Structural Feasibility Study of a Medium-Rise Timber Office Building

by

Mohsen Nasr

B.S. Mechanical Engineering
Yale University, 2004

Submitted to the Department of Civil and Environmental Engineering in Partial Fulfillment of the Requirements for the Degree of Master of Engineering in Civil and Environmental Engineering

at the

Massachusetts Institute of Technology
June 2005

Signature of Author ....
Department of Civil and Environmental Engineering
May 6, 2005

Certified by ....
John Ochsendorf
Assistant Professor of Building Technology
Thesis Supervisor

Certified by ....
Jerome J. Connor
Professor of Civil and Environmental Engineering
Thesis Superviser

Accepted by ....
Andrew J. Whittle
Chairman, Departmental Committee for Graduate Students

Structural Feasibility Study of a Medium-Rise Timber Office Building

by

Mohsen Nasr

B.S. Mechanical Engineering
Yale University, 2004

Submitted to the Department of Civil and Environmental Engineering on May 6, 2005 in Partial Fulfillment of the Requirements for the Degree of Master of Engineering in Civil and Environmental Engineering

Abstract

Using timber as a structural material for commercial projects will certainly gain importance and popularity in the coming decades as more focus is placed on reducing environmental effects created by a dependence on steel and concrete in the construction industry. Timber is a clean alternative that despite its historical use is too often overlooked by designers when they are choosing materials for ordinary commercial projects like office buildings. This thesis presents a case for using timber as the primary structural material in a medium-rise office building (up to ten stories), where currently only concrete and steel are normally used.

The study accomplishes this using a custom structural design for a typical office building and exploring the structural issues that presumably prohibit timber from being used more commonly. Such issues are strength capacity, stiffness, material reliability, natural defects, area of required material, fire protection, and constructability. Addressing these issues in terms of building codes and in general comparison to steel and concrete makes up the bulk of the feasibility study. Future work essential to completing the structural case for timber is also identified, and the study concludes that timber is indeed a viable alternative material in typical office building design.

The motivation behind the thesis is one based on obtaining and sharing an introduction to a material that finds little application in traditional engineering education yet will grow to play a large role in the field of structural engineering in the coming age of sustainability-minded design.

Thesis Supervisor: John Ochsendorf
Title: Assistant Professor of Building Technology

Thesis Supervisor: Jerome J. Connor
Title: Professor of Civil and Environmental Engineering

Acknowledgements are in order for Professor Ochsendorf, for guiding this work and sharing his passion, and for Professor Connor, for all of his care and energy spent on his students.

4983-57

Table of Contents

List of Figures

List of Tables

1. Introduction

> Wood symbolizes pre-industrial technologies and craft traditions, while metal represents the industrial age, technical progress, and the primacy of science.
>
> - Eric Schatzberg, *Wings of Wood, Wings of Metal: Culture and Technical Choice in American Airplane Materials, 1914-1915*

Sustainable design has been an important topic in the realm of structural engineering since the beginning of the field of construction. It is self-evident that resources from the earth are not infinite and cannot be extracted, refined, and returned to the soil without a negative effect on natural ecology. The *practice* of sustainable design, however, has mainly been neglected, to the point where strength and serviceability have become the only two aspects of structural design that are considered worth teaching and learning. This, along with a desire to create modernity, has led to the proliferation of application-specific materials, or materials that are commonly considered "fit" for certain functions without challenge from other materials. One field where this occurs is in the materials of airplanes, where aluminum, and now composites, has dominated over wood, the original aeronautical material, for reasons based largely on a "progress ideology of metal," as Schatzberg argues.[1] Another field, of specific interest here, is commercial building design.

In particular, similar mindset has produced the notion that steel and concrete are the only materials capable of supporting the structures of tall buildings, based on strength and performance considerations. This status quo, however, is mostly perception, for history teaches that countless other materials have supported grand structures for centuries. One only need consider the stone Pont du Gard in France, built by the Romans before the Common Era, or the 220ft tall Yingxian wooden pagoda in China, built in 1056 CE.[2]

This paper proves that from a structural standpoint it is entirely feasible to build a modern office building up to ten stories in height made completely out of timber members. Initial doubts as to why this may be presumably stem from matters of strength or deflection for given vertical and lateral loads. They may stem from thoughts about fire protection, preservation from natural decay, or attack from termites. Some doubts may stem from concerns about construction constraints, connections, or maintenance. They may even stem from considerations for usable office space area.

All of these doubts are addressed, and at least partially discounted, through this feasibility study, which also focuses on avoiding the use of complicated engineered wood

---

[1] Schatzberg, Eric. *Wings of Wood, Wings of Metal: Culture and Technical Choice in American Airplane Materials, 1914-1945*. Princeton, New Jersey: Princeton University Press, 1999.

[2] "Yingxian Wooden Pagoda." Great Wall Travel Service Co., 2002. <http://www.greatwalltour.com/greatwall_pages/tours/highlight/gt07.htm>. April 21, 2005.

systems like glulam or hybrid material systems, like steel braced shear walls, for instance. Further work needs to be done to fully deal with some of the issues with timber that this study itself raises, such as the disadvantages of creating a lightweight structure and difficulty in obtaining large sections of heavy timber. Other types of reservations, such as ones based on cost, interior and exterior decorating, and psychology, are not addressed in this study but remain important issues that deserve proper attention in the case for or against wood.

The study opens with prefatory material in Chapter 2 intended to elucidate some of the material-related issues with wood that distinguish it from other materials and control certain aspects of a timber building's structural design, such as available member geometries and construction methods. This discussion frames the structural design by accepting timber as a practical choice for a structural material. Chapter 3 describes the assumed structural properties and pieces of the office building that define the specific problem tackled in the design process. This study focuses on the design of load-bearing members, shear walls, floors, connections, and foundations, the details of which are governed both by typical building considerations and timber-specific ones. Chapter 4 works through the hand calculations used for preliminary and final design of the various structural timber elements and evaluates the member sizing results in terms of availability and office space area reduction. Chapter 5 presents the finite element modeling component of the study, which is used to verify hand-based designs and check for building deflection and motion behavior, which occasionally govern the design of building systems rather than strength. This analysis uncovered some areas of concern with the design, such as the potential for overturning, that need to be examined further. In Chapter 6, there is discussion on the general findings and a comparison between hand and computer calculations, which correlate quite well. Possible topics for future work on the subject of applied timber design to office buildings are also suggested. The conclusions of Chapter 7 verify the hypothesis that timber is a viable and important option as a structural material for an office building. Appendices, including structural plans, hand calculations, design summaries, and computer analysis output, are included in this report as reference material.

The intention of the study is to help affect the builders of today to shed some of their negative misconceptions about wood as a structural material, as well as contribute to building a case for wood as a viable, and in some respects structurally better (such as in seismic design), alternative to steel and concrete in many applications. This will undoubtedly produce immense positive effects on the natural resources crisis that the world faces in this age. Indeed, a timber building, even one made from engineered products like glulam or plywood, would contain much less embodied energy than, for instance, a steel building.[3] Finally, it should be noted that the adoption of a new material (if wood can be labeled that) in common office building design may carry with it valuable architectural consequences as well, for another choice of material helps lift the limitation on creativity. So, from structural, environmental, and aesthetic points of view it is worthwhile to explore the possibility of timber for office building design.

[3] Embodied energy refers to the total amount of mechanical energy that is needed to produce a structure, from the mining phase of the materials to the fabrication of the member connections.

2. Timber Design and Innovations

Figure 1 – Glulam bridge (courtesy of APA: The Engineered Wood Association)

Timber engineering has come a long way since the ancient uses of wood. In general, today wood is much better understood and its behavior predictable under any given loading situation. Once completely governed by unreliable environmental factors that caused mistrust in designers, now wood is as much a human product as it is a natural one. As discussed below, it can be classified and graded in terms of strength, and it is produced in standard sizes and shapes in the manner that steel is. Innovations like glued-laminated timber (or glulam), plywood, and crafted I-joists have increased the capabilities of wood with regard to elongating allowable spans and enabling the creation of unique forms, like curved beams. Fire protection philosophy has also changed over the years, and today the general practice is to design wooden beams to char for a code-specified length of time without failing. Finally, wood handling and preservation is an important part of timber construction and requires careful attention in a discussion on how to properly use wood for structural applications. Thus, timber design has evolved to address many of the concerns its skeptics have traditionally retained for it as not being a practical tall building material. Being familiar with these innovations forms a platform on which to erect the proposed design for an all-timber building.

2.1 Wood as a Natural Product

Wood is a natural material produced directly by the earth. This immediately sets it apart from steel and concrete, which are engineered. Such distinction carries great social overtones: the architect Le Corbusier once said that in order to industrially transform buildings it was essential to replace "heterogeneous and unreliable natural materials [with] homogeneous, artificial materials subject to laboratory tests."[4] Indeed, wood is prone to natural decay, fungus, and attack from organisms, and its performance is a function of environmental factors like moisture content and tree maturation. Other strength-reducing factors for wood are natural, such as cracks, knots, grain defects, or rings, as well as conversion-based, such as milling techniques, storage conditions, and handling. Wood fabrication, consisting of drying and treating processes, reduces actual

[4] Schatzberg.

lumber dimensions from those obtained after sawing wood while it is still green, which are referred to as nominal dimensions. Thus, standard lumber sections that are given in nominal dimensions actually contain corresponding smaller dimensions as the result of shrinkage. For example, a 2x4 piece of lumber is not actually 2"x4" in section, but rather 1½" by 3½".[5] In this report, nominal dimensions given in inches are used at all times to indicate member sizes. Finally, wood is an anisotropic material, so its mechanical properties are dependent on its grain orientation. Specifically, a wooden member is much stronger under loading parallel to its grains than perpendicular to them, up to 10 times stronger in the case of compressive loading. Wood also varies according to tree species, climate, and geography.[6]

2.2 Wood as a Human Product

As a result of some of these natural eccentricities, much effort has gone into making wood design more uniform and subject to code. Stress grading is a major convention used to provide some uniformity. It is based on properties described above – species, defects, moisture content – and can be done either visually or by mechanical testing. Along with corresponding standardized lumber sections, it allows designers to pick wooden members in much the same manner as W-sections in steel. As for lumber sections, three categories based on thickness are generally designated: boards, less than 2" in nominal thickness; dimensioned lumber, from 2" to 4½" in nominal thickness; and timber, greater than 5" in nominal thickness. Heavy timber refers to pieces of wood with particularly large cross-sectional areas. Structural composite lumber, which refers to glulam, plywood, and I-joists, are also standardized according to available thicknesses, number of laminations, and other common features.[7]

Engineered products themselves have provided a means of making wood more homogeneous and less limited by natural conditions. Glulam and other laminated members inherently contain smaller defected areas because they are built up from smaller sections. They are also less prone to geometry changes and splitting. The result is an overall increase in their stiffness. This accordingly makes longer spans possible. Also achievable are longer lengths, produced through end-jointing, and curved forms, created by altering lamination thicknesses and bending pieces. More efficient use of material is also obtained, since stronger wood can be positioned in areas with higher stresses, like top and bottom fibers in flexural members.

Fire protection is a source of concern when it comes to using wood in structures, since wood begins to char at only 300°F and ignites at 480°F. But it is well known that charring occurs on the outside of timber members first and actually provides an insulating cover for the inner core.[8] Thus, the overall heat and time of fire exposure that a thick member can withstand before failing is greatly increased. This has led to the practice of

---

[5] Faherty, Keith F. and Thomas G. Williamson. *Wood Engineering and Construction Handbook.* New York: McGraw-Hill, 1989.
[6] Kermani, Abdy. *Structural Timber Design.* Oxford: Blackwell Science Ltd., 1999.
[7] Faherty and Williamson.
[8] Schatzberg.

rating wood for time exposure resistance to fire, the standard usually being one-hour exposure before failure. The result in design is increased cross-sectional areas of wooden members. For normal timber, charred areas can often be removed and untouched cores salvaged and reused in new applications. For glulam, an exposed member can continue to serve its function if its damaged laminations can be disbanded and new laminations installed in their place. Fire retarding chemicals can be detrimental to the performance of timber, especially to the adhesives in glulam, and so, intumescent paint and special stains – on top of moisture-fighting sealants – are used instead to slow fire penetration.[9] Of course, fire protection begins with picking the most suitable design for a particular application. Since office buildings do not exhibit a particularly irregular tendency to catch fire, like a chemical warehouse might, avoiding timber for this application based purely on doubts of fire resistance does not seem reasonable.

2.3 Handling and Treating Wood

The handling of timber members is a fragile process that has a great effect on their performance. From the beginning, sawing and milling techniques affect important mechanical properties like grain direction and can cause undue cracking. Cut members must then be handled very carefully and stored in protected areas. They need to be wrapped but well-ventilated when stored, and kept well-drained from water. They should be kept out of the sunlight to prevent discoloration and they should not be scratched or mishandled – when being transported they should be stabilized snuggly, perhaps by multiple forklifts. The drying process altogether is meant to strengthen wood and give it better fastener-holding capacity. This reduces squeaking in nailed floors, for example. Keeping moisture levels in wooden members below 17 to 23% of their total weight also helps prevent adverse geometric effects like shrinkage, creep, and warping, and even decay and insect attack.[10] Preservatives applied in pressure or non-pressure processes are nearly always used to combat moisture, and sometimes to provide protection against attack from organisms.

One main advantage to using wood is that it is relatively light weight – it has a strength to weight ratio comparable to that of steel and larger than that of concrete.[11] Being light weight makes it easy to handle and position by hand or forklift, as opposed to by crane. For the case of a ten-story office building, this fact alone would reduce equipment costs a significant amount and simplify many aspects of construction. Gained time, though, would probably be spent on ensuring proper storage conditions for the wood and treating it.

---

[9] "Glulam Product Guide." APA: The Engineered Wood Association, Dec. 2003. <http://www.apawood.org/glu_level_b.cfm?content=prd_glu_main>. March 30, 2005.
[10] Kermani.
[11] For 50ksi steel, the strength to weight ratio is $50*10^3$psi / 490pcf = 14,694ft; for 35ksi steel, it is 10,286ft. For 2ksi wood, the ratio is $2*10^3$psi / 35pcf = 8229ft; for 3ksi wood, it is 12,342ft. For 5ksi reinforced concrete, the ratio is $5*10^3$psi / 150pcf = 4800ft.

2.4 Summary

Wood is a product of the earth but has undergone significant innovation with the aim of refining its properties and standardizing its use. For all its natural vulnerability to defects and environmental conditions, wood today is quite durable and reliable as a high-performance material. Techniques for fire resistance and proper handling have been improved and guidelines exist to lead designers through formerly complicated structural issues with timber. Without even referring to glulam and similar products, timber by itself has to some extent become an engineered material in the spirit that steel and concrete are. It is indeed a practical choice for the medium-rise office building in question. Thus, repudiations of timber on material-based grounds can be discredited, clearing the path for further study into a possible structural system.

3. Problem Design Decisions

The design of a ten-story office building is regulated by many types of considerations beyond structural ones. In addition to exterior and interior architecture, much of the overall design is a function of the following: accessibility, user friendliness, unobstructed window area, usable floor space, utility systems, and environmental consciousness. The integration of all these parts leads to the best design for an office building and yields superb ideas like doubling elevator cores as shear walls or using trusses to allow the passing through of pipes. The design proposed in this report aims to consider much of these topics of essential details, but in no way does it profess to be more than a structural design to be used in determining whether timber is a practicable alternative to steel and concrete in typical office building design. This seems reasonable, for much of the remaining concerns, made up of issues like aesthetics and utilities, are alleviated by current, common use of timber in successful residential and commercial applications. In other words, there is no need to prove here that timber is a fashionable material suited for an office environment. Therefore, this thesis focuses on addressing the structural issues shaped by prescribed features of the all-timber building, which are: a large amount of clear-span, rentable space; an open-air atrium; a shear wall lateral bracing system; a comfortable floor system; strong, simple connections consisting of steel plates; and efficient, concrete foundations. These specifications govern the preliminary sizing of load-bearing members, design of the shear walls, and detailing of beam to column connections. They are laid out below.

3.1 Building Layout and Space

The simplest floor plan is used to clearly illustrate principles of structural performance that are necessary in assessing timber as a viable material to be used in the office building application. It is generally accepted that the width of buildings is regulated by the need to ensure the admission of daylight and ventilation into its inner confines, in addition to architectural consideration for the city block or plot of land on which the building is situated.[12] The use of atriums or open-air corridors is a popular and energy-saving method of bringing in natural light to wider building floor plans, and works well with the sustainability mentality advocated in this study. Thus, the square building plan adopted here makes use of 90ft sides and a square central atrium with 30ft sides, resulting in the furthest point from potential light being just 15ft, which is acceptable. The addition of the atrium creates some structural challenge in that lateral loads must be transmitted across the void somehow or taken up by only one side of the building at a time.

The square shape of the overall layout allows the implementation of a straight-forward beam and column design, the simplest structural system that could be chosen for

[12] Taranath, Bungale S. *Structural Analysis and Design of Tall Buildings*. New York: McGraw-Hill, 1988.

this building type. The intention is not to analyze the ideal building, but in reality the *typical* building, so that the substitution of the design produced here is quite easy with realistic office buildings of this scale, which tend to be simple structurally.

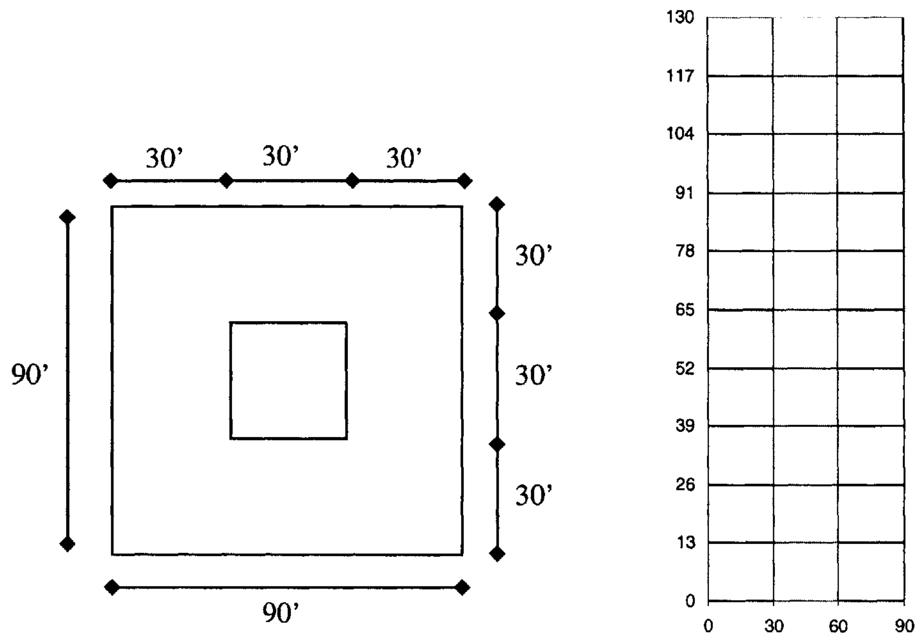


Figure 2 - Building Plan and Profile

The ten stories are taken to be 13ft in height each, for an overall building height of 130ft. The story height takes into account floor and ceiling thicknesses, beam depths, utility line clearances, insulation, and any forms of hung ceilings and light fixtures that might be installed in the finished building. This makes initial sizing of columns much more realistic. The settling of dimensions right away enables a guess at the expected dead load of the wooden structure and its façade and roof, and also gives some idea on the amount of available rental space, which is 7200ft^2 per floor, or 72,000ft^2 total.[13] This amount of rentable space decreases with the incorporation of columns into the floor plan. Thus, columns with large cross-sectional areas negatively affect the usefulness of the building. Comparing what size timber columns would be needed to support the building at different elevations with equivalent steel and concrete columns provides a means of assessing the efficiency of timber as a structural material. This is carried through to some extent later.

Initial notions of column placement in the layout are controlled by typical office plans and spans, as well as an idea on how far to stretch timber beams. It has been noted elsewhere that some timber members, like glulam beams, may span great lengths – up to 100ft. However, lengths of this magnitude result in intolerable deflections for an office application unless supported by unreasonably thick members. Also, the initial goal of this

[13] Actually, the true rentable space does not include space allotted to stairwells, elevator shafts, restrooms, and other service areas, but this is common to the design for any material.

feasibility study is to utilize the simplest timber forms possible, perhaps even off-the-shelf, to avoid adding complexity to manufacturing and construction. Thus, uniform spans of 15ft are chosen, based on professional suggestion.[14] This yields a first iteration on the necessary column positioning and sizing, and also governs the design of the shear wall and floor systems.

