	.00	.00	.00	

...AME ELEMENT FORCES

...LT ID	LOAD COMB	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
			100.3	.00	.00	.00	.00	
70								
	1	-5.45	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-13.86	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
71								
	1	-5.45	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-.71	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
72								
	1	-5.45	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	
	2	-.43	.0	.00	.00	.00	.00	
			100.3	.00	.00	.00	.00	