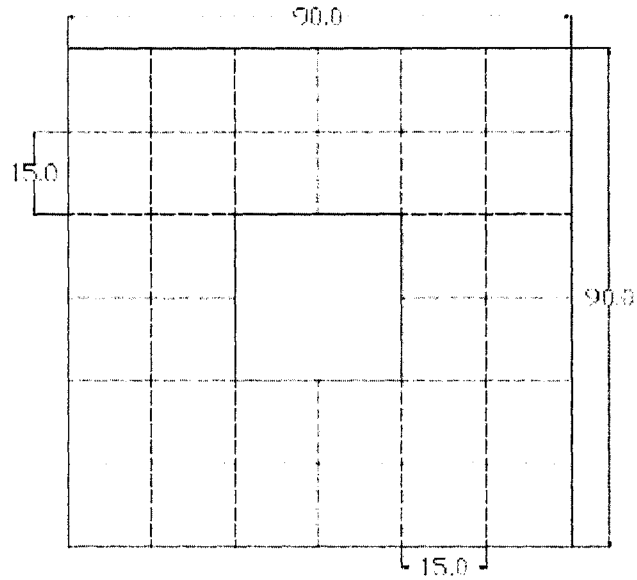


Figure 3 – Initial Column Plan

3.2 Shear Walls

The lateral load resisting system of the building is chosen to consist of mainly wooden shear walls, as opposed to only rigid frames, diagonal bracing, or a hybrid system featuring steel, concrete, or masonry. Wooden shear walls, again, are common to residential applications and mostly come in the form of plywood sheathing applied around load-bearing stud frames, with studs commonly placed at least 1ft apart.[15] The plywood panels on either side of the frame act like the web of a beam and take up the horizontal shear, but transmit opposite, vertical reaction forces through the studs. The anchorage system, thus, is integral to the design of a shear wall.[16] Alternatively, a uniquely tailored bracing system composed of thick timber elements could take the place of the plywood-stud setup, but the plywood technology is so well understood and common that it represents the simplest means of resisting lateral loads.

---

[14] Carbone, Chris. BensonWood Homes. Telephone interview. March 30, 2005.
[15] Faherty and Williamson.
[16] "Wood-Frame Shear Walls." Washington State University, July 26, 2002. <http://timber.ce.wsu.edu/Supplements/ShearWall/deflection.htm>. April 20, 2005.

In this project, the shear walls (more accurately the studs) are taken to be non-load-bearing and are connected to the columns and beams like partitions. Beams are always in line with shear walls so that their axial loads, taken from the building's lateral loads, can be easily transferred to the walls. In turn, the columns that frame the walls take up the vertical reactions induced by the shear force from lateral loads, one acting in tension and the other in compression. Since all the columns are part of the gravity load bearing system of the building, it is likely that columns exposed to tensile forces by the shear wall would remain in compression. This is akin to the outrigger design philosophy for tall building lateral load systems.[17] The use of columns at the edges of the shear walls also implies that either the shear walls should be 15ft in length to match the beam spans or new columns should be added to the existing configuration to allow shorter shear walls, for purposes of preserving interior hallways. The latter of these options is chosen, based on office space considerations, resulting in some smaller beam spans and additional columns.[18]

The positioning of the shear walls is extremely important in minimizing inter-story drift in the building. The core system common to tall buildings is not entirely transferable to this building due to its atrium. Shear walls, too, are traditionally integrated with elevator shafts and stairwells, which are usually clustered in the middle of buildings where the atrium now lies. Thus, in this design the placement of these services around the atrium is important and should not detract from the intended purpose of the atrium to introduce light. Also, the shear walls should not only be positioned around the atrium but also interspersed in the interior and exterior walls, so that edges of the building do not displace more than the center.

Finally, there is the concept of a building's center of stiffness that controls shear wall layout. The principle is that the location of the center of stiffness of a building around its vertical axis should coincide with the location of its center of mass; otherwise, torsional moment may be created around the building's axis and an uncomfortable twisting motion will mark the behavior of the building under lateral excitation. Indeed, this twisting is commonly the most noticeable and nauseating response a building can impart on its occupants.[19] To avoid this, symmetry exists as much as possible in the final design, as shown in the figure below.

[17] Taranath.

[18] The appendix presents column sizing for both the cases considering these additional columns and not considering them, since the overall process was iterative. Final sizing is given in Appendix D.

[19] Wakabayashi, Minoru. *Design of Earthquake-Resistant Buildings.* New York: McGraw-Hill, 1986.

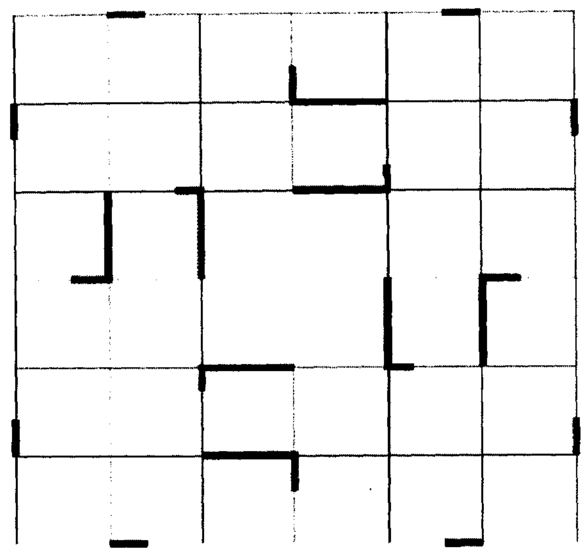


Figure 4 - Final Shear Wall Layout

3.3 Floors

Wooden floor systems are common to residential applications and have been well researched by those hoping to find the optimal distribution of joists and spans to minimize deflections, vibrations, and even sound transmission through floors.[20] Hybrid floor systems are also heavily investigated in aim of producing longer spans and more durable floors. In the design of this ten-story office building, a 1½" lightweight concrete overlay is used on all floors, thereby providing a protective inter-story layer to halt the spread of fire between floors. This concrete layer also serves to absorb vibrations and allows easier installation of floor covering. It may also function as a flexural component with shear capacity, or as a diaphragm to transmit lateral forces to the shear walls. However, this design aims to use timber to the fullest potential, and the concrete is not expected to provide any structural support. Instead, it is assumed that the timber beams will transmit the lateral forces to the shear walls, in addition to transmitting their flexural loads to the columns.

Another aspect of floor design that deserves mention is the area between the top and bottom covering. This is where the insulation and sound-proofing material used to minimize sound transmission is installed. Springs and dampers may also be utilized to reduce vibrations, though good workmanship during fabrication is paramount in minimizing vibrations and squeaks.[21] As for duct work and utilities, these lines may be hung from the floor joists and covered from view by bottom sheathing. Since truss members are not used for the main beams in this building, conduits must pass above the timber beams within the floors (or beneath the beams, which is not preferred).

[20] Walk, Michael. "New Impact-Sound-Proof Wooden Floor Slabs." Bauphysik, ETH-Zurich, 2003. <http://www.bph.hbt.arch.ethz.ch/contents/subfolder/research/disswalk. html>. April 20, 2005.
[21] Faherty and Williamson.

3.4 Timber Connections

Joints and connections in timber can be complicated and difficult to successfully design, and this in itself can discourage the use of timber in a building application. But connection details and attention to them are vital to any project using any material, and timber perhaps more than any other material, due to its age of use, has been experimented with the most and undergone the most variety. From the nail-less pegs of the architecture of Greene and Greene at the turn of the century to the steel connectors of Simpson Strong-Tie Company today, timber joints have shown excellent performance for many years.[22] What are of interest to this study are primary connections – column to column, beam to column, and column to foundation – and whether these connections need to be significantly moment-resistant.

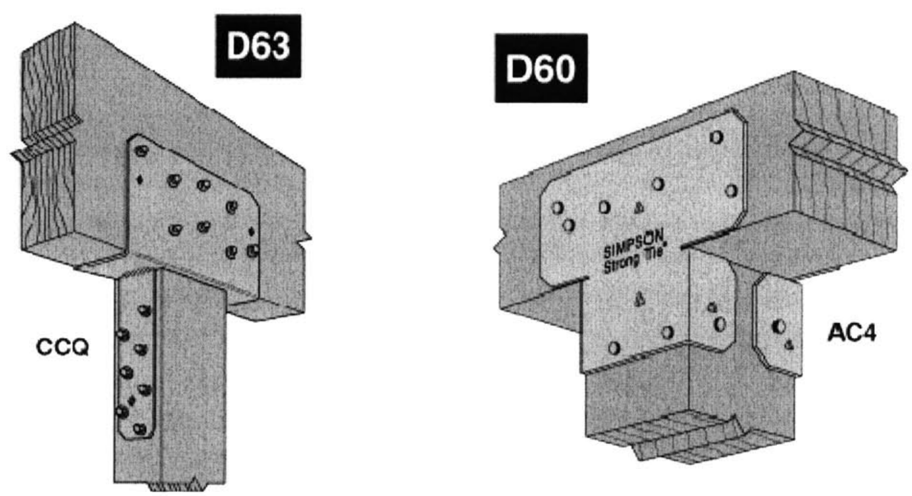


Figure 5 – Beam to Column Steel Connections (courtesy of Simpson Strong-Tie Co.)

In terms of column to column connections, the main source of difficulty centers on the question of whether the columns should be made continuous through floors. In this design, the 13ft columns are designed to rest on one another and the beams are hung from the side of the columns, with the floor slabs resting on the tops of the beams. This allows the column ends to directly transfer the column loads, which takes advantage of the parallel grain orientation in the wood, since wood is stronger in compression in that direction than the perpendicular one, as mentioned earlier. An alternative would be to rest the top column on the beams and transfer loads through them to the bottom column. This would require stronger connection details, however, since column loads would be transferred perpendicularly to the beam grains, which would make the beams more prone to crushing.

The beams are attached to the column sides with bolted, thin-gauge steel plates. This connection has two advantages. First, the beams themselves help confine the column

[22] Simpson Strong-Tie Co., Inc. 2005. <http://www.simpsonstrongtie.com>. April 22, 2005.

connection, especially in the case of interior joints, where four beams are connected at the same point. Second, hanging the beams creates more of a shear connection rather than moment connection. As will be seen later, this is preferred so as to prevent the columns from taking bending moments, which would significantly diminish their strength.[23] As for the column ends, there are at least two considerations worth relating to this design. For one, the column ends may not require significant dowel and epoxy connection if there is enough confining effect from the beams, which is advantageous. Secondly, using glulam columns with vertical laminations would determine the end-jointing technique directly, since adding length to glulam is primary to its appeal and purpose. One method of joining glulam laminations together is through finger-jointing, where the very end tip of a lamination is cut into fingers (using a special knife) that fit into mating fingers at the end of a neighboring lamination.[24] Thus, the 13ft column pieces form continuous vertical lines but are not rigidly connected at splices.

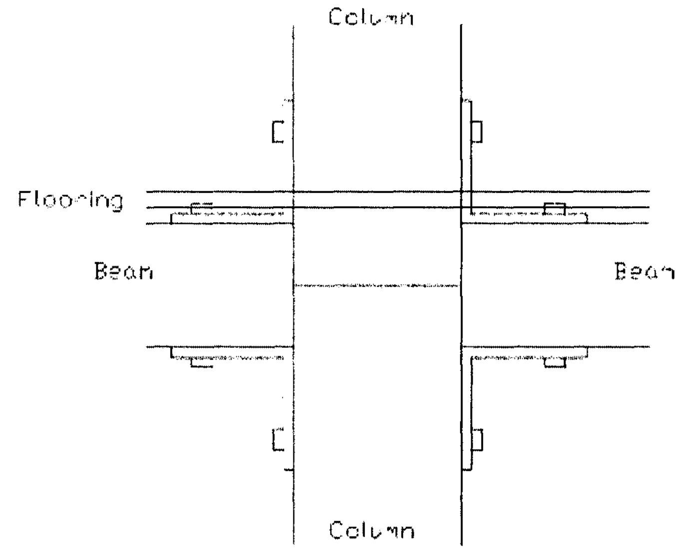


Figure 6 – Cross-sectional View of Connection with Plywood and Concrete Floor Overlays

Bolts, in general, may cause splitting in wood, especially if it is too dry. It is thus preferable to pre-drill holes. Bolts are favored over nails because of their higher shear strength and withdrawal resistance, which is especially important under lateral and seismic loading.[25] More creative solutions for attaching the beams to the columns could include using non-steel parts like rope or leather ties or intricate nailing schemes. However, such non-standardized parts make assembly complicated and may not provide reliable performance. Needless to say, all-timber connections would require significant

[23] Additional moment resistance and ductility in the steel plate connections could be gained by using toothed-rings or spiked plates (see Faherty and Williamson). Until the shear wall capacity is explored, it is not entirely obvious how significant moment connections or rigid frames are to the structural system.
[24] "Glulam Product Guide."
[25] Kermani.

design work and careful construction, which is beyond the scope of this work. However, such connections do exist and could be utilized.

It should be noted that in this design, beam to beam connections do not in fact occur. Instead, the beams – which may be 15, 11, 9, 6, or 4ft in length, depending on their proximity to shear walls (see Figure 4) – span between columns, with their ends attached to column sides. The result is a discontinuous beam system with no need for moment-splicing. An alternative could be to pass continuous beams through the joints and position beam splices at low-stress points. This would result in a less clean setup and would require further analysis, with the benefit being less eccentric loading on the columns and stronger connections.

3.5 Foundations

Column to foundation connections raise the question of what form the substructure of the office will take given the timber design. At first glance, it is apparent that the timber structure would weigh less than a corresponding steel or concrete building, indicating a need for a less massive footing. Still, a reinforced concrete foundation might be required to counteract any soil uplift (due to hydrostatic pressure, for instance), due to the high efficiency of concrete in this application. For completeness, one could consider a timber foundation comprised of wooden planks. However, this setup would be inefficient, due to the required weight needed to hold down the hydrostatic soil pressure, and fragile, due to the effects of moisture and organism attack on wood.

Given a concrete footing, then, the design needs to account for the interface between the load-bearing timber columns and the concrete slabs they rest on. Such a connection is also quite standard and commonly done with bolted steel plates connecting the faces of the timber column directly to the top face of the concrete. Alternatively, the columns could be tied to floor boards instead, and these boards, in turn, anchored to the concrete face. This may alleviate some crushing in the timber as it rests on the hard concrete.

3.6 Summary

The building specimen for this feasibility study is kept as simple as possible so that the main points of design may be illuminated. The use of a square layout with an atrium defines the 15ft spans that the horizontal load-bearing members will need to be designed for, and the building's height stipulates that the vertical members will need to reach a height of 13ft and undergo combined loading without buckling. The layout also gives a value for the amount of available interior space, which the final-sized, timber columns must not diminish too much compared to corresponding steel or concrete columns. The placement of beams and columns additionally defines the locations of shear walls for the lateral load resisting system, which is also kept simple and symmetric, partially out of concern for proper positioning of the building's center of stiffness. Shear walls are chosen to be plywood-based and to act as only horizontally-loaded elements.

Accordingly, columns will have to be designed to take up the vertical reactions of the shear walls from lateral loads. Beams, too, must be designed for axial loads derived from the lateral loads as they are transferred to the shear walls. Floors are made up of a complicated series of joists, insulation, and vibration damping components, which all affect the structural design of the system. In this study, only the load-bearing elements of the floor system will be concentrated on any further. The detailing of connections and foundations, too, can derive from deeper design considerations and take on many forms. Here, the connections and footings are kept simple and standard, based on tested and proven technology using materials other than wood. This allows more focus to be placed on the designing of structural members, which is done first by hand and then validated through a finite-element analysis.

4. Hand Calculations

The feasibility study is highly structural in nature and requires both careful hand calculations and supplementary finite-element modeling. The hand methods described in this section begin with certain assumptions that must be updated after successive iterations of design to finalize acceptable member sizes and geometries. Some of these assumptions were highlighted earlier and include beam spans, column heights, and story height, among others. Also essential from the start is a clear definition of structural design loads to be dealt with in the design process, and so, these are presented below. With these requirements it is straightforward to size vertical and horizontal members, and then to look at the shear walls and floor systems. Beyond strength-based concerns, issues with deflection govern many pieces of the system, including spans and shear wall performance, and these issues in particular can be checked with computer software to obtain adequate confidence in the design.

4.1 Structural Design Loads

The adopted design load methodology is LRFD, with the following relationships governing the design:

$$\begin{aligned} \text{Strength} &= 1.2 * \text{Dead} + 1.6 * \text{Live, and} \\ &= 1.2 * \text{Dead} + 0.5 * \text{Live} + 1.3 * \text{Wind} \end{aligned}$$

An initial floor dead load value of 42psf and roof load value of 17psf were taken from Breyer to initiate member sizing.[26] These values are itemized as follows:

Floor		*psf*
	1½" thick concrete floor slab	12.5
	1⅛" thick plywood flooring surface	3.4
	½" thick ceiling drywall & supports	3.2
	Framing	2.5
	Partition & façade	20
	Estimated TOTAL	42.0
Roof		
	5-ply roofing	6.5
	Re-roofing	2.5
	½" thick plywood	1.5
	Framing	3.2
	Tile ceiling & insulation	2.5
	Estimated TOTAL	17.0

Table 1 - Initial Design Dead Loads (adapted from Breyer)

[26] Breyer, Donald E. *Design of Wood Structures*, 2nd Edition. New York: McGraw-Hill, 1988.

The roof load is taken by every column on every floor, but only by the beams on the top floor.

A live load value of 80psf was taken into account according to common building code for office spaces, and a wind load of 30psf was chosen to be applied uniformly across one face of the building for wind analysis.[27] Other environmental loads like snow and rain were neglected for simplicity.

Seismic excitation was virtually non-existent in the design process beyond some computer-initiated analysis, since seismic concerns run beyond the scope of this work. Still, it should be noted that it is expected that a timber building would perform very well under earthquake loading due its material ductility and light weight, which places its natural period below the dangerous range of seismic excitation, which is on the order of a few seconds.[28] Indeed, the fundamental period of a structure is approximately given by $\sqrt{(\text{mass/stiffness})}$. The lower mass of wood should give a lower period for a constant stiffness compared to steel and concrete. However, assuming a constant stiffness is not entirely correct, since wood is inherently less stiff than either of those materials, with a Young's modulus value taken to be just 1700ksi in this report. Of course, member cross-sectional areas and moments of inertia will be larger for wood due to its smaller strength, which increases stiffness values. Thus, it is reasonable to believe that the timber structure would contain a relatively low natural period.

4.2 Vertical Members

The final plan, with the majority of beam spans being 15ft and shear walls placed strategically throughout the floor layout, results in a total of 64 columns, each meant to take equal share of the floor and live loads and the loads flowing down from above. This means that the columns on the top floor may generally be smaller than the columns on the first floor, and for the purposes of design only the first floor columns are focused on here, though final dimensions are given for the top columns for reference. Axial loads yield initial cross-sectional area requirements for given properties of wood, taken in this study to be as follows:[29]

Species:	*Douglas Fir*		
	Allowable Strength in Compression	2	ksi
	Allowable Strength in Bending	2	ksi
	Modulus of Elasticity	1700	ksi
	Modulus of Rigidity	90	ksi
	Density	35	pcf

Table 2 - Properties of Wood Used (adapted from Breyer)

[27] *Uniform Building Code*. Whittier, CA: International Conference of Building Officials, 1994.
[28] Wakabayashi.
[29] Breyer.

The buckling check is of utmost importance, as none of the columns may be considered "short" due to their 13ft heights.[30] In general, this does not affect the total cross-sectional area of the members as much as it does the dimensions, since the smallest side lengths for the rectangular columns are used in the slenderness ratio terms to find the allowable stresses on the members (see Appendix B). Also essential is a combined loading analysis, for the columns may at times be eccentrically loaded or subjected to bending moment. During the design it was seen that eccentricities in axial load greatly decreased the amount of compressive load the columns could support, and lateral loads at the tops of columns should ultimately be kept small – under 15kips. This can be ensured by avoiding moment connections between beams and columns.

Iterations on column design are carried through once more precise column, beam, floor, and shear wall dimensions are determined, though it is true that the original dead load value of 42psf assumed at the beginning accounts for most of the structural framing system. The shear walls in particular determine to a large extent the final sizing of columns, since they create reaction forces that are transferred to the columns in opposite axial directions. In other words, lateral loads are ultimately taken up by the columns, and depending on the orientation of the loads some columns may take more load than others. But neglecting shear walls and increased loads due to the weights of beam and shear wall members, it is found that 12"x14" nominal columns should support the loads on the first floor, with 6"x10" columns necessary for the tenth floor (see Appendix B). These large column sizes, at 13ft in length, are available as heavy timber pieces, though using glulam or built-up sections could also be considered.[31]

4.3 Horizontal Members

The main beams may be up to 15ft in length, with some beams measuring only 4, 6, 9, or 11ft at shear wall bay locations. The beams transfer all of the floor loads and live loads to the columns, and in addition carry lateral loads axially to the shear walls. They are thus under combined loading. Strength-based design using tributary area for the case of 90 total 15ft beams yields relatively small cross-sectional areas that are quickly deemed unacceptable by deflection considerations. In this study, acceptable deflections are taken as 1/240 of the span for total load and 1/360 for live load only.[32] The shorter span beams are not considered here since they are not limiting factors of design, though it may be mentioned that due to visual considerations for the ceiling, uniform beam areas may be preferred in the structure.

---

[30] Faherty and Williamson.
[31] *Ibid.*
[32] *Ibid.*

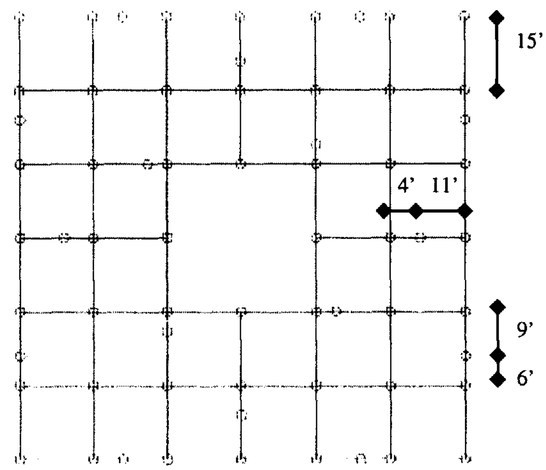


Figure 7 - Beam Layout

Deflection analysis was carried through assuming simply-supported spans. The governing variable for constant modulus of elasticity is the moment of inertia, based on a rectangular cross-section for the purposes of this study. It should be noted, however, that engineered timber I-joist systems could be considered for the design of these main beams, with their efficiency deriving from their cross-sectional geometry but their drawback being their energy-intensive fabrication and cost. Glulam, too, is an obvious choice, and corresponding lamination details are given for the sawn lumber nominal dimensions. For tenth floor beams that are required to support additional roof loads, the beams are designed to be 8"x14" nominally, neglecting axial load, with the larger dimension representing the depth of the beam. A corresponding glulam section could be fabricated from an 8¾" wide section consisting of eight 1½" horizontal laminations, for a depth of only 12". All beams in other stories also need to be 8"x14" in nominal size. However, these sizes change when combined axial loads are taken into account based on the design lateral loads (see Appendix B). In this case, combined stress criteria using an axial load of 46kips dictates that all beams be 8"x18"in nominal section. These are the final beam dimensions taken in this study.

4.4 Shear Walls: Lateral Resistance System

Shear wall design is controlled by the amount of deflection allowed in the story, given by h/200, where h is 13ft. Thus, the fundamental concept of design is stiffness and the controlling factor is inter-story drift. Shear walls provide stiffness with four mechanisms – bending, shear, nail deformation, and anchorage slippage. The overall effect is given by:

$$\Delta = (8*V*h^3) / (E*A*b) + (V*h) / (G*t) + 0.75*h*e_n + h/b*d_a < 0.78''$$

where V is the shear per unit length at the top of the wall, h is the height of the wall, A is the cross-sectional area of the boundary columns, and b is the width of the wall. The modulus values are known. The quantities of e_n and d_a represent the nail deformation and deflection due to anchorage slippage, respectively, and are given by code, albeit not very clearly.[33] Here it is assumed that e_n is 0.05 and d_a is 0.10", which are conservative estimates based on the material used (Structural I plywood) and the spacing between nails joining the sheathing to the stud assembly (assumed to be 6").[34]

Determining which walls take what amount of shear poses an interesting question in the design process. The first thought is that it would be desirable for the largest shear walls to be clustered in the center of the building and be thick enough to take the majority of shear created from lateral loads. Specifically, this was done by summing up the entire lateral load on a floor – 45,630lb, also used as the maximum axial load in the beams[35] – and dividing it by the total length of shear wall absorbing the force. For the walls surrounding the atrium, which in any direction consist of one large 15ft long wall and one smaller 4ft wall, the two walls act together and also in unison with the walls on the opposite of the atrium in taking load, so the total length of shear wall is 38ft. This assumption was made and yielded a required thickness value of 0.76" (see Appendix C). This means that for all four of the core walls acting in the direction of lateral loading, the total thickness of plywood around the stud assembly should be 0.76", which may be achieved using one sheet of ½" plywood on each side of the assembly.

The second design assumption was that each outer bay, or line of beams not on the atrium perimeter, should take 1/7 of the amount of lateral load on any given face of the building, based on tributary area. This value is 6,519lb and was divided by the total length of shear wall in a given bay. There are three types of outer-bay shear wall systems in the building – the exterior system, consisting of two 6ft walls per line; the interior middle system, consisting of one 6ft wall on either side of the atrium along the center lines of the building; and the inner system, consisting of one 15ft wall per line. The first two systems share wall thicknesses of 0.55" (made from two 3/8" thick plywood sheets), while the latter needs only 0.35" (two ¼" thick sheets) of wall thickness (see Appendix C).

These thicknesses, it can be shown with the computer, work well in the building system, but a final buckling check needs to be completed to ensure proper sizing (see Appendix C). Indeed, the shear acting on the walls acts as a compressive force, with the slenderness ratio of the wall being proportional to its width and thickness. Simple Euler buckling analysis shows that the thicknesses must be updated to account for this buckling. In particular, the core shear walls are increased to 1¾" thickness (made from of four ½" thick plywood sheets), and the inner walls are increased to 1½" thickness (two ¾" thick sheets). The exterior and interior middle walls are only slightly updated to 0.73" thickness (still two 3/8" thick sheets) because their length, only 6ft, is sufficiently small to negate buckling. A second buckling check, taking the entire shear over a 1ft wide strip across the plywood face with fixed ends, as opposed to the entire 13ft height, informs that the stud assembly has an important role in breaking up the length of the wall to prevent buckling. Though the calculation shows that only one stud needs to be used to divide the wall lengths in half, the final design calls for studs placed every 1ft to ensure low values

---

[33] *Uniform Building Code.*
[34] Faherty and Williamson.
[35] Using the factored wind load and surface area of the building: 1.3*(30psf)*(13ft)*(90ft) = 45,630lb.

for nail slippage. Yet another method of checking buckling in the shear walls may utilize a braced frame analogy, which relates the stresses in the shear walls to equivalent areas of diagonal bracing systems through stiffness values. These diagonal members may in turn be checked for buckling for calculated axial loads. This was done using known relations and did not add new light to the previous computation (see Appendix C).[36]

4.5 Vertical Member Reiterations

The shear walls give reaction forces and contain overturning moments that must be resisted by the columns, which are axially loaded from the main beams. The overturning moment is given by the product of the total shear acting on a wall and the height of the wall. The tensile and compressive reactions are given by this moment divided by the length of the shear wall. Also, in the proposed design some shear walls share the same columns, so these columns must take additional reaction loads, as well as the weight of the shear walls themselves. The result is that for the largest shear walls, columns must take about 18kips of additional load and are thus increased to 14"x16" nominal sections on the first floor (see Appendix D). Some shear walls may contain columns of different cross-sectional areas, such as in the case of a 6ft wall abutting a 15ft wall. Generally, the 6ft walls require only 8"x8" end columns on the first floor to carry ordinary vertical loads and the lateral load reactions. There are also 14"x14" columns at the ends of "inner" shear walls (see Appendix D). The final column layout, seen in terms of shear wall lengths and placement, is shown in Figure 8.

The uneven distribution of column sizes makes the design efficient. Larger columns are clustered around the core and smaller columns tend to be found toward the outside. The largest columns on the first floor are designed to take over 300kips of axial load and have the capacity to take around 15kips of lateral point load at their tops. This number is much less than the 46kips designed to be taken by the beams and transferred to the shear walls. This is not contradictory, though, because the shear walls ultimately take this force and it does not appear as a moment on the columns. As a final note, elevator shaft and stairwell loads are intended to be taken by the large core columns, but some of the dynamic effects of these structures were not explored and may actually necessitate the use of other load-bearing materials instead of timber.

[36] Smith, Bryan Stafford and Alex Coull. *Tall Building Structures: Analysis and Design.* New York: John Wiley and Sons, 1991.

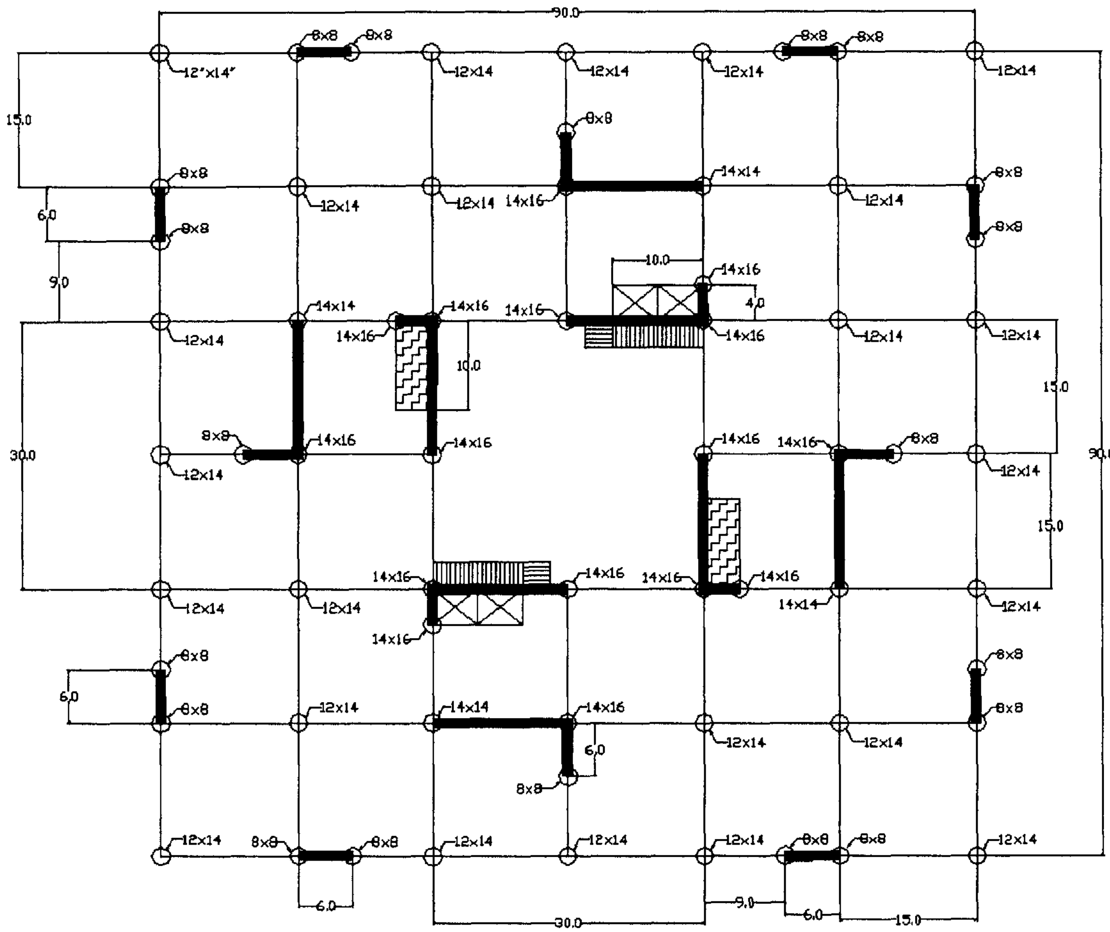


Figure 8 – Final Building Structural Layout

4.6 Floor Systems

Calculations for the floor joists were carried through assuming fully loaded, square slabs of 15ft sides (see Appendix E). Joists with 2"x12" nominal sections were chosen instead of engineered I-joists to keep the design simple. Such joists may be spaced every 12" and aligned in only one direction to satisfy strength requirements. However, deflection and vibration rule the design of floors, and it was seen that 15ft joist spans would create excessive deflection – on the order of 6" instead of the required 0.75". To solve the problem, cross-girders are installed to shorten the effective lengths of the joists and increase the overall rigidity of the floor. The joists pass over these girders, since they cannot pass through them. The number of girders needed depends on whether they are intended to take load from the joists, which should be the case to increase the overall efficiency of the floor system. The final design calls for only two cross-girders with 2"x12" section placed at 5ft intervals, though more thorough floor design may reveal a more efficient system. In fact, equally numbered joists and girders, creating a two-way, square network, would perhaps be the most efficient system.

In practice, the plywood covering and concrete overlay also act to increase the rigidity of the structure. This is particularly important in looking at the floor slabs as diaphragms to aid in the transmission of lateral loads to shear walls. The higher stiffness value also helps to put the natural frequency of the floors above human perception levels. This implies, too, that bottom sheathing serves a role in generating stiffness, specifically by restraining torsion in the joists.[37] Including these different stiffness terms is difficult to accomplish in hand analysis, but it should be kept in mind that the proposed design is for a typical office building, which demands much less stringent vibration standards than, for example, a laboratory or medical building. In other words, looking at timber for certain other building applications entails consideration for additional aspects of design, of which dynamic control is but one example.

4.7 Office Space Area Reduction

As pointed out earlier, a useful measure of the effectiveness of using timber framing in the proposed design is the perceived change in usable office floor space as compared to cases for other common materials. For the final column configuration outlined above, there is less than a 1% change in first floor area for the case of timber. This percentage is so small that it does not actually need to be compared quantitatively with percentages for steel and concrete design, which will be slightly less than the timber percentage due to higher modulus and strength values. The point is to check for excessive area loss, and this has clearly been proven to not be a result of the timber design.

Column Section	Number	Area (in^2)	Total (ft^2)	
12x14	24	168	28.00	
8x8	20	64	8.89	
14x14	4	196	5.44	
14x16	16	224	24.89	
Total	64		67.22	ft^2
Original Office Space Total (first floor)			7200.00	ft^2
Net Space			7132.78	ft^2
Percent Change			0.93%	

Table 3 - Effect of Column Sections on Rentable Floor Area

[37] Faherty and Williamson.

4.8 Summary

The hand calculations have produced complete dimensioning and detailing for the columns, beams, shear walls, and floor slabs (see Appendix F for a design summary). These designs are based on prescribed loading conditions that were refined to account for the changing dead loads of the structural members as they underwent iterations.

Ignoring seismic loading conditions, vertical load-bearing members on the first floor were sized to four different sections, depending on their support for shear wall reaction forces. The controlling factor for most of the design was buckling, and the columns generally do not possess much flexural capacity. The largest columns, which are found around the core of the building, measure 14"x16" nominally and are designed to take most of the lateral load the building might be subjected to. The other nominal column sizes are 14"x14", 8"x8" and 12"x14", the last of which represents typical, non-shear wall supporting columns. These large column areas, it was found, do not significantly detract from the available floor space area in the office layout. Also, as large as these sections are, such sizes are found in standard timber tables, indicating that the availability of these columns is not a limiting factor of design.[38]

Beam sizes are generally smaller. They do not vary between floors 1 through 10 or among the different spans created by the shear wall lengths, for purposes of consistency. The constant nominal size is 8"x18, even for the tenth floor beams that support additional roof loads. These sizes result mainly from deflection criteria and combined loading analyses, as opposed to simple flexural strength requirements. Indeed, the beams satisfy the L/360 deflection limit and are capable of taking 46kips of axial load – the entire possible wind load on a building face – to be transferred to the shear walls.

Shear walls are designed to take up the factored wind load without causing more than 0.78" of inter-story drift. The typical shear wall system is taken from residential design and consists of plywood sheathing stretched across an assembly of non-load-bearing stud beams spaced at 1ft intervals. A buckling check on the initial shear wall design indicated that plywood thicknesses needed to be slightly larger than originally anticipated. The final design calls for four ½" thick plywood sheets at each shear wall around the core, two ¾" thick sheets at inner walls, and two 3/8" thick sheets at the exterior and interior middle walls.

The floor system consists of 2"x12" nominal joists spaced at 12" apart and laid out in one direction across the 15'x15' slab cutouts. To increase the rigidity of the floor, two cross-girders of the same dimension, spaced at 5ft apart and attached to the bottoms of the joists, are used. More efficient floor systems operating in two directions could be implemented as well. All floor loads are transferred directly to the main beams as uniformly distributed loading.

The hand calculations do not reveal impractical or unreasonable member sizes and at this point suggest that strength issues should not restrict the use of timber in the design application under discussion. Though the designs are not completely detailed – for instance, column sizes for all the floors are not worked out – they can be used in a finite element model to test for deflections and other non-strength issues that may affect the success of the design.

---

[38] Faherty and Williamson.

5. Finite Element Modeling

The next step in the feasibility study is to check the member sizing from the hand calculations and look at the dynamic behavior of the building system with a finite element program. Using the SAP2000 software, the whole 130ft tall building, complete with shear walls and actual dimensioned wooden elements, was subjected to gravity and lateral loads and tested for deflections, loading path, and mode shape behavior. Iterations were carried through by releasing the member connections, varying the thicknesses of the shear walls, and removing the floor slabs to discover the roles each of these plays in affecting the building's performance. In general, the computer results show a successful building design in terms of inter-story drift, axial loads, moment distribution, and torsion. However, the results also raise some issues with regard to overturning, stability, and possible column overloading. These matters are discussed here. Output data values may be found in Appendix G.

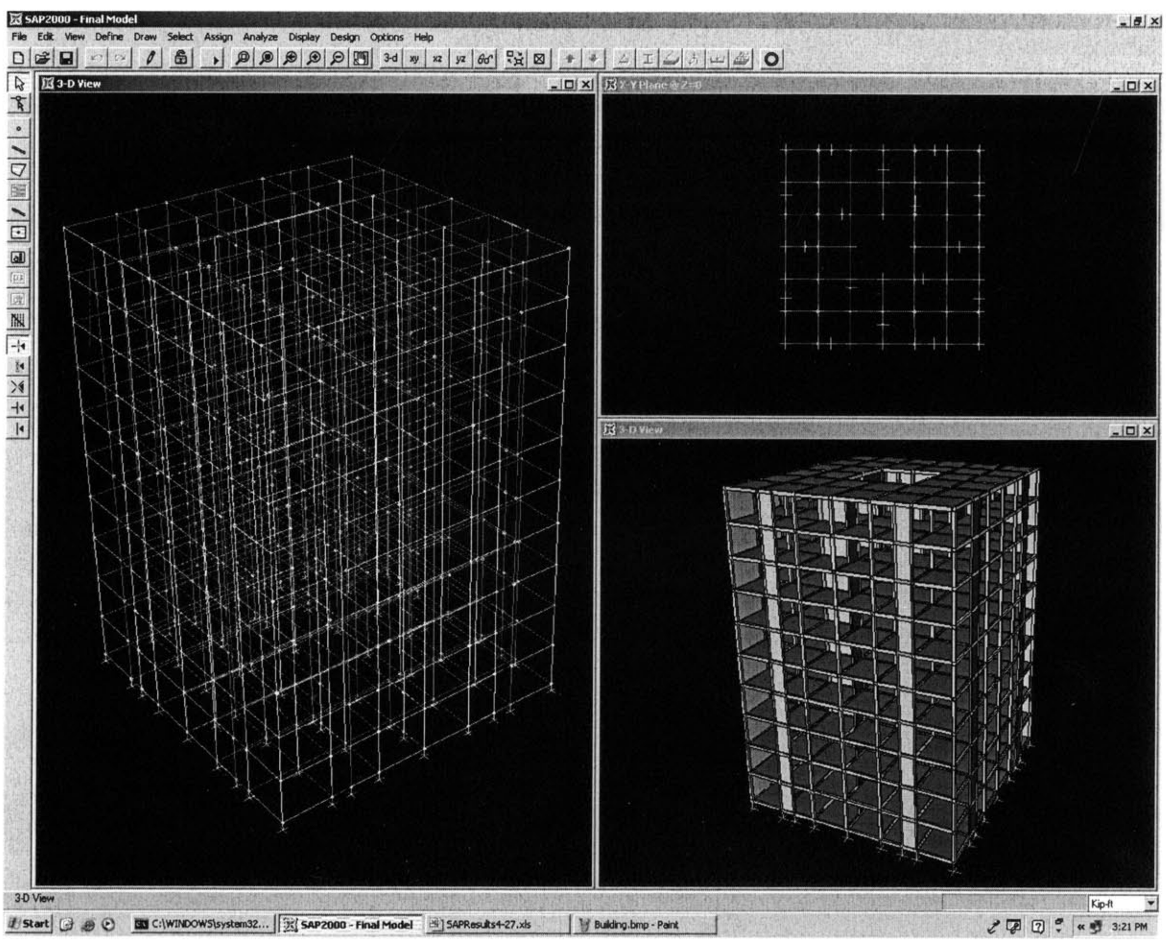


Figure 9 – SAP2000 Model

5.1 Deflections

The default computer setting defines the joints between members in the model as moment-resisting connections. This type of connection significantly reduces the amount of deflection in the building, with the adverse effect being the transfer of bending moment to the columns. So, to more accurately model the system, the column frames were all released from their connections, effectively turning their joints into shear connections.

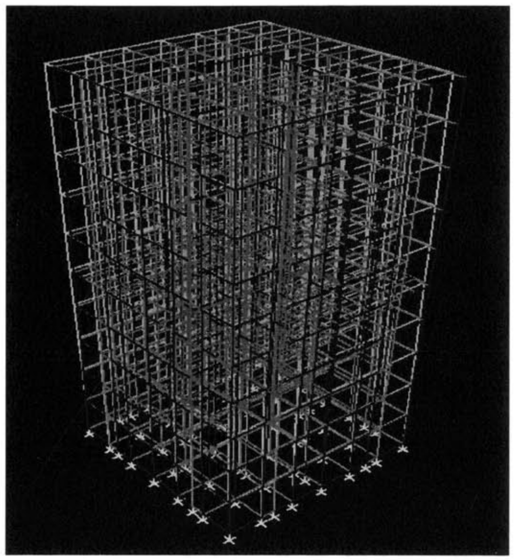


Figure 10 – Deflection under Wind Loading

The first computer analysis included the floor slabs, modeled initially as 12" thick wooden shells. Coupled with the shear walls, these slabs kept story deflections well within reasonable limits. Separate cases were analyzed for 1.2" thick wooden shells and without slabs altogether to test for the stiffness contribution of the floors to the overall building performance, since the timber frame design was not intended to rely on the floor slabs for shear transfer. The 12" thick shell thickness case gave deflections of 1.40" at the top of the building and 0.16" between stories in the direction of the applied, factored 30psf wind loading, while the 1.2" thick case gave slightly larger deflections values, namely, 2.77" at the top and 0.28" between stories. These values satisfy the allowable deflection criteria: at the top, H/200 = 7.8", and for inter-story drift, h/200 = 0.78". The case with no floors (only frames) also satisfied the deflection criteria, with the maximum deflection at the top limited to 2.84" and the drift to just 0.32". This result shows that in reality, depending on their thickness, the slabs would act as diaphragms to transfer shear to the shear walls, though it is not necessary to depend on them for this purpose, since the beams are adequately designed with this capability. Thus, the floors do stiffen the structure and need to be considered to correctly predict building behavior.

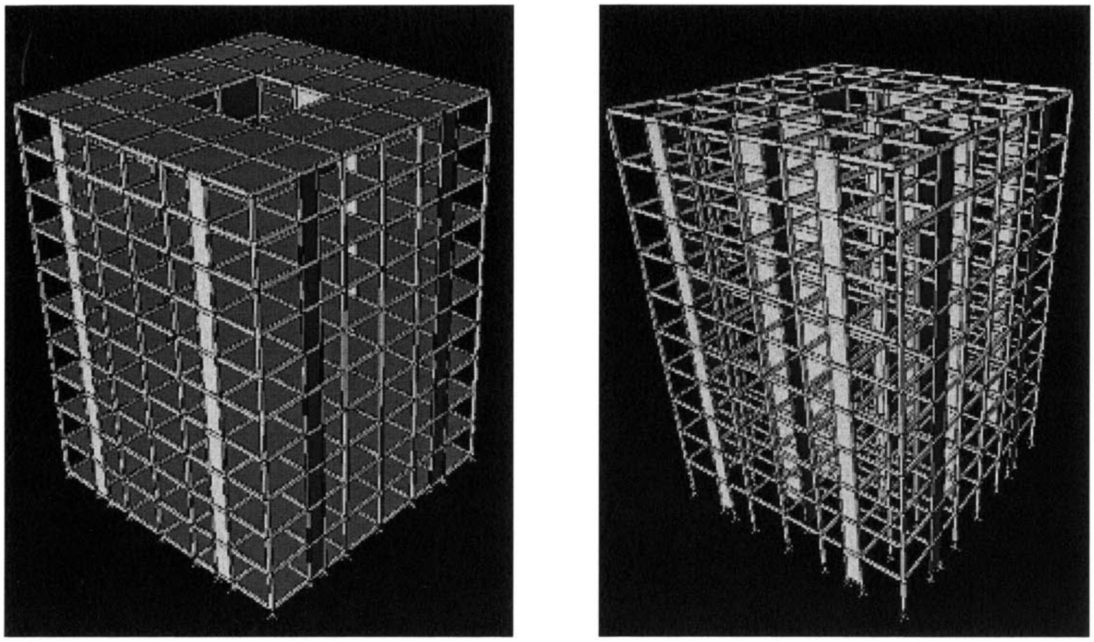


Figure 11 – [Left] Model with Floors; [Right] Model without Floors

Further iteration to check the performance of the wooden-frame structure was run on the model for various shear wall designs. First, the case of no shear walls was analyzed to gain an idea of the importance of the walls in supporting lateral loads. What was found in this case was that even with the existence of moment-resisting connections the deflections in the building could not be contained within acceptable limits, the deflections being on the order of several feet. On the other hand, it was seen that the use of concrete in the shear walls for the assigned thicknesses yielded better deflection performance – up to 20% better for maximum deflection and 30% for drift. Finally, the case for using only core shear walls resulted in excessive total deflection at the building edges, with an increase of about 70% from the normal case (see Appendix G). This indicates again the importance of using shear walls in all bays of the building, especially if moment connections are not used.

Also of interest is the computer generated values for torsion around the building axis, given the consideration paid to the positioning of the shear walls in order to correctly locate the center of twist of the building As it turns out, the torsion is not completely eliminated in the building, since there is some displacement at points in the building in both the directions parallel and perpendicular to the applied loading. The angle of twist is about 0.106° for both the cases of floors and no floors. The existence of twist, though not very large in magnitude, hints at unevenness in the column, wall, and slab layout, which may be rectified with more precise modeling but is beyond the point of concern here. The analysis illustrates that keeping the layout symmetrical is a way of minimizing deflections.

5.2 Member Loading

For the control scenario (with shear walls and 1.2" thick floors), the axial loads in the columns remained within allowable stress limits for the cases considering wind loading and not considering wind, though some columns showed tensile action. Success is measured by comparing the computer generated axial forces to the anticipated compressive loads for which the columns were sized, which were 330kips for the 14"x16" columns, 300kips for the 14"x14" columns, and 280kips for the generic 12'x14" floor columns. In the scenario for the absence of shear walls for wind loading conditions, though, it was determined that some columns were subjected to disproportionately large compressive load, in some instances over 400kips for the largest columns. Others exhibited undue tensile forces. This hints at the possibility that in the program the shear walls take some of the vertical load instead of passing it completely to the columns.

This was tested by running a case considering all the shear walls except those on the first floor and looking at the axial forces in the first floor columns. It was seen that, indeed, there was a jump in the load in the columns between the second and first floors, suggesting that the shear walls in the upper floors were taking vertical load. Also, the first floor columns exhibited maximum compressive loads of only 250kips and tensile loads of 3kips. This does not match with the static load case ignoring wind, where the first floor columns take their limit of over 300kips of compression. Thus, the wind loading activates the shear walls as vertical load-bearing elements and affects the vertical loading distribution in the building significantly.

The fact that some columns take enormous amounts of compressive load while others take very little load stems from the directionality of the wind loading, which effectively turns the entire building into a shear wall. The result is that the front columns undergo tension and the rear columns undergo compression. The existence of interior shear walls moderates this effect by controlling tensile and compressive forces and distributing them to the properly supported columns. The computer model shows this quite well – columns under tension are always attached to shear walls and balanced by their partner columns under compression. Additionally, however, the model shows that under wind the gravity and live loads also get redistributed to interior columns. This creates abnormally large compressive loads in certain columns and even fully tensile loads in others attached to shear walls. The shear walls also complicate the stress distribution by absorbing some of the compression and tension, which is not meant to be the case.

The figures below illustrate the axial force distribution under the cases of non-wind loading and wind loading. The color distribution represents the magnitude of compression and tension in the columns and shear walls. In the first figure, the right-hand image contains light-colored infill at some shear wall columns, illustrating the tensile effect exhibited during wind loading. The left-hand image shows, for no wind loading, uniform axial force distribution in the columns, increasing in compressive magnitude from higher floors to lower floors. The right-hand image shows certain columns functioning at above their stress capacities and other columns working below theirs.

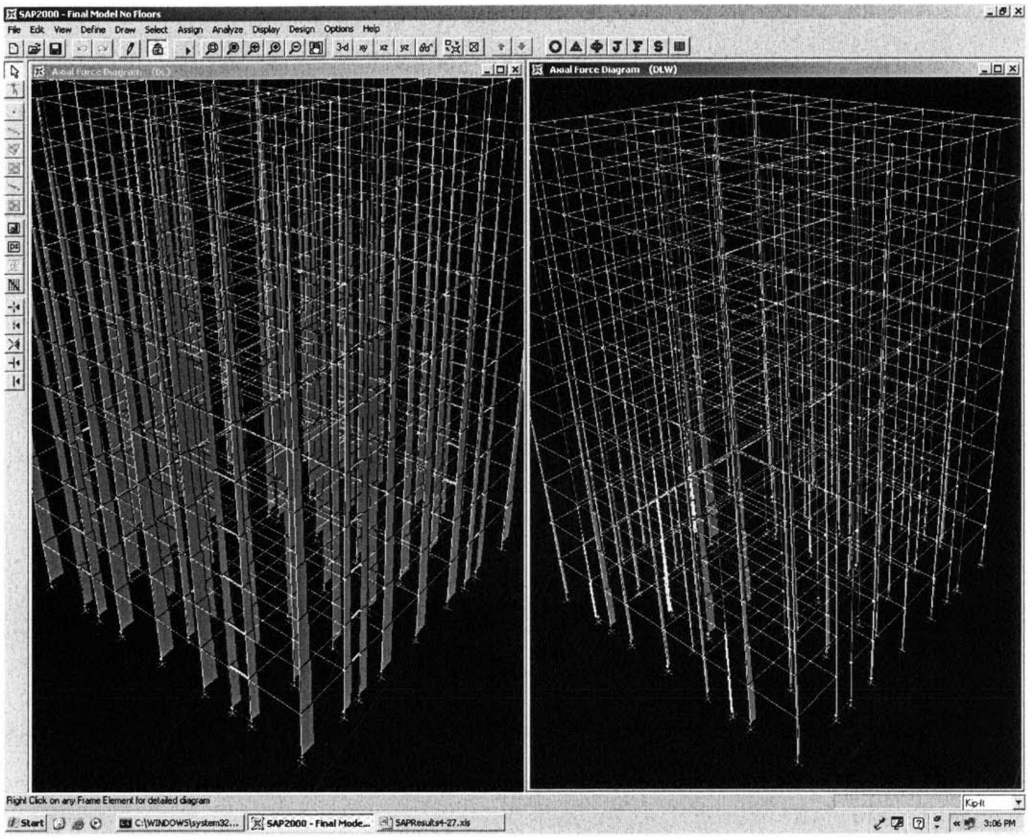


Figure 12 – Axial Column Forces: [Left] Under Static Gravity Loads; [Right] Under Wind Loading

The bottom figure shows positive stress gradients in the shear walls changing to negative in the direction of the wind loading, indicating that the walls are being subjected to overturning.

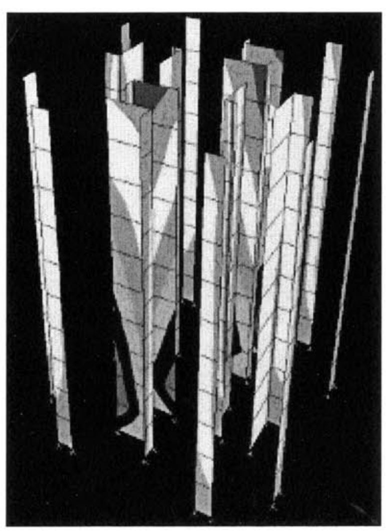


Figure 13 - Shear Wall Stresses Under Wind Loading

The situation implies that there is some overall uplift in parts or the building, since otherwise the dead load of the building alone should be enough to keep columns in compression. In fact, this uplift is verified by the fact that there is some small, positive vertical deflection at the top of the building at certain column locations, but only in the case considering floor slabs. That only this case displays such effect is explained by the higher stiffness of the building provided by the floors, since the added rigidity makes the building behave increasingly like a bending beam rather than a shear beam building. This may indicate that the building is in fact too stiff, as a result of large member sections, and requires more mass to offset undesirable effects.

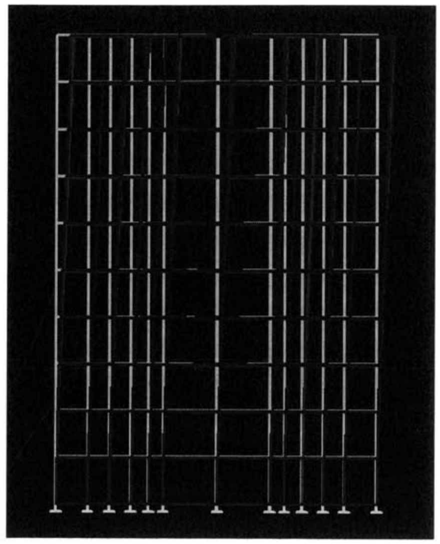


Figure 14 - Deflection of Building with Floors Showing Slight Uplift in Middle

The flow of forces, in general, should take the largest loads to the stiffest areas of the building, preventing the over-loading of columns and avoiding the use of shear walls as vertical members. However, bending action may preclude this from happening, creating an over-loaded situation ripe for column failure and unanticipated shear wall buckling. This possibility should be explored with more in-depth analysis of lateral loading conditions. For instance, wind loading at the corner of the building may lead to additional column over-loading. In fact, this case was run in the modeling process and showed reduced total deflections – 2.20" at the top and 0.23" for inter-story drift – and even more unique axial force distribution.

As for the beams, the amount of bending moment and axial load given in the computer analysis falls within the range expected in the hand calculations. The maximum bending moment recorded in the uniformly 8"x18" beams was 34k-ft, leading to a bending stress of 0.84ksi, under the 2ksi limit of the chosen wood. The maximum axial load in the beams was found to be 23kips, well under the capacity load of 46kips. So, the beams do not seem to be the weak link or source of failure in the structure as much as the columns seem to be.

5.3 Dynamic Behavior

The building was examined in terms of its mode shapes to gain additional insight into the performance of the timber structure under variable loadings. It was found that, as predicted, the natural period of the building is slightly less than the value that would be expected for corresponding steel or concrete buildings. The first mode, in fact, is torsional and occurs at 0.66sec for the case including 1.2" floors, at 0.80sec for the 12" floor case, and at 0.60sec for the case excluding floors. The expected first mode – straight line deflection, or the fundamental mode – occurs at 0.63sec, 0.79, and 0.56sec for the three cases, respectively, all periods less than the 1sec or so mark expected for steel or concrete.[39] The 12" floors case shows much higher periods not because the floors provide noticeably more stiffness than the other cases – indeed, that would drive the period down. In fact, the extra thickness does not affect the amount of stiffness contribution from the floor much, since as discussed earlier the deflection values for the two thickness cases are similar. Rather, the extra thickness increases the amount of mass of the building, which increases the modal periods.

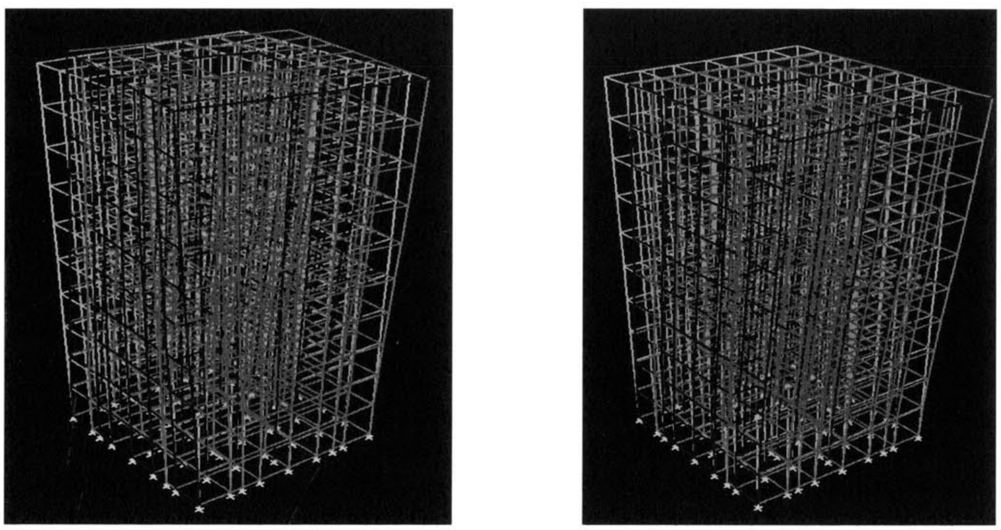


Figure 15 – [Left] True First Mode, torsion; [Right] Expected First Mode, straight line

Additional torsional modes also exist in the structure before one finds the expected second mode of the building – flexure with one inflection point. For the case including the stiff, 1.2" thick floor slabs, this mode is identified as the fifth mode in the building and occurs at 0.15sec. For the case of no floors, this mode is number eleven and occurs at 0.16sec. For this case, a number of stretching and wave motion modes exist due to the absence of stiffening diaphragm action. Additional cases were examined to illustrate basic concepts. For example, the case of no shear walls resulted in a very high

[39] It is a rule of thumb that the fundamental mode of a steel or concrete building is approximately one-tenth of the number of stories of the building. In the case of this ten-story building, that yields T = 1sec.

fundamental period of 10.31sec with no torsion, which can be explained by the very low stiffness value for this case.

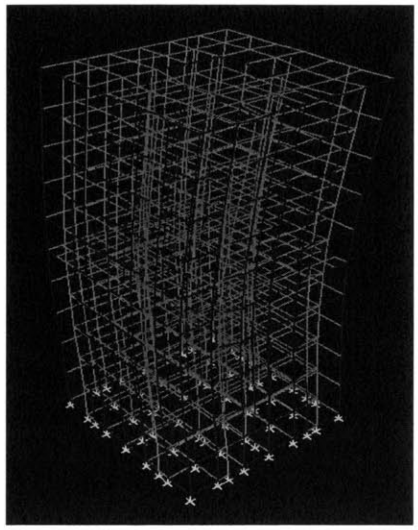


Figure 16 – Expected Second Mode, flexure one inflection point

The simple implications of these results are that the light weight timber creates a structure with very small modal periods, which decreases the chances of the building hitting resonance under environmental loads but may lead to undesirable ringing. Indeed, the low natural period is advantageous for areas that are affected by frequent winds and earthquakes. At the same time, though, the lack of mass may affect the damping characteristics of the structure, requiring structural damping devices to maintain human comfort levels.

5.4 Floor System Modes

Some computer analysis on the generalized floor system draws attention to certain aspects of design that are necessary to completing the feasibility study. Accurate modeling of the floor system is complex due to the indeterminacy of the system and the multiple layers of structure, but relevant conclusions can be drawn from a simple model utilizing roller supports at two corners and hinge supports at the other two. For instance, bending moments in the main beams are as expected – about 34k-ft (see Appendix B) – for the case of using a network of 2"x12" joists spaced at 12" across the 15ft sides and two cross-girders spaced at 3ft. The maximum deflection is 0.5", which is below the L/240 limit of 0.75". Also, the fundamental mode of this floor falls below 0.039sec, corresponding to a natural frequency of 26Hz, which is well out of the likely range of human stepping, which tops out around 4Hz.[40] Thus, the floor as designed is stiff enough

[40] Allen, D.E. and G. Pernica. "Control of Floor Vibration." National Research Council of Canada, December 1998. <http://irc.nrc-cnrc.gc.ca/pubs/ctus/22_e.html>. April 30, 2005.

to meet deflection and vibration criteria, though the floor is actually even stiffer due to the end connections and existence of plywood and concrete layers.

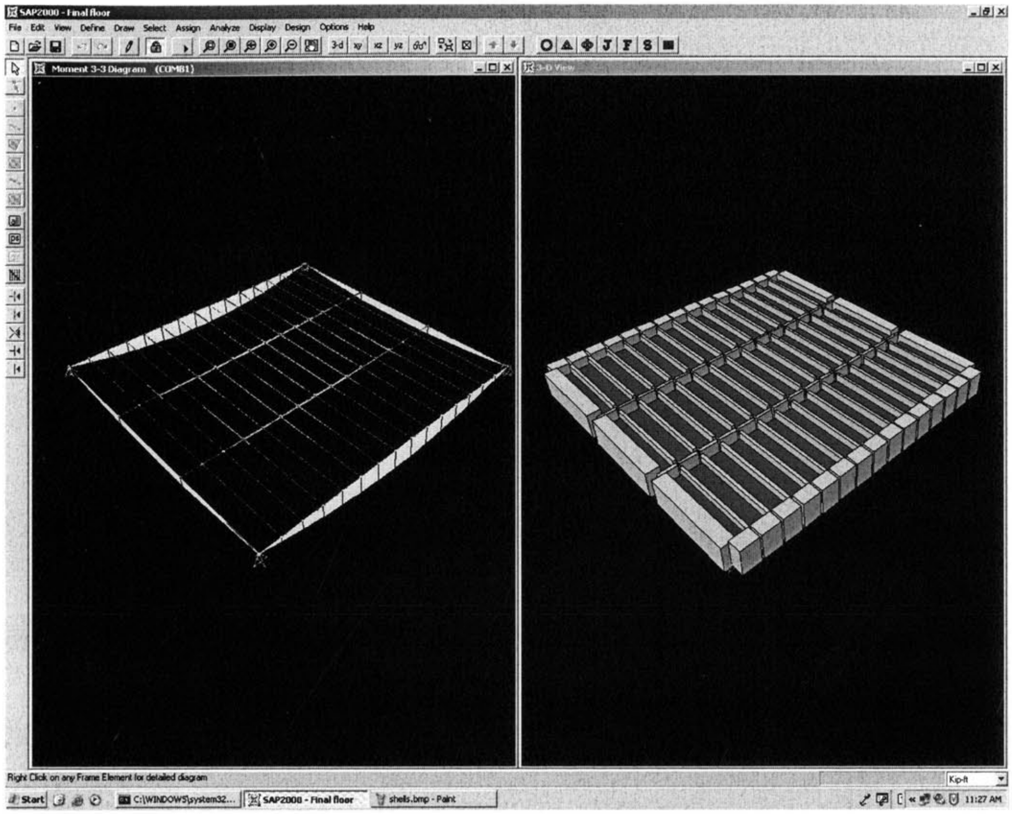


Figure 17 – [Left] Bending Moments in Floor Joists; [Right] Extruded Slab Elements

5.5 Summary

The finite element analysis for the control case of 1.2" thick wooden floors and the prescribed shear walls produced results that confirmed some aspects of the hand calculations, including the role of shear walls, but pointed to other sources of concern. The maximum building deflection was recorded to be just 2.7", with 0.26" inter-story drift and 0.106° of twist. These numbers can be driven downward by using thicker floors, thereby creating diaphragm action to stiffen the structure. However, after examining the axial loads on the columns in the model and noticing that zones of tension exist alongside zones of compression, it was determined that the building may possibly be too stiff and require more mass to counteract bending effects. That the building is relatively stiff was further indicated by the low fundamental period of the structure – only 0.63sec. So, questions surround the stiffness issue and load path. Finally, it was shown through the computer model that the floor system, as proposed, is sufficiently stiff itself for the purposes of this design, with small deflection and a high natural frequency out of the range of human stepping. In all, the computer analysis has served an extremely useful role in the study.

6. Discussion of Findings and Future Work

The feasibility study is verified by three parts – a discussion on the material aspects of wood, hand calculations, and computer modeling analysis. The material-based issues provide the framework and setting for the hand design of the building in timber. All of the deflection-based criteria used for the hand-methods of design were confirmed with the computer model – maximum building deflection, inter-story drift, and beam deflection. One exception may be the torsion of the building about its vertical axis, which is not a core point of design but part of the study nevertheless. Not all of the strength-based criteria were as satisfactorily confirmed, particularly the load-bearing actions of the columns and shear walls. Indeed, the vulnerability of the building to bending about its base, resulting in uplift motion and net tensile forces in columns, may outline a basic flaw in the system that requires further exploration – namely, the weight of the structure as a negative attribute. The underlying limitation for using timber in the proposed design is motion control, not material unreliability or strength.

6.1 Discussion of Findings

As outlined at the beginning of this report, timber is an engineered material that is well understood and properly outfitted to be thrust into new types of applications where its potential might be fully realized. It should not be neglected for fears of natural defects, environmental weaknesses, awkward workability, or even fire resistance. With proper care, handling, and treating, wood can be a very useful, easy-to-use, and advantageous material in diverse applications.

Once this was established at the outset, the study was able to be pressed forward and applied to a specific building layout with a series of structural stipulations. Columns were fixed to be 13ft in height and beams to be 15ft in length. Shear walls were positioned in column bays and arranged symmetrically to keep the building's center of stiffness on top of its center of mass. Floor systems were taken from common applications and contain relatively straight-forward joist and girder strength designs, yet more complicated issues revolve around their sound and vibration control. Similarly, the steel plate connections and concrete foundations were adopted from current standard practice.

The sizing of the timber members was accurately done based on specified design loads and given properties for Douglas fir wood. The results from hand calculations and computer modeling show that the ten-story building could be constructed from relatively standard timber shapes and sizes and without affecting any aspect of normal office space setting. The sectional sizes of the slender columns range from 8"x8" to 14"x16" nominal size, depending on their proximity to shear walls. Of course, 14"x16" timber sections are on the large end of timber sizes, but such sizes are obtainable from heavy timber pieces or built-up sections of smaller timber or lumber pieces (even glulam).[41] Also, these

[41] Faherty and Williamson.

dimensions are not sufficiently large to affect the area of usable office space in any considerable way.

Clear spans of up to 15ft are achieved rather simply and in the same manner as steel or concrete design, with 8"x18" nominal beams being the singular size. This size, as with the columns, also implies the use of heavy timber or glulam sections, as opposed to simple lumber boards. Connections between beams and columns, it was decided, must be shear-transferring only, so that large moments are not placed on the columns. Floor systems were designed with 2"x12" nominal joists placed at 12" spacing and two 2"x12" nominal cross-girders intended to add stiffness. The computer model indicated that this design was adequately stiff to avoid dynamic problems with pedestrian use, exhibiting a natural frequency of 26Hz.

The shear walls constitute a lateral load-resisting system designed to keep lateral deflections minimal. The walls consist of plywood sheathing attached to a stud assembly with stud beams placed at 1ft spacing. The strongest shear walls, designed to take the bulk of the lateral loads without buckling, are located at the core of the building and consist of four ½" thick plywood sheets each. Secondary shear walls are located in other areas to ensure that drift does not occur at the edges of the building. The finite element model verified that deflections in the building are significantly reduced through the incorporation of shear walls, and also diaphragms, into the structural system. For the proper design case, modeled using 1.2" thick wooden floors, inter-story drift is minimized to just 0.26" for the given shear wall design.

The shear walls were not meant to carry any vertical loads, but in the computer model it was interpreted that this might actually occur, obscuring the load path. Indeed, the finite element analysis showed that tensile forces might fully develop in some columns, leaving other columns to take too much compression or the shear walls themselves to take vertical loads. It seems, then, that as the result of using only timber, the building may be both too light and too stiff, leaving it vulnerable to overturning action, represented by the appearance of tensile forces on the first floor of the building. Indeed, the fundamental period of the building is just 0.63sec, which makes it well suited for seismic or other low-frequency cyclical loading applications. This is not an uncommon problem, however, and countless methods exist that may be used to address this overturning issue. An outrigger system, for instance, composed of a hat truss at the top of the building, would be well-suited for this design to help in transferring lateral loads from one side of the building to the other, thereby disrupting overturning and muffling axial tensile effects in the columns.

It was mentioned that damping may also be an issue with the design as a result of the light weight, with the building requiring an imposed higher damping coefficient in order to offset ringing and vibrations under loading and unloading cycles. The option of installing damping devices may thus be worth exploring as a way of maintaining precise motion control. This would entail deeper levels of dynamic analysis and further research into the vibration characteristics of wood. The ultimate word on the design here is that the building is effectively very stiff, as a result of the shear walls, floors, and light weight-to-dimensions ratio. Thus, it would perform very well under lateral loading but may require added damping effects. This can be compared to corresponding steel and concrete designs, which are quite heavy but gain their stiffness from their material properties.

Ultimately, these materials experience the same overturning problem showcased in this timber design.

6.2 Areas for Future Work

Future work on the structural front would inevitably involve more attention to the dynamic properties of the building, which is as much a function of the geographic location of the building as it is of its inherent behavior. Specifically, such work would address the overturning issue and obscured load path of the proposed structural system, with some investigation into the redundancy of the system, which was not covered enough here. Also, a time history study of the building under cyclical loading at periods around the fundamental and higher periods of the building would be essential to a full understanding of the possibility of using timber in this project application. One aspect of possible research would be to investigate the integration of other materials into the timber structure to create the most efficient lateral load-resisting design. An example could be the use of concrete or even composites in plywood shear walls, which might mitigate buckling or overturning concerns, especially if the walls are heavy and strong enough to be load-bearing as well.

Along the same lines, studies on human comfort and perception issues with the dynamic response of the timber building would also shed more light on the effectiveness of using wood in an office space environment. Finally, much more work needs to be done on the topic of transferring known construction methods for wooden frame residential applications to the medium-rise office building application laid forth here. Indeed, installation, connections, detailing, and wood treating are all topics integral to the success of timber building that have been refined for quite a while as applied to low-rise residential units. Building higher, however, presents new challenges for moving pieces and building elements on top of one another that have not been practiced much to the scale implied in this feasibility study, at least recently.

The main areas for future work that would complete the structural feasibility study for the ten-story timber office building can thus be classified as such:

- Guarding against overturning
- Time history behavior
- Use of hybrid materials
- Human response
- Applicability of current residential construction methods

Still, this feasibility study represents a starting point to the process of studying timber as an alternative structural material. It has answered many questions with regard to practicality, strength, deflection, and constructability. It has also raised important questions with regard to weight-to-stiffness ratio and stability. Relevant work would build on the concepts set forth here and continue in the same spirit of initiative, efficiency, and imagination.

7. Conclusions

This feasibility study has shown that structurally a ten-story office building can be constructed entirely out of timber, using only trace amounts of concrete and steel for the floor slabs, foundations, and connections. It has not attempted to explore the many other issues that limit the proliferation of this kind of structure. Such issues, like fire control, functionality, and cost, deserve great attention and are currently being researched across the globe. Still, the study has shown that wood is a suitable material for large building applications and exhibits considerable strength properties. Deflections can be controlled and kept well within allowable limits, while the high stiffness of the timber system gives it some advantages for environmental cyclical loading as well as disadvantages in terms of overturning.

Increasingly, designers are tapping into the potential of wood as a structural material in many applications formerly reserved for steel and concrete. This is the result of greater environmental awareness and an overwhelming sense of monotony with the same materials. Certain countries have taken the lead with promoting wood specifically for its role as a clean, alternative material – Sweden, New Zealand, and Japan, to name a few.[42] What currently stands in the way of wood having a significant impact on the corporate architecture world is the absence of new, breakthrough timber projects that receive the kind of attention paid to works by the most important modern architects and engineers. The existence of such projects would lead to greater understanding of and trust in wood for this kind of office application, which in turn would win timber a larger place in the code books, where it is currently restricted to the low-rise residential sector.[43] This study has aimed to set a precedent in this path by proposing a design that may at this moment cause incredulity but may eventually describe the standard.

Figure 18 – Proposed Design for a Wooden Structure Building (courtesy of Takenaka Corporation)

[42] "Multi-Storey Timber Frame: TF 2000." Brick Development Association, 2005. <http://www.brick.org.uk/innovation/Innovation.htm>. April 20, 2005.
[43] *Uniform Building Code.*

8. References

Texts:

1. Breyer, Donald E. *Design of Wood Structures*, 2nd Edition. New York: McGraw-Hill, 1988.
2. Dowrick, David J. *Earthquake Resistant Design*, 2nd Edition. New York: John Wiley and Sons, 1987.
3. Faherty, Keith F. and Thomas G. Williamson. *Wood Engineering and Construction Handbook*. New York: McGraw-Hill, 1989.
4. Gonzalez, E. and R. Aroca. "Wooden Framed Structures in Madrid domestic architecture of 17th to 19th centuries."
5. Harris, David A., Byron W. Ergen, and William E. Fitch. *Planning and Designing the Office Environment*, 2nd Edition. New York: Van Nostrand Reinhold, 1991.
6. Kahn, A. Eugene and Paul Katz, ed. *Building Type Basics for Office Buildings*. New York: John Wiley and Sons, 2002.
7. Kermani, Abdy. *Structural Timber Design*. Oxford: Blackwell Science Ltd., 1999.
8. McCormac, Jack C. and James K. Nelson, Jr. *Structural Steel Design*, 3rd Edition. Upper Saddle River, NJ: Prentice Hall, 2003.
9. Quatman, G. William and Ranjit Dhar, ed. *The Architect's Guide to Design-Build Services*. Hoboken, NJ: John Wiley and Sons, Inc., 2003.
10. Schatzberg, Eric. *Wings of Wood, Wings of Metal: Culture and Technical Choice in American Airplane Materials, 1914-1945*. Princeton, New Jersey: Princeton University Press, 1999.
11. Smith, Bryan Stafford and Alex Coull. *Tall Building Structures: Analysis and Design*. New York: John Wiley and Sons, 1991.
12. Taranath, Bungale S. *Structural Analysis and Design of Tall Buildings*. New York: McGraw-Hill, 1988.
13. *Uniform Building Code*. Whittier, CA: International Conference of Building Officials, 1994.
14. Wakabayashi, Minoru. *Design of Earthquake-Resistant Buildings*. New York: McGraw-Hill, 1986.

Websites:

1. Alexander, Max. "Floor in a Flash." This Old House, 2005. <http://www.thisoldhouse.com/toh/knowhow/interiors/article/0,16417,202570,00.html>. April 20, 2005.
2. Allen, D.E. and G. Pernica. "Control of Floor Vibration." National Research Council of Canada, December 1998. <http://irc.nrc-cnrc.gc.ca/pubs/ctus/22_e.html>. April 30, 2005.

3. Forest Products Laboratory, "Wood Handbook – Wood as an Engineering Material," Madison, WI: Department of Agriculture, Forest Service, 1999, http://www.woodweb.com/knowledge_base/Wood_Handbook.html.
4. "Glulam: Lower Cost, Higher Design Value." APA: The Engineered Wood Association, 2005. <http:// www.apawood.org/ glu_level_b.cfm? content=prd_ glu_ main>. March 30, 2005.
5. "Glulam Product Guide." APA: The Engineered Wood Association, Dec. 2003. <http://www.apawood.org/glu_level_b.cfm?content=prd_glu_main>. March 30, 2005.
6. "How Your House Works." HouseTips.com, 2003. <http://www.hometips.com/hyhw/ structure/116frame.html>. April 20, 2005.
7. "Medium-Level Wooden-Structure Office Building Developed." Takenaka Corporation, February 1, 2001. <http://www.takenaka.co.jp/takenaka_e/news_e/ pr0102/m0102_01.htm>. April 13, 2005.
8. "Multi-Storey Timber Frame: TF 2000." Brick Development Association, 2005. <http://www. brick.org.uk/innovation/Innovation.htm>. April 20, 2005.
9. Simpson Strong-Tie Co., Inc. 2005. <http://www.simpsonstrongtie.com>. April 22, 2005.
10. "Span Tables." McVicker Associates, 2005. <http://www.mcvicker.com/resguide/ page013.htm>. April 20, 2005.
11. "Standard Lumber Sizes." August 29, 2003. East Carolina University. <http://www.theatre-dance.ecu.edu/Faculty-Stff/Leonard_Darby/Lumber_Size.html>. April 20, 2005.
12. Walk, Michael. "New Impact-Sound-Proof Wooden Floor Slabs." Bauphysik, ETH-Zurich, 2003. <http://www.bph.hbt.arch.ethz.ch/contents/subfolder/research/disswalk. html>. April 20, 2005.
13. "Wood-Frame Shear Walls." Washington State University, July 26, 2002. <http:// timber.ce.wsu.edu/Supplements/ShearWall/deflection.htm>. April 20, 2005.
14. "Yingxian Wooden Pagoda." Great Wall Travel Service Co., 2002. <http://www. greatwalltour.com/greatwall_pages/tours/highlight/gt07.htm>. April 21, 2005.

Interviews:

1. Chris Carbone, BensonWood Homes. Telephone. March 30, 2005.

9. Appendix

A. **Building Plans and Connection Detail**

B. **Column Sizing Without Shear Walls and Beam Sizing**

C. **Shear Wall Design**

D. **Final Column Sizing Considering Shear Walls**

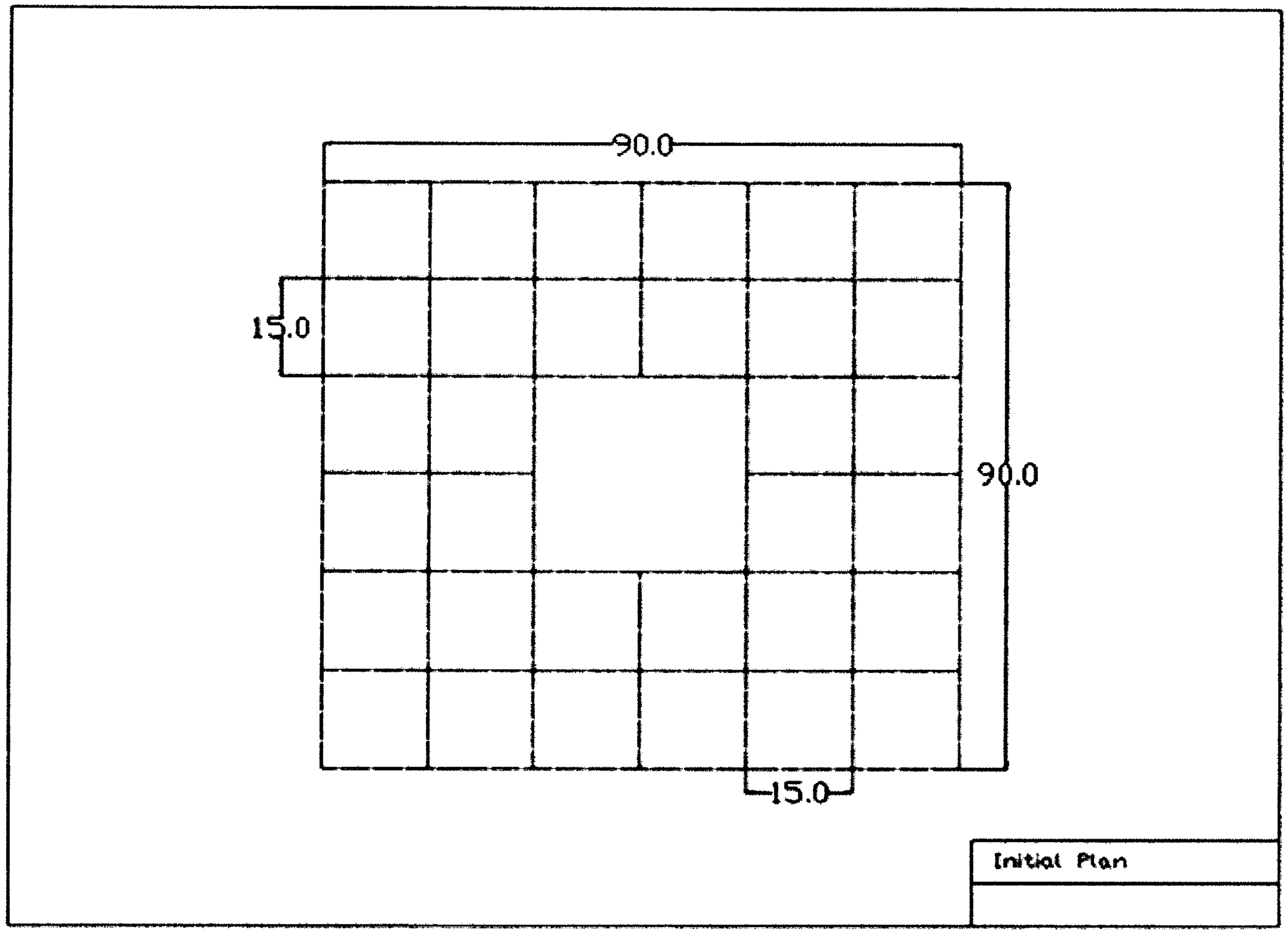
E. **Floor Slab Design**

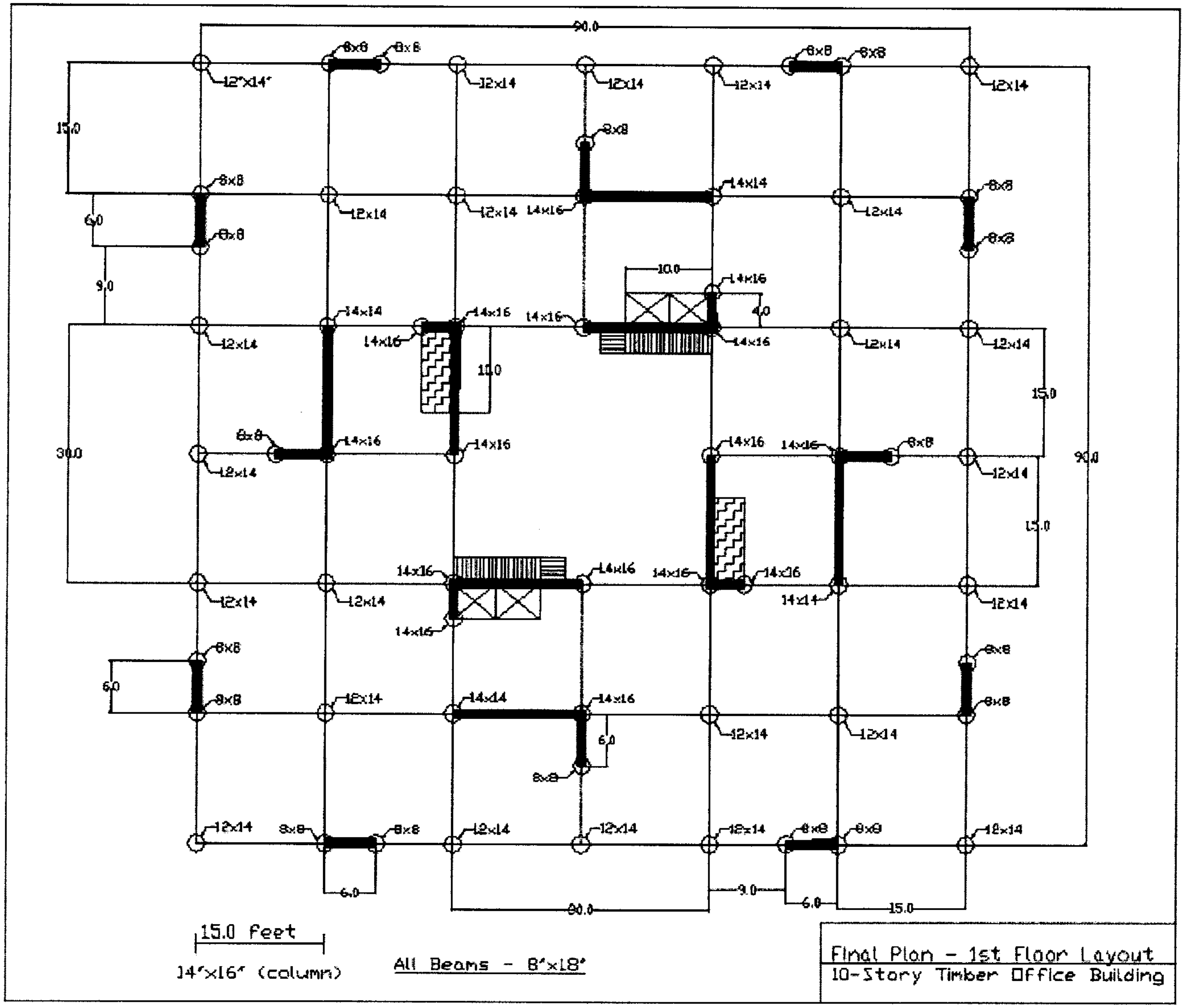
F. **Final Member Sizing Summary**

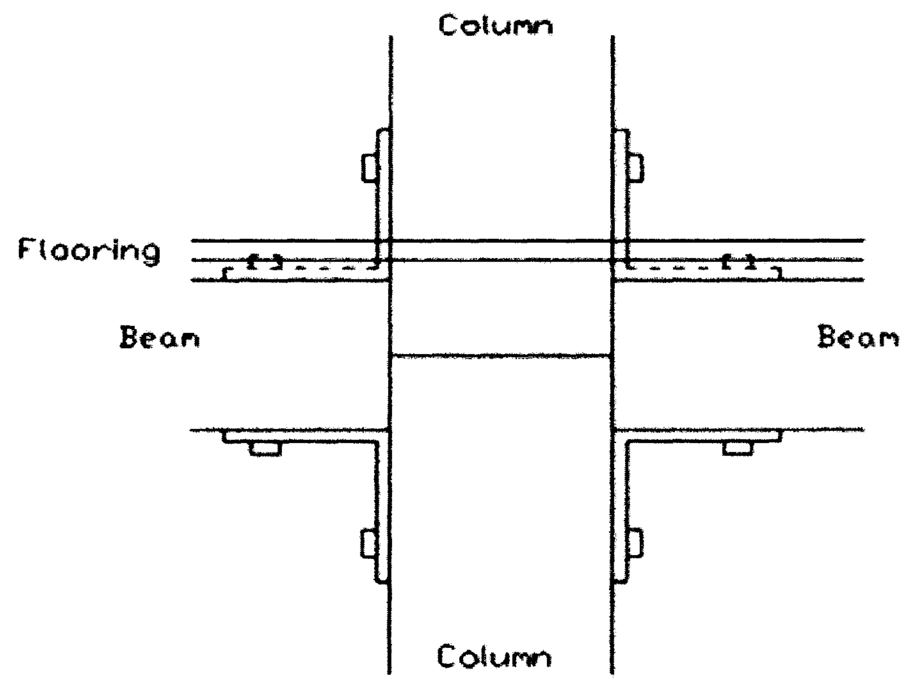
G. **SAP2000 Data Results**

H. **SAP2000 Input File – Case of 1.2" Wooden Floors**

A. Building Plans and Connection Detail




90.0
15.0
6.0
9.0
30.0
90.0
10.0
4.0
11.0
15.0
15.0
6.0
6.0
6.0
9.0
6.0
15.0
30.0
12"x14"
12x14
8x8
14x14
14x16
15.0 feet
14"x16" (column)
All Beams - 8"x18"
Final Plan - 1st Floor Layout
10-Story Timber Office Building



Cross-Sectional View of Typical Beam to Column Connection

10-Story Timber Office Building Study

B. Column Sizing Without Shear Walls and Beam Sizing

Loads Values Considering Preliminary Beam and Column Designs

LOADS - Iterated with Beam and Column Dead Loads

Live			
Office Floor	80	psf	
Lateral			
Wind	30	psf	
Dead	(from Breyer, Ex. 2.1)		
15' Beams	20.964	plf	
No. of beams	56		
Total Load	15848.78	lb	
Office Space Area	6804	ft^2	
Beams - Dist. Load	2.33	psf	
13' Columns	32.144	plf	
Average No. of Columns	24	total columns - 48, but sizes should decrease for increasing stories	
Total Load	15429.12	lb	
Office Space Area	6804	ft^2	
Columns - Dist. Load	2.27	psf	
Floor	42	psf	(includes: lightweight concrete covering 1.5in thick at 100lb/ft^3, 1-1/8in plywood, partitions, and walls)
Roof	17	psf	(includes roofing, re-roofing, ceiling, insulation, etc.)
	63.60	psf	
No roof	46.60	psf	
LRFD			
	=	1.2*wD+1.6wL	
	Floor Only -> LRFD - 1.2D+1.6L		
	=	183.92 psf	
	Floor and Roof (10th Floor) -> LRFD		
	=	204.32 psf	

Column Design – Final Non-Shear Wall Column Dimensions

Number of Floors			Office Floor Space		Window Space per Floor		Floor Load		Ultimate Stress of Wood	
n	10									
Without top floor	9		Total per floor	7200 ft^2	Total per floor	4680 ft^2	Floors 1-9	183.92 psf	Fc	2 ksi
h	13	ft					Floor 10	204.32 psf	E	1700 ksi

Plan 3 - Final Columns (no Shear Walls):

24	exterior columns
8	interior columns around atrium
16	floor columns
48	Total columns

Span = 15 ft

Tributary Area per Column = 150 ft^2

Axial Force on 1st Floor Column = 278934.58 lb; 278.93 kips >

AXIAL STRESS ANALYSIS

Necessary cross-sectional area: 139.47 in^2; 0.97 ft^2 side= 11.81 in; 0.98 ft

Axial Force on 10th Floor Column = 30647.46 lb; 30.65 kips >

Necessary cross-sectional area: 15.32 in^2; 0.11 ft^2 side= 3.91 in; 0.33 ft

> Net Floor Space:

		7148.25 ft^2
1st floor	Reduction =	51.75 ft^2
		7193.58 ft^2
10th floor	Reduction =	6.42 ft^2

> Net Window Space:

		4329.00 ft^2
1st floor	Reduction =	351.00 ft^2
		4578.22 ft^2
10th floor	Reduction =	101.78 ft^2

Choose 12"x14" (A=155.250in^2, S=349.313in^3, I=2357.859in^4)

Douglas fir standard dressed size (bxd)

A	1.0781 ft^2
b	0.96 ft
d	1.13 ft
weight	35 pcf
	32.144 plf

Corresponding Glulam Dimensions:

Use one 10.75in width sections
Use depth of 13.5in, needs nine 1.5in laminations
Total Area = 145.1 in^2
Douglas Fir 35.3 lb/ft

BUCKLING ANALYSIS (assuming PIN ends), 1st Floor Column, 12x14

length	h	13	ft	
length-eff	Le	13	ft	
dimension	d	0.96	ft	
Slenderness ratio	Le/d	13.57	> 11, so the column is not "short"	
Intermediate factor	K	19.56	(from Faherty and Williamson, eq. 3.2, K = 0.671(E/Fc)^0.5)	

Since Le/d is less than K, the column is "intermediate"

Euler Stress	F'c	1.85	ksi	<<F'c = Fc * (1-1/3(Le/d/K)^4)
Actual Stress	fc	1.80	ksi	GOOD

And for Floor 10:

Choose 4"x6" (A=19.250in^2, S=17.646in^3, I=48.526in^4)

Douglas fir standard dressed size (bxd)

A	0.1337 ft^2
b	0.29 ft
d	0.46 ft
weight	35 pcf
	4.679 plf

COMBINED LOADING ANALYSIS (eccentric loading), 1st Floor Column, 12x14

eccentricity	e	2.00	ft	
dimension	d	0.96	ft	
Bending Stress	F'b	2.00	ksi	
For Le/d>K	J	0.30	(from J = (Le/d-11)/(K-11))	
	Max J	1.00		

Table 3.2 (Faherty and Williamson):

Allowable Axial Stress fc >> fc/F'c+(fc(6+1.5J)(e/d))/(F'b-J*fc)<1

solving,

1.00 max fc = 0.11 ksi

Axial Load 15.78 kips

< If there is an eccentricity of 2 ft, then the column above can take only 15 kips

CHOOSE 12x14 for 1st Floor

BUCKLING ANALYSIS (assuming PIN ends), 10th Floor Column, 4x6

length	h	13	ft	
length-eff	Le	13	ft	
dimension	d	0.29	ft	
Slenderness ratio	Le/d	44.57	> 11, so the column is not "short"	
Intermediate factor	K	19.56	(from Faherty and Williamson, eq. 3.2)	

Since Le/d is more than K, the column is "long"

Euler Stress	F'c	0.26	ksi	<<F'c = 0.30 * E / (Le/d)^2
Actual Stress	fc	1.59	ksi	N.G.
Using 6x10	A	0.36 ft^2		
	d	0.458333333 ft		
	F'c	0.63	ksi	
	fc	0.59	ksi	GOOD

CHOOSE 6x10 for 10th Floor

Initial Beam Design

	Number of Floors		Office Floor Space	
n	10			
Without top floor	9		Total per floor	7200 ft^2
h	13	ft		

Plan 3 - Main Beams:

Spans =	15 ft	
Main Beams:	80	Total main beams
15' Beams:		
Tributary area per beam =	90 ft^2	

Window Space per Floor				Floor Load	Ultimate Stress of Wood	
Tot. p. Flr.	4680 ft^2	Floors 1-9:	dead	46.60 psf	Fc	2 ksi
			live	80.00 psf	E	1700 ksi
			factored total	183.92 psf	Fb	2.1 ksi
		Floor 10:	dead	63.60 psf		
			live	80.00 psf		
			factored total	204.32 psf		

1st Floor>	Load per Beam:		
	Beam length = L =	15 ft	
	Load on Beam =	16.55 kips	
	w = Wd + Wl =	1.10 k/ft	
	Wl =	0.77 k/ft	
	Expected Moment = wL^2/8 =	31.04	
	DEFLECTION ANALYSIS		
	L/240 - total load	0.75 in	
	I-min	985.85 in^4	<<I = 5w(L^4)/(384*E*delta)
	L/360 - live load	0.50 in	
	I-min	1029.18 in^4	
	Necessary cross-sectional area:		
	Table A.2 (Faherty and Williamson):		Choose 8"x14" (S=227.813in^3, I=1537.734in^4)
			Douglas fir standard dressed size (bxd)
			35 pcf
			24.609 plf
	Glulam Design:		
	Table A.5 (Faherty and Williamson):		
	Use 8.75in wide section>>>		
	No. of 1.5in laminations	8	
	depth d	12	
	I, in^4	1200	
	weight, douglas fir, lb/ft^3	25.5	
10th Floor>	Load per Beam:		
	Beam length = L =	15 ft	
	Load on Beam =	18.39 kips	
	w = Wd + Wl =	1.23 k/ft	
	Wl =	0.77 k/ft	
	DEFLECTION ANALYSIS		
	L/240 - total load	0.75 in	
	I-min	1095.20 in^4	<<I = 5w(L^4)/(384*E*delta)
	L/300 - live load	0.60 in	
	I-min	857.65 in^4	
	Necessary cross-sectional area:		
	Table A.2 (Faherty and Williamson):		Choose 8"x14" (S=227.813in^3, I=1537.734in^4)
			Douglas fir standard dressed size (bxd)
			35 pcf
			24.609 plf
	Glulam Design:		
	Table A.5 (Faherty and Williamson):		
	Use 8.75in wide section>>>		
	No. of 1.5in laminations	8	
	depth d	12	
	I, in^4	1200	
	weight, douglas fir, lb/ft^3	25.5	

Final Beam Design – Iterated for Axial Load from Wind Loading

Re-examining Beams for Combined Loading

Beams: Are actually beam-columns - subjected to both floor loads and lateral loads

1st floor:	L	15 ft	10th floor:	L	15 ft
	b	8 in		b	8 in
	d	14 in		d	14 in
	I	1537.7 in^4		I	1537.7 in^4
	S	227.81 in^3		S	227.81 in^3
	w	1.1585 k/ft		w	1.1585 k/ft
	P	45.63 kips		P	45.63 kips
	fb	1.7163 ksi		fb	1.7163 ksi
	fc	0.4074 ksi		fc	0.4074 ksi

COMBINED LOADING ANALYSIS:
Pin Ends:

Le	15 ft	
d	0.6667 ft	
Le/d	22.5	
K	19.563	= 0.671*(E/Fc)^0.5
E	1700 ksi	
Fc	2 ksi	
J	1.343	= ((Le/d) -11) / (K -11)
max J	1	
F'c	1.0074 ksi	
F'b	2.1 ksi	

criteria 1 > fc/F'c+ fb / (F'b-J*fc)	criteria 1 > fc/F'c+ fb / (F'b-J*fc)
1.4184 N.G.	1.4184 N.G.

Try:	L	15 ft	10th floor:	L	15 ft
	b	8 in		b	8 in
	d	18 in		d	18 in
	I	3349.6 in^4		I	3349.6 in^4
	S	382.81 in^3		S	382.81 in^3
	w	1.1585 k/ft		w	1.1585 k/ft
	P	54 kips		P	54 kips
	fb	1.0213 ksi		fb	1.0213 ksi
	fc	0.375 ksi		fc	0.375 ksi

<< NEW BEAM DIMENSIONS:

1st Floor:	b	8 in	28.255 lb/ft
	d	18 in	
	I	3349.6 in^4	
	S	382.81 in^3	
10th Floor:	b	8 in	31.901 lb/ft
	d	18 in	
	I	3349.6 in^4	
	S	382.81 in^3	

Le	15 ft	
d	0.8333 ft	
Le/d	18	
K	19.563	= 0.671*(E/Fc)^0.5
E	1700 ksi	
Fc	2 ksi	
J	0.8175	= ((Le/d) -11) / (K -11)
max J	1	
F'c	1.5741 ksi	
F'b	2.1 ksi	

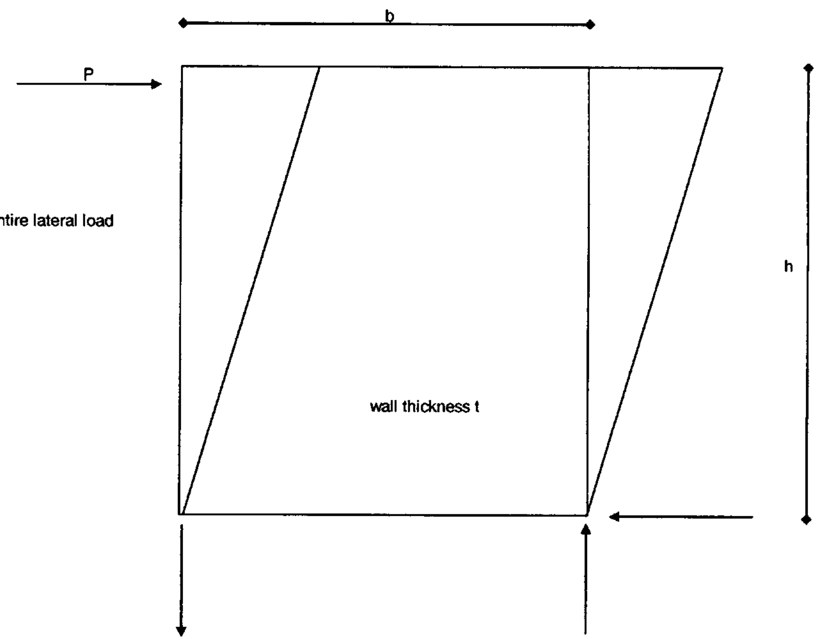
criteria 1 > fc/F'c+ fb / (F'b-J*fc)	criteria 1 > fc/F'c+ fb / (F'b-J*fc)
0.8303 O.K.	0.8303 O.K.

C. Shear Wall Design

Plywood Shear Wall Sizing: Core

Plywood Shear Walls: Core

Strength-Based Design



Height of Floors, h	13	ft	
Total Building Height, H	130	ft	
Building Side Dimension	90	ft	
Factored Lateral Load due to Wind	39	psf	
Wind Load (Vertically Distributed Load)	3510	plf	
Total Load on Floor due to Wind (Point Load), P	45630	lb	
Total Length of Shear Wall in X- or Y-Direction, b	38	ft	< Two 19ft bays take entire lateral load
Height of Shear Walls	13	ft	
Total Shear Face Area	494	ft^2	
Wall thicknesses, t	t	ft	
Total Shear Stress on Walls	P / (b*t)	psf	
Distributed, V	1200.79	plf	

Table 8.7 (Faherty and Williamson):
Use Structural I pylwood grade, 3/8in thick
Minimum nail penetration in framing, 1.25in, and 6d nail size
Nail spacing at 6in

Story-Drift Considerations

Allowable Inter-Story Drift	h/200	ft
=	0.78	in
Total Building Displacement	H/200	ft
	7.8	in

UBC Code, Volume 3

delta = 12*((8*V*h^3) / (E*A*b)) + (V*h) / (G*t) + 0.75*h*e-n + h/b*d-a < 0.78"

Max. Shear due to design loads at top of wall	V = P/b	lb/ft	1200.79	
Area of boundary element cross section	A	in^2	132.20	(Column Size - 12x12 nominal)
Wall height	h	ft	13.00	
Wall width	b	ft	38.00	
Deflection due to anchorage details	d-a		0.10	Educated guess
Modulus of rigidity of plywood	G	lb/in^2	90000.00	(UBC Table 23-2-J)
Effective thickness of plywood for shear	t	in	?	
Nail deformation	e-n	in	0.05	(from Table 8.2)
Young's Modulus	E	psi	1700000.00	
t-min		in	0.76	<<Requires 3 sheets of 3/8" plywood

>> Would rather use even number of sheets
>> Choose 4 sheets of 1/4" plywood

Plywood Shear Wall Sizing – Interior and Exterior

Plywood Shear Walls: Exteriors

Strength-Based Design

Height of Floors, h	13.00	ft			
Total Building Height, H	130.00	ft			
Building Side Dimension	90.00	ft			
Factored Lateral Load due to Wind	39.00	psf			
Wind Load (Vertically Distributed Load)	501.43	plf	<<Tributary Area = 1/7		
Total Load on Floor due to Wind (Point Load), P	6518.57	lb			
Total Length of Shear Wall in X- or Y-Direction, b	15.00	ft	OR	12.00	ft
Height of Shear Walls	13.00	ft			
Total Shear Face Area	195.00	ft^2	OR	156.00	ft^2
Wall thicknesses, t	t	ft			
Total Shear Stress on Walls	P / (b*t)	psf			
Distributed, V	434.57	plf	OR	543.21	plf

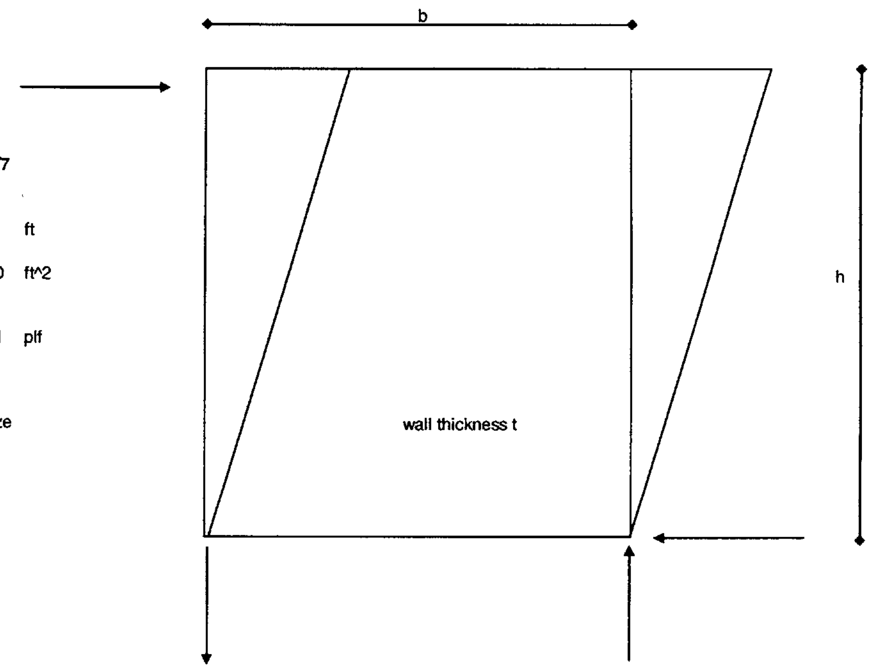


Table 8.7 (Faherty and Williamson):
Use Structural I pylwood grade, 3/8in thick
Minimum nail penetration in framing, 1.25in, and 6d nail size
Nail spacing at 6in

Story-Drift Considerations

Allowable Inter-Story Drift	h/200	ft
=	0.78	in
Total Building Displacement	H/200	ft
	7.80	in

UBC Code, Volume 3:

delta = 12*((8*V*h^3) / (E*A*b)) + (V*h) / (G*t) + 0.75*h*e-n + h/b*d-a < 0.78"

			15ft Bays		12ft Bays
Max. Shear due to design loads at top of wall	V = P/b	lb/ft	434.57		543.21
Area of boundary element cross section	A	in^2	132.20	(Column Size - 12x12	132.20
Wall height	h	ft	13.00		13.00
Wall width	b	ft	15.00		12.00
Deflection due to anchorage details	d-a		0.10	Educated guess	0.10
Modulus of rigidity of plywood	G	lb/in^2	90000.00	(UBC Table 23-2-J)	90000.00
Effective thickness of plywood for shear	t	in	?		?
Nail deformation	e-n	in	0.05	(from Table 8.2)	0.05
Young's Modulus	E	psi	1700000.00		1700000.00
	t-min	in	0.35	in	0.55
			Requires 2 sheets of plywood		Requires 2 sheets of plywood
			>> Use 1/4"		>> Use 3/8"

Plywood Shear Wall Buckling Check

Shear Wall Buckling

Assuming Pin Ends, Whole Section, Entire Length:

E, ksi 1700

	15ft	12ft	38ft
t, in	1.50	0.73	1.75
Longest Wall Width, ft	15	6	15
Le for pinned ends	15	6	15
V, Shear per length, lb/ft	434.57	543.21	600.39
S, Total Shear at Top, lb	6518.57	3259.29	9005.92
Le/d	120.00	98.63	102.86
F'c = 0.3E/(L/d)^2, ksi	0.04	0.05	0.05
h, height, ft	13	13	13
A, area, f^2	1.63	0.79	1.90
Q, allowable shear, lb	8287.50	5970.33	13160.24

Necessary t, in (by iteration)			
	1.5	0.73	1.75

Assuming Fixed Ends, 1ft Section, Necessary Length as cut by studs:

E, ksi 1700

	15ft	12ft	38ft	
t, in	1.50	0.73	1.75	
Longest Wall Width, ft	7.5	3	7.5	<<Necessary length as provided by stud placement
Le for fixed ends	3.75	1.5	3.75	
V, Shear per length, lb/ft	434.57	543.21	600.39	
S, Total Shear at Top, lb	6518.57	3259.29	9005.92	
Le/d	30.00	24.66	25.71	
F'c = 0.3E/(L/d)^2, ksi	0.57	0.84	0.77	
h, height, ft	1	1	1	<<1ft section as opposed to entire 13ft section
A, area, f^2	0.13	0.06	0.15	
Q, allowable shear, lb	10200.00	7348.10	16197.22	

Desired t, in (by iteration)			
	1.5	0.73	1.75

Braced Frame Analogy

Each chord takes the angle of the shear

Angle = atan (h / w)	0.71	1.14	0.71	radians
Axial Comp = Tens chord	4313.00	3888.82	5958.75	lbs
diagonal length	19.85	14.32	19.85	ft

Smith & Coull:

A-d = t*w*(.25+B) / (sin (angle))^3, where B = (h^2/(16w^2(1+poisson)))

Area of brace analogy	1.90	0.23	2.22	ft^2
Square side	16.56	5.75	17.89	in

Euler Buckling critical load = Pi^2*E*I/(L^2), for pinned ends

1852925.3	51721.8114	2522037.16	lbs	OK

Shear Wall Chord Reaction Forces

Shearwall Reactions

Summary -

			15ft		12ft		38ft	
Max. Shear due to design loads at top of wall	V = P/b	lb/ft	434.57		543.21		1200.79	
Area of boundary element cross section	A	in^2	132.20	(Column Size - 12x12 nominal)	132.20		132.20	
Wall height	h	ft	13		13		13	
Wall width	b	ft	15		12		38	
Deflection due to anchorage details	d-a	in	0.10	Educated guess	0.10		0.10	
Modulus of rigidity of plywood	G	lb/in^2	90000.00	(UBC Table 23-2-J)	90000.00		90000.00	
Effective thickness of plywood for shear	t	in	?		?		?	
Nail deformation	e-n	in	0.05	(from Table 8.2)	0.05		0.05	
Young's Modulus	E	psi	1700000		1700000		1700000	
	t-min	in	1.50		0.73		1.75	
Density of wood	rho	lb/in^3	0.017					
Weight of Shear Wall	w-p	lb	716.04	lb	278.78	lb	2116.30	lb

Overturning Moment:

for b>> M = V * b * h

	15ft	12ft	38ft
M	84741.43 lb-ft	84741.43 lb-ft	593190.00 lb-ft

Chord Forces:

T = C = M / b = V * h

	15ft	12ft	38ft
	5649.43 lb	7061.79 lb	15610.26 lb
	5.65 kips	7.06 kips	15.61 kips
Adding weight of Shear Walls and Reactions:	6.37 kips	7.34 kips	17.73 kips

<< These vertical loads are transferred to columns and shear walls

	15ft	12ft	38ft
Number of supporting columns:	2	2	6
Number Shared with another s.w.:	1 (with 12ft s.w.)	0 or 2 (with 15ft s.w.)	4 (with 38ft s.w.)
Extra Load Per Column:	3.18 kips	3.67 kips	2.95 kips
Extra Load per Shared Column:	6.85 kips	6.85 kips	5.91 kips

D. Final Column Sizing Considering Shear Walls

Column Design – Considering Shear Wall Forces

	Number of Floors		Office Floor Space		Window Space per Floor		Floor Load			Ultimate Stress of Wood
n	10									
Without top floor	9	Total per floor	7200 ft^2	Total per floor	4680 ft^2	Floors 1-9	183.916	psf	Fc	2 ksi
h	13 ft					Floor 10	204.316	psf	E	1700 ksi

Plan 4:

24	exterior columns
8	interior columns around atrium
16	floor columns
48	Total columns

Span = 15 ft

Tributary Area per Column = 150 ft^2

Shared, 38ft Shearwall Columns:

Number 4
Extra Load 5.91 kips

Axial Force on 1st Floor Column = 332114.26 lb
332.11 kips

AXIAL STRESS ANALYSIS
Necessary cross-sectional area: 166.06 in^2
1.15 ft^2

side= 12.89 in
1.07 ft

Choose 14"x20" (A=263.250in^2, S=855.563in^3, I=8341.734in^4)
Douglas fir standard dressed size (bxd)
A 1.83 ft^2
side: b 1.125 ft
d 1.63 ft
> weight 35.00 pcf
63.98 plf

Choose 10"x22" (A=204.250in^2, S=731.896in^3, I=7867.879in^4)
Douglas fir standard dressed size (bxd)
A 1.42 ft^2
side: b 0.79 ft
d 1.79 ft
> weight 35.00 pcf
49.64 plf

Corresponding Glulam Dimensions:

Use one 10.75in width section
Use depth of 27in, needs eighteen 1.5in laminations
Total Are: 290.3 in^2
Douglas F 70.5 lb/ft

> Net Floor Space:
7112.25 ft^2
1st floor Reduction = 87.75 ft^2

> Net Window Space:
4329.00 ft^2
1st floor Reduction = 351.00 ft^2

Shared, 15ft-12ft Shearwall Columns:

Number 2
Extra Load 6.85 kips

Axial Force on 1st Floor Column = 340611.72 lb
340.61 kips

AXIAL STRESS ANALYSIS
Necessary cross-sectional area: 170.31 in^2
1.18 ft^2

side= 13.05 in
1.09 ft

Choose 10"x22" (A=204.250in^2, S=731.896in^3, I=7867.879in^4)
Douglas fir standard dressed size (bxd)
A 1.42 ft^2
side: b 0.79 ft
d 1.79 ft
> weight 35.00 pcf
49.64 plf

Choose 14"x16" (A=209.250in^2, S=540.563in^3, I=4189.359in^4)
Douglas fir standard dressed size (bxd)
A 1.45 ft^2
side: b 1.125 ft
d 1.29 ft
> weight 35.00 pcf
50.86 plf

Corresponding Glulam Dimensions:

Use one 10.75in width section
Use depth of 18in, needs twelve 1.5in laminations
Total Area = 193.5 in^2
Douglas Fir 47 lb/ft

> Net Floor Space:
7131.92 ft^2
1st floor Reduction = 68.08 ft^2

> Net Window Space:
4433.00 ft^2
1st floor Reduction = 247.00 ft^2

Unshared, Shearwall Columns, GENERAL:

Largest Extra Load 3.67 kips

Axial Force: 311967.12 lb
311.97 kips

Area Need 155.98 in^2
1.08 ft^2

side= 12.49 in
1.04 ft

Choose
14"x14" (A=182.250in^2, S=410.063in^3, I=2767.922in^4)
Douglas fir standard dressed size (bxd)
A 1.27 ft^2
side: b 1.13 ft
d 1.13 ft
weight 35.00 pcf
44.30 plf

continued

BUCKLING ANALYSIS (assuming PIN ends), 1st Floor Column, using 14x20

length	h	13	ft	
length-eff	Le	13	ft	
dimension	d	1.125	ft	
Slenderness ratio	Le/d	11.56	> 11, so the column is not "short"	
Intermediate factor	K	19.56		

(from Faherty and Williamson, eq. 3.2, K = 0.671(E/Fc)^0.5)

Since Le/d is less than K, the column is "intermediate"

Euler Stress	F'c	1.92	ksi	<<F'c = Fc * (1-1/3(Le/d/K)'
Actual Stress	fc	1.26	ksi	GOOD

COMBINED LOADING ANALYSIS (eccentric loading), 1st Floor Column, using 14x20

eccentricity	e	2	ft
dimension	d	1.125	ft
Bending Stress	F'b	2	ksi
For Le/d<K	J	0.06	(from J = (Le/d-11)/(K-11))
	Max J	1	

Table 3.2 (Faherty and Williamson):

Allowable Axial Stress	fc	>>	fc/F'c+(fc(6+1.5J)*e/d)/(F'b-J*fc)<1
			solving,
	1.00		max fc = 0.1675 ksi
			Axial Load 27.812 kips

< If there is an eccentricity of 2 ft, then the column above can take only 28 kips

COMBINED LOADING ANALYSIS (Over-Turning Moment loading), 1st Floor Column

Axial Load	f	332.11	kips
Area	A	263.25	in^2
Axial Stress	fc	1.26	ksi
Height	h	13	ft
dimension	d	1.125	ft
Section Modulus	S	855.56	in^3
Bending Strength	F'b	2.00	ksi
For Le/d<K	J	0.06	(from J = (Le/d-11)/(K-11))
	Max J	1.00	

Table 3.2 (Faherty and Williamson):

Allowable Axial Stress	fc	>>	fc/F'c+fb/(F'b-J*fc)<1
			solving,
	0.98		max fb = 0.63 ksi
			Lateral Point Load 41.21 kips

< Maximum amount of lateral load the largest column can take at its top

BUCKLING ANALYSIS (assuming PIN ends), 1st Floor Column, using 10x22

length	h	13	ft	
length-eff	Le	13	ft	
dimension	d	0.79166667	ft	
Slenderness ratio	Le/d	16.42	> 11, so the column is not "short"	
Intermediate factor	K	19.56	(from Faherty and Williamson, eq. 3.2, K = 0.671(E/Fc)^0.5)	

Since Le/d is less than K, the column is "intermediate"

Euler Stress	F'c	1.67	ksi	
Actual Stress	fc	1.67	ksi	N.G.
Using 14x16 >>	Euler	1.92		
	Actual	1.63		GOOD

COMBINED LOADING ANALYSIS (eccentric loading), 1st Floor Column, using 14x16

eccentricity	e	2	ft
dimension	d	1.125	ft
Bending Stress	F'b	2	ksi
For Le/d<K	J	0.06	(from J = (Le/d-11)/(K-11))
	Max J	1	

Table 3.2 (Faherty and Williamson):

Allowable Axial Stress	fc	>>	fc/F'c+(fc(6+1.5J)*e/d)/(F'b-J*fc)<1
			solving,
	1		max fc = 0.16749 ksi
			Axial Load 28.5241 kips

< If there is an eccentricity of 2 ft, then the column above can take only 29 kips

COMBINED LOADING ANALYSIS (Over-Turning Moment loading), 1st Floor Column, using 14x16

Axial Load	f	340.61	kips
Area	A	209.25	in^2
Axial Stress	fc	1.63	ksi
Height	h	13	ft
dimension	d	1.125	ft
Section Modulus	S	855.56	in^3
Bending Strength	F'b	2.00	ksi
For Le/d<K	J	0.06	(from J = (Le/d-11)/(K-11))
	Max J	1.00	

Table 3.2 (Faherty and Williamson):

Allowable Axial Stress	fc	>>	fc/F'c+fb/(F'b-J*fc)<1
			solving,
	0.97		max fb = 0.24 ksi
			Lateral Point Load 15.49 kips

< Maximum amount of lateral load the largest column can take at its top

Addition of End Columns to All Shear Walls

(Only after a point was it realized that each shear wall needs two end columns. This results in the need for smaller column areas where before one column held the load that in the end actually two should hold.)

PLAN 5: Adding Columns to Shear Wall Ends		
Shear Walls need to be supported at both sides with a column to take their vertical reactions.		
Shear Walls:		
Height	13 ft	
Exterior:	8 total	
Length per wall	6 ft	
Length per side	12 ft	
Plywood Thickness	0.73 in	
Columns per side	4	>> There used to be only 2 columns, each being 14"x16", compared to the 12"x12" non-shear wall exterior columns
		Now there are twice as many columns, so the dimensions for each can be half of the original dimension:
		7"x8" columns
		CHOOSE --> 8"x b 8 in
		d 8 in
		>> There used to be 6 15ft span beams along each exterior side
		Now there will be 4 15ft spans, 2 9ft spans, and 2 6ft spans over the shear walls
		Preserve beam sections - 8"x16" for first floor - for all beams
Interior Middle "Lines":	2 total	
Length per wall	6 ft	
Length per "line"	12 ft	
Plywood Thickness	0.73 in	
Columns per line	4	>> There used to be only 2 columns, each being 14"x16" due to their shared loads with the 15ft shear walls.
		The non-shear wall floor columns are only 12"x12".
		Now there are twice as many columns, so the dimensions for each can be half of the original dimension:
		But one is shared with an "inner" shear wall and must stay 14"x16". So, for the other:
		7"x8" columns
		CHOOSE --> 8"x b 8 in
		d 8 in
		>> There used to be 4 15ft span beams along each line
		Now there will be 2 15ft spans, 2 9ft spans, and 2 6ft spans over the shear walls
Inner:	4 total	
Length per wall	15 ft	
Length per side	15 ft	
Plywood Thickness	1.5 in	
Columns per side	2	>> There used to be only 2 columns, one being 14"x16" due to its shared load with the 12ft shear walls, and the other 14"x14".
		There is no change now in the number of supporting columns, so no dimensions change.
Core "Double-Lines":	2 total	
Length per wall	15 ft	
OR	4 ft	
Length per "line"	38 ft	
Plywood Thickness	1.75 in	
Columns per line	8	>> There used to be only 6 columns, each being 14"x20" due to their shared or non-shared loads with the 38ft shear walls.
		Now there is an extra column per line.
		Total extra load per column: 2.6661 kips
		Maximum shared extra load per column: 5.3322 kips
		Required Area: 177.6 in^2
		So, the size can be downgraded to 14"x16", based on combined loading considerations:
		Area 209.25 in^2
		All columns in the core layout will be 14"x16"
		>> For a whole line, there used to be 6 15ft span beams along each line
		Now there will be 5 15ft spans, 1 11ft spans, and 1 4ft span over the short shear wall
Floor Slabs:		
Span, both directions	15 ft^2	
Square Area	225 ft^2	
Lightweight Concrete Overlay	1.5 in	
Plywood Surface	1.13 in	>>USE two 5/8" sheets over stud assembly
Joists (2x12):	14	>>USE 2x12s
Spacing	12 in	
Girders (2x12):	1, at least	>>USE 2x12s

Shear Wall Chord Reaction Forces Considering Added Columns

Shearwall Reactions

Summary -

			15ft		12ft		38ft	
Max. Shear due to design loads at top of wall	V = P/b	lb/ft	434.57		543.21		1200.79	
Area of boundary element cross section	A	in^2	132.20	(Column Size - 12x12 nominal)	132.20		132.20	
Wall height	h	ft	13.00		13.00		13.00	
Wall width	b	ft	15.00		12.00		38.00	
Deflection due to anchorage details	d-a	in	0.10	Educated guess	0.10		0.10	
Modulus of rigidity of plywood	G	lb/in^2	90000.00	(UBC Table 23-2-J)	90000.00		90000.00	
Effective thickness of plywood for shear	t	in	?		?		?	
Nail deformation	e-n	in	0.05	(from Table 8.2)	0.05		0.05	
Young's Modulus	E	psi	1700000		1700000		1700000	
	t-min	in	1.50		0.73		1.75	
Density of wood	rho	lb/in^3	0.017					
Weight of Shear Wall	w-p	lb	716.04	lb	278.78	lb	2116.30	lb

Overturning Moment:

for b>> M = V * b * h

	15ft	12ft	38ft
M	84741.43 lb-ft	84741.43 lb-ft	593190.00 lb-ft

Chord Forces:

T = C = M / b = V * h

	15ft	12ft	38ft
	5649.43 lb	7061.79 lb	15610.26 lb
	5.65 kips	7.06 kips	15.61 kips
Adding weight of Shear Walls and Reactions:	6.37 kips	7.34 kips	17.73 kips

<< These vertical loads are transferred to columns and shear walls

	15ft	12ft	38ft
Number of supporting columns:	2	4	8
Number Shared with another s.w.:	1 (with 12ft s.w.)	0 or 2 (with 15ft s.w.)	4 (with 38ft s.w.)
Extra Load Per Column:	3.18 kips	1.84 kips	2.22 kips
Extra Load per Shared Column:	5.02 kips	5.02 kips	4.43 kips

Final Column Design – Considering Shear Wall Forces with Added Columns

Number of Floors			Office Floor Space		Window Space per Floor		Floor Load			Ultimate Stress of Wood	
n	10										
Without top floor	9		Total per floor	7200 ft^2	Total per floor	4680 ft^2	Floors 1-9	183.92	psf	Fc	2 ksi
h	13	ft					Floor 10	204.32	psf	E	1700 ksi

Plan 4:

24	exterior columns
8	interior columns around atrium
16	floor columns
48	Total columns

Span = 15 ft

Tributary Area per Column = 150 ft^2

Shared, 38ft Shearwall Columns:

Number 4
Extra Load 4.43 kips

Axial Force on 1st Floor Column = 318819.34 lb
318.82 kips

AXIAL STRESS ANALYSIS
Necessary cross-sectional area: 159.41 in^2
1.11 ft^2

side= 12.63 in
1.05 ft

Choose 14"x20" (A=263.250in^2, S=855.563in^3, I=8341.734in^4)
Douglas fir standard dressed size (bxd)
A 1.83 ft^2
side: b 1.125 ft
d 1.63 ft
\> weight 35.00 pcf
63.98 plf

Choose 10"x22" (A=204.250in^2, S=731.896in^3, I=7867.879in^4)
Douglas fir standard dressed size (bxd)
A 1.42 ft^2
side: b 0.79 ft
d 1.79 ft
\> weight 35.00 pcf
49.64 plf

Corresponding Glulam Dimensions:

Use one 10.75in width section
Use depth of 27in, needs eighteen 1.5in laminations
Total Area = 290.3 in^2
Douglas Fir 70.5 lb/ft

\> Net Floor Space:
7112.25 ft^2
1st floor Reduction = 87.75 ft^2

\> Net Window Space:
4329.00 ft^2
1st floor Reduction = 351.00 ft^2

Shared, 15ft-12ft Shearwall Columns:

Number 2
Extra Load 5.02 kips

Axial Force on 1st Floor Column = 324095.46 lb
324.10 kips

AXIAL STRESS ANALYSIS
Necessary cross-sectional area: 162.05 in^2
1.13 ft^2

side= 12.73 in
1.06 ft

Choose 10"x22" (A=204.250in^2, S=731.896in^3, I=7867.879in^4)
Douglas fir standard dressed size (bxd)
A 1.42 ft^2
side: b 0.79 ft
d 1.79 ft
\> weight 35.00 pcf
49.64 plf

Choose 14"x16" (A=209.250in^2, S=540.563in^3, I=4189.359in^4)
Douglas fir standard dressed size (bxd)
A 1.45 ft^2
side: b 1.125 ft
d 1.29 ft
\> weight 35.00 pcf
50.86 plf

Corresponding Glulam Dimensions:

Use one 10.75in width section
Use depth of 18in, needs twelve 1.5in laminations
Total Area = 193.5 in^2
Douglas Fir 47 lb/ft

\> Net Floor Space:
7131.92 ft^2
1st floor Reduction = 68.08 ft^2

\> Net Window Space:
4433.00 ft^2
1st floor Reduction = 247.00 ft^2

Unshared, Shearwall Columns, GENERAL:

Largest Extra Load 1.84 kips

Axial Force: 295450.85 lb
295.45 kips

Area Need 147.73 in^2
1.03 ft^2

side= 12.15 in
1.01 ft

Choose
14"x14" (A=182.250in^2, S=410.063in^3, I=2767.922in^4)
Douglas fir standard dressed size (bxd)
A 1.27 ft^2
side: b 1.13 ft
d 1.13 ft
weight 35.00 pcf
44.30 plf

continued

BUCKLING ANALYSIS (assuming PIN ends), 1st Floor Column, using 14x20

length	h	13	ft	
length-eff	Le	13	ft	
dimension	d	1.125	ft	
Slenderness ratio	Le/d	11.56	> 11, so the column is not "short"	
Intermediate factor	K	19.56		
		(from Faherty and Williamson, eq. 3.2, K = 0.671(E/Fc)^0.5)		
	Since Le/d is less than K, the column is "intermediate"			
Euler Stress	F'c	1.92	ksi	<<F'c = Fc * (1-1/3(Le/d/K)^4)
Actual Stress	fc	1.21	ksi	GOOD

COMBINED LOADING ANALYSIS (eccentric loading), 1st Floor Column, using 14x20

eccentricity	e	2	ft	
dimension	d	1.125	ft	
Bending Stress	F'b	2	ksi	
For Le/d<K	J	0.06	(from J = (Le/d-11)/(K-11))	
	Max J	1		
Table 3.2 (Faherty and Williamson):				
Allowable Axial Stress	fc	>>	fc/F'c+(fc(6+1.5J)*e/d)/(F'b-J*fc)<1	
			solving,	
		1.000000507	max fc =	0.167487541 ksi
			Axial Load	26.69913324 kips

< If there is an eccentricity of 2 ft, then the column above can take only 28 kips

COMBINED LOADING ANALYSIS (Over-Turning Moment loading), 1st Floor Column

Axial Load	f	318.82	kips	
Area	A	263.25	in^2	
Axial Stress	fc	1.21	ksi	
Height	h	13	ft	
dimension	d	1.125	ft	
Section Modulus	S	855.56	in^3	
Bending Strength	F'b	2.00	ksi	
For Le/d<K	J	0.06	(from J = (Le/d-11)/(K-11))	
	Max J	1.00		
Table 3.2 (Faherty and Williamson):				
Allowable Axial Stress	fc	>>	fc/F'c+fb/(F'b-J*fc)<1	
			solving,	
		0.96	max fb =	0.63 ksi
			Lateral Point Load	41.21 kips

< Maximum amount of lateral load the largest column can take at its top

BUCKLING ANALYSIS (assuming PIN ends), 1st Floor Column, using 10x22

length	h	13	ft	
length-eff	Le	13	ft	
dimension	d	0.791666667	ft	
Slenderness ratio	Le/d	16.42	> 11, so the column is not "short"	
Intermediate factor	K	19.56	(from Faherty and Williamson, eq. 3.2, K = 0.671(E/Fc)^0.5)	
	Since Le/d is less than K, the column is "intermediate"			
Euler Stress	F'c	1.67	ksi	
Actual Stress	fc	1.59	ksi	N.G.
Using 14x16 >>	Euler	1.92		
	Actual	1.55		GOOD

COMBINED LOADING ANALYSIS (eccentric loading), 1st Floor Column, using 14x16

eccentricity	e	2	ft	
dimension	d	1.125	ft	
Bending Stress	F'b	2	ksi	
For Le/d<K	J	0.06	(from J = (Le/d-11)/(K-11))	
	Max J	1		
Table 3.2 (Faherty and Williamson):				
wable Axial Stress	fc	>>	fc/F'c+(fc(6+1.5J)*e/d)/(F'b-J*fc)<1	
			solving,	
		1.000000002	max fc =	0.167487456 ksi
			Axial Load	27.14096173 kips

< If there is an eccentricity of 2 ft, then the column above can take only 29 kips

COMBINED LOADING ANALYSIS (Over-Turning Moment loading), 1st Floor Column, using 14x16

Axial Load	f	324.10	kips	
Area	A	209.25	in^2	
Axial Stress	fc	1.55	ksi	
Height	h	13	ft	
dimension	d	1.125	ft	
Section Modulus	S	855.56	in^3	
Bending Strength	F'b	2.00	ksi	
For Le/d<K	J	0.06	(from J = (Le/d-11)/(K-11))	
	Max J	1.00		
Table 3.2 (Faherty and Williamson):				
wable Axial Stress	fc	>>	fc/F'c+fb/(F'b-J*fc)<1	
			solving,	
		0.93	max fb =	0.24 ksi
			Lateral Point Load	15.49 kips

< Maximum amount of lateral load the largest column can take at its top

E. Floor Slab Design

FLOORS:			
Side A	15 ft		
Side B	15 ft	8 ft	<< Maximum length of slab span to meet deflection requirement, discovered below
Area	225 ft^2		>
wD	42 psf		> This can be achieved by using cross-girders (cross-joists) in the floor system
wL	80 psf		> Also, reduces total amount of load per joist
w, factored	178.4 psf		> Effect is a larger number of load-carrying joists
Joists:			
b	2 in		<< Can adjust thickness of joists
d	12 in		
Spacing	12 in		<< Can adjust spacing
Number	14		
w,joist	191.143 plf		
Bending Moment	5375.89 lb-ft		
Stress	1343.97 psi	<< I = 1/12*b*d^3	
		I, Full Sla 87480000	
E, wood	1700 ksi		
I, wood joists	4032 in^4		<< Can be optimized with I-joists
E, concrete	3600 ksi		
t, concrete slab	1.5 in		
I, concrete slab	50.625 in^4		
E, eff	2650 ksi		
Deflection	6.49129 in	<<deflct = w*L^4/(384EI)	
L/240, total load	0.75 in		

ITERATION: With Cross-Girders			
Side A	15 ft		
Side B	15 ft	8 ft	
Area	225 ft^2		
wD	42 psf		
wL	80 psf		
w, factored	178.4 psf		
Joists and Girders:			
b	2 in		
d	12 in		
Spacing	12 in		
Number	28	<<< Same number of cross-girders	
w,joist	95.5714 plf	as main joists = 14	
Span Length	1 ft		
E, wood	1700 ksi		
I, wood joists	8064 in^4	<<< Should be different	
E, concrete	3600 ksi		
t, concrete slab	1.5 in		
I, concrete slab	50.625 in^4		
E, eff	2650 ksi		
Deflection	6.5E-05 in	<<deflct = w*L^4/(384EI)	
L/240, total load	0.75 in		

ITERATION: With One Cross-Girder		
Side A	15 ft	
Side B	15 ft	8 ft
Area	225 ft^2	
wD	42 psf	
wL	80 psf	
w, factored	178.4 psf	
Joists and Girders:		
b	2 in	
d	12 in	
Spacing	12 in	
Joists and Girders:	14	
Girders	1	<<< Only one cross-girder -
w,joist	191.14 plf	takes no load, only provides
Span Length	7.5 ft	
E, wood	1700 ksi	
I, wood joists	4032 in^4	<<< Should be different
E, concrete	3600 ksi	
t, concrete slab	1.5 in	
I, concrete slab	50.625 in^4	
E, eff	2650 ksi	
Deflection	0.4057 in	<<deflct = w*L^4/(384EI)
L/240, total load	0.75 in	

F. Final Member Sizing Summary

- Building Dimensions
  - Floors - n = 10
  - Height of floors - h = 13ft
  - Total building height - H = 130ft
  - Building length - 90ft
  - Building width - 90ft
  - Atrium length - 30ft
  - Atrium width - 30ft
- Columns
  - Number per floor - 64
  - Exterior - 32
  - Non-shear wall - 24
    - 1st Floor Size - 12"x14" nominal
    - 10th Floor Size - 6"x10" nominal
  - Small shear wall columns - 20
    - 1st Floor Size - 8"x8" nominal
  - Medium s.w. columns - 4
    - 1st Floor Size - 14"x14" nominal
  - Large s.w. columns - 16
    - 1st Floor Size - 14"x16" nominal
- Beams
  - Number of 15ft spans - 64
  - Number of 11ft spans - 4
  - Number of 9ft spans - 12
  - Number of 6ft spans - 12
  - Number of 4ft spans - 4
  - 1st Floor Size - 8"x18" nominal
  - 10th Floor Size - 8"x18" nominal
- Shear Walls
  - Available panel size - 4'x8'
  - Number of Exterior, 6ft - 8
    - Needed thickness per wall - 0.73"
    - Available - 0.75" (with two 3/8" sheets)
    - Number of panels needed - 2
  - Interior middle lines, 6ft - 4
    - Needed - 0.73"
    - Available - 0.75" (with two 3/8" sheets)
    - Panels needed - 2
  - Inner, 15ft - 4
    - Needed - 1.5"
    - Available - 1.5" (with two ¾" sheets)
    - Panels needed - 3 or 4
  - Core, 15ft - 4
    - Needed - 1.75"
    - Available - 2.0" (with four ½" sheets)
    - Panels needed - 3 or 4
  - Core, 4ft - 4
    - Needed - 1.75"
    - Available - 2.0" (with four ½" sheets)
    - Panels needed - 2
- Floors
  - Span, in both directions - 15ft
  - Concrete overlay thickness - 1.5"
  - Plywood thickness - 1.125"
  - Joists - 14
    - Spacing - 12"
    - Size - 2"x12" nominal
  - Cross-girders - 2, at least
    - Spacing - 5'
    - Size - 2"x12"

G. SAP2000 Data Results

Regular Wind

With released columns, not beams, 1' floors

max (ft)	0.11708	-0.01978	-0.0196	1.40496	-0.23736	-0.2352 (in)	
other side	0.08337	0.01385	-0.01406 torsion	1.00044	0.1662	-0.16872	<< evidence of torsion >> Angle = r / s = (x^2+y^2)^0.5 / (90*(2^.5))
3rd story	0.03118	-0.00275	-0.0098	0.37416	-0.033	-0.1176	0.000933 rad
2nd story	0.01776	-0.00126	-0.0069	0.21312	-0.01512	-0.0828	0.053451 degrees
Drift	0.01342	-0.00149	-0.0029	0.16104	-0.01788	-0.0348	

beam moment	28.79
Column Tension	31.09 frame 223
column compression	172.59 frame 215 14x14

Modes				
1	0.8027 torsion		6	0.2063 wiggle inflection point
2	0.7876 straight line		7	0.1206 wiggle
3	0.6838 torsion		8	0.1116 second inflection point
4	0.2343 wiggle		9	0.1067 third inflection point
5	0.2239 inflection point		10	0.0971 flex

Regular Wind

With released columns, not beams, 0.1' floors = CONTROL CASE

max (ft)	0.23078	-0.05158	-0.01125	2.76936	-0.61896	-0.135 (in)	
other side	0.19678	-0.00761	-0.00777 torsion	2.36136	-0.09132	-0.09324	<< evidence of torsion >> Angle = r / s = (x^2+y^2)^0.5 / (90*(2^.5))
3rd story	0.0499	-0.0092	-0.00558	0.5988	-0.1104	-0.06696	0.001858 rad
2nd story	0.0266	-0.00462	-0.00393	0.3192	-0.05544	-0.04716	0.106451 degrees
Drift	0.0233	-0.00458	-0.00165	0.2796	-0.05496	-0.0198	

beam moment	36.91
Column Tension	141.39 frame 223
column compression	204.46 frame 215 14x14

Modes				
1	0.6629 torsion		6	0.1349 wiggle inflection point
2	0.6318 straight line		7	0.0765 wiggle
3	0.4848 torsion		8	0.0699 second inflection point
4	0.1632 wiggle		9	0.0661 third inflection point
5	0.1515 inflection point		10	0.0597 flex

Max. Moment in Beam	34 kips-ft	<< Criteria = M*y/I < 2ksi	1.195313 GOOD
Max. Axial in Beam	23 kips-ft	<< Expected = 54 kips	GOOD

Regular Wind

With released columns, not beams, No floors

max	0.2364	-0.00836	-0.00437	2.8368	-0.10032	-0.05244 (in)	
other side	0.23186	-0.00466	-0.000331	2.78232	-0.05592	-0.003966	<< evidence of torsion >> Angle = r / s = (x^2+y^2)^0.5 / (90*(2^.5))
3rd story	0.05574	-0.00148	-0.00225	0.66888	-0.01776	-0.027	0.001858 rad
2nd story	0.02894	-0.000693	-0.00159	0.34728	-0.008317	-0.01908	0.106484 degrees
Drift	0.0268	-0.000787	-0.00066	0.3216	-0.009443	-0.00792	

beam moment	34.1	
Column Tension	141.16	223 14x16
column compression	206.39	215 14x14

Modes				
1	0.5957 torsion		5	0.2608 wave
2	0.5649 straight line		6	0.2465 wave
3	0.4692 torsion		7	0.1958 double wave
4	0.363 stretch		11	0.1635 inflection point

No Wind

12x14 section	158.29 kips, compression max
8x8	94.13
14x16	307.14
14x14	261.3

Core Shear Walls Only								
max	0.38381	-0.00578	-0.01093		4.60572	-0.06936	-0.13116	(in)
3rd story	0.07949	-0.00098	-0.00532		0.95388	-0.01177	-0.06384	
2nd story	0.04258	-0.00054	-0.00373		0.51096	-0.00653	-0.04476	
Drift	0.03691	-0.00044	-0.00159		0.44292	-0.00524	-0.01908	
beam moment	52.8							
Column Tension	272.98							
column compression	348.98							
Modes								
1	1.1378			5	0.2038			
2	0.8646							
No Shear Walls								
max	50.18363	0.03664	-0.01095		602.2036	0.43968	-0.1314	(in)
3rd story	19.29212	0.01679	-0.00539		231.5054	0.20148	-0.06468	
2nd story	10.0729	0.00723	-0.00382		120.8748	0.08676	-0.04584	
Drift	9.21922	0.00956	-0.00157		110.6306	0.11472	-0.01884	
beam moment	357.65	975						
Column Tension	307.34	202	12x14					
column compression	421.06	201	14x16					
Modes								
1	10.3144	straight line		3	3.4514	inflection point		
2	9.6352	torsion						
No Shear Walls in 1st Floor								
column compression	252.71	254	14x16					
Concrete Shear Walls								
max	0.18466	-0.01704	-0.01004		2.21592	-0.20448	-0.12048	(in)
3rd story	0.03478	-0.00218	-0.00497		0.41736	-0.02616	-0.05964	
2nd story	0.01791	-0.00095	-0.0035		0.21492	-0.01145	-0.042	
Drift	0.01687	-0.00123	-0.00147		0.20244	-0.01471	-0.01764	
beam moment	26.44							
Modes								
1	0.7168	torsion		5	0.1548	inflection point		
2	0.6944	straight line						
Corner Wind								
	With released columns, not beams, 0.1 floors							
max	0.1853	0.08828	-0.01137		2.2236	1.05936	-0.13644	(in)
3rd story	0.04127	0.02323	-0.00568		0.49524	0.27876	-0.06816	
2nd story	0.02238	0.01306	-0.00401		0.26856	0.15672	-0.04812	
Drift	0.01889	0.01017	-0.00167		0.22668	0.12204	-0.02004	
beam moment	25.61							
Column Tension	120.46	frame 223	14x16					
column compression	162.1	frame 218	14x16					
Redundant Case								
	Axial Forces							
	frame	Before	After					
case 1	243	113.33	161.97	kips				
	240	120.81	0	(12x12, 1st floor, middle, opposite to wind)				
	222	117.43	164.12					
case 2	256	98.98	103.22					
	237	90	93.05					
	251	90.88	0	(14x16, inner column, but not core)				
	252	198.55	214.67					
	236	251.62	253.07					

H. SAP2000 Input File – Case of 1.2" Wooden Floors

```
; File U:\Thesis\Final Model
2.$2k saved 4/30/05 14:47:47 in
Kip-ft

SYSTEM
 DOF=UX,UY,UZ,RX,RY,RZ
LENGTH=FT FORCE=Kip
PAGE=SECTIONS

JOINT
 1 X=3.825708 Y=7.660122
Z=0
 2 X=3.825708 Y=-7.339878
Z=0
 3 X=3.825708 Y=-13.33988
Z=0
 4 X=3.825708 Y=-22.33988
Z=0
 5 X=3.825708 Y=-37.33988
Z=0
 6 X=3.825708 Y=-52.33988
Z=0
 7 X=3.825708 Y=-61.33988
Z=0
 8 X=3.825708 Y=-67.33987
Z=0
 9 X=3.825708 Y=-82.33987
Z=0
 10 X=18.82571 Y=7.660122
Z=0
 11 X=24.82571 Y=7.660122
Z=0
 12 X=33.82571 Y=7.660122
Z=0
 13 X=48.82571 Y=7.660122
Z=0
 14 X=63.82571 Y=7.660122
Z=0
 15 X=72.82571 Y=7.660122
Z=0
 16 X=78.82571 Y=7.660122
Z=0
 17 X=93.82571 Y=7.722622
Z=0
 18 X=93.82571 Y=-7.339878
Z=0
 19 X=93.82571 Y=-13.33988
Z=0
 20 X=93.88821 Y=-22.33988
Z=0
 21 X=93.82571 Y=-37.33988
Z=0
 22 X=93.88821 Y=-52.33988
Z=0
 23 X=93.88821 Y=-61.33988
Z=0
 24 X=93.82571 Y=-67.33987
Z=0
 25 X=93.82571 Y=-82.33987
Z=0
 26 X=78.82571 Y=-82.33987
Z=0
 27 X=72.82571 Y=-82.27737
Z=0
 28 X=63.88807 Y=-82.33987
Z=0
 29 X=48.82571 Y=-82.33987
Z=0
 30 X=33.82571 Y=-82.40237
Z=0
 31 X=24.82571 Y=-82.33987
Z=0
 32 X=18.82571 Y=-82.33987
Z=0
 33 X=18.82571 Y=-67.33987
Z=0
 34 X=18.82571 Y=-52.33988
Z=0
 35 X=18.82571 Y=-37.33988
Z=0
 36 X=18.82571 Y=-22.33988
Z=0
 37 X=18.82571 Y=-7.339878
Z=0
 38 X=33.82571 Y=-7.339878
Z=0
 39 X=33.82571 Y=-22.33988 Z=0
 40 X=33.82571 Y=-37.34739 Z=0
 41 X=33.82571 Y=-52.33988 Z=0
 42 X=33.82571 Y=-56.33988 Z=0
 43 X=33.82571 Y=-67.33987 Z=0
 44 X=48.88821 Y=-73.33987 Z=0
 45 X=48.82571 Y=-67.33987 Z=0
 46 X=48.85696 Y=-52.33988 Z=0
 47 X=63.82571 Y=-52.33988 Z=0
 48 X=67.82571 Y=-52.33988 Z=0
 49 X=78.82571 Y=-52.33988 Z=0
 50 X=78.82571 Y=-67.37112 Z=0
 51 X=63.82571 Y=-67.33987 Z=0
 52 X=63.82571 Y=-37.33988 Z=0
 53 X=63.82571 Y=-22.33988 Z=0
 54 X=63.88821 Y=-18.33988 Z=0
 55 X=63.82571 Y=-7.339878 Z=0
 56 X=78.82571 Y=-7.339878 Z=0
 57 X=78.82571 Y=-22.33988 Z=0
 58 X=78.82571 Y=-37.33988 Z=0
 59 X=84.82571 Y=-37.33988 Z=0
 60 X=12.82571 Y=-37.33988 Z=0
 61 X=29.82571 Y=-22.33988 Z=0
 62 X=48.82571 Y=-22.33988 Z=0
 63 X=48.82571 Y=-7.339878 Z=0
 64 X=48.82571 Y=-1.339878 Z=0
 65 X=3.825708 Y=7.660122 Z=13
 66 X=3.825708 Y=-7.339878 Z=13
 67 X=3.825708 Y=-13.33988 Z=13
 68 X=3.825708 Y=-22.33988 Z=13
 69 X=3.825708 Y=-37.33988 Z=13
 70 X=3.825708 Y=-52.33988 Z=13
 71 X=3.825708 Y=-61.33988 Z=13
 72 X=3.825708 Y=-67.33987 Z=13
 73 X=3.825708 Y=-82.33987 Z=13
 74 X=18.82571 Y=7.660122 Z=13
 75 X=24.82571 Y=7.660122 Z=13
 76 X=33.82571 Y=7.660122 Z=13
 77 X=48.82571 Y=7.660122 Z=13
 78 X=63.82571 Y=7.660122 Z=13
 79 X=72.82571 Y=7.660122 Z=13
 80 X=78.82571 Y=7.660122 Z=13
 81 X=93.82571 Y=7.722622 Z=13
 82 X=93.82571 Y=-7.339878 Z=13
 83 X=93.82571 Y=-13.33988 Z=13
 84 X=93.88821 Y=-22.33988 Z=13
 85 X=93.82571 Y=-37.33988 Z=13
 86 X=93.88821 Y=-52.33988 Z=13
 87 X=93.88821 Y=-61.33988 Z=13
 88 X=93.82571 Y=-67.33987 Z=13
 89 X=93.82571 Y=-82.33987 Z=13
 90 X=78.82571 Y=-82.33987 Z=13
 91 X=72.82571 Y=-82.27737 Z=13
 92 X=63.88807 Y=-82.33987 Z=13
 93 X=48.82571 Y=-82.33987 Z=13
 94 X=33.82571 Y=-82.40237 Z=13
 95 X=24.82571 Y=-82.33987 Z=13
 96 X=18.82571 Y=-82.33987 Z=13
 97 X=18.82571 Y=-67.33987 Z=13
 98 X=18.82571 Y=-52.33988 Z=13
 99 X=18.82571 Y=-37.33988 Z=13
 100 X=18.82571 Y=-22.33988 Z=13
 101 X=18.82571 Y=-7.339878 Z=13
 102 X=33.82571 Y=-7.339878 Z=13
 103 X=33.82571 Y=-22.33988 Z=13
 104 X=33.82571 Y=-37.34739 Z=13
 105 X=33.82571 Y=-52.33988 Z=13
 106 X=33.82571 Y=-56.33988 Z=13
 107 X=33.82571 Y=-67.33987 Z=13
 108 X=48.88821 Y=-73.33987 Z=13
 109 X=48.82571 Y=-67.33987 Z=13
 110 X=48.85696 Y=-52.33988 Z=13
 111 X=63.82571 Y=-52.33988 Z=13
 112 X=67.82571 Y=-52.33988 Z=13
 113 X=78.82571 Y=-52.33988 Z=13
 114 X=78.82571 Y=-67.37112 Z=13
 115 X=63.82571 Y=-67.33987 Z=13
 116 X=63.82571 Y=-37.33988 Z=13
 117 X=63.82571 Y=-22.33988 Z=13
 118 X=63.88821 Y=-18.33988 Z=13
 119 X=63.82571 Y=-7.339878 Z=13
 120 X=78.82571 Y=-7.339878 Z=13
 121 X=78.82571 Y=-22.33988 Z=13
 122 X=78.82571 Y=-37.33988 Z=13
 123 X=84.82571 Y=-37.33988 Z=13
 124 X=12.82571 Y=-37.33988 Z=13
 125 X=29.82571 Y=-22.33988 Z=13
 126 X=48.82571 Y=-22.33988 Z=13
 127 X=48.82571 Y=-7.339878 Z=13
 128 X=48.82571 Y=-1.339878 Z=13
 129 X=3.825708 Y=7.660122 Z=26
 130 X=3.825708 Y=-7.339878 Z=26
 131 X=3.825708 Y=-13.33988 Z=26
 132 X=3.825708 Y=-22.33988 Z=26
 133 X=3.825708 Y=-37.33988 Z=26
 134 X=3.825708 Y=-52.33988 Z=26
 135 X=3.825708 Y=-61.33988 Z=26
 136 X=3.825708 Y=-67.33987 Z=26
 137 X=3.825708 Y=-82.33987 Z=26
 138 X=18.82571 Y=7.660122 Z=26
 139 X=24.82571 Y=7.660122 Z=26
 140 X=33.82571 Y=7.660122 Z=26
 141 X=48.82571 Y=7.660122 Z=26
 142 X=63.82571 Y=7.660122 Z=26
 143 X=72.82571 Y=7.660122 Z=26
 144 X=78.82571 Y=7.660122 Z=26
 145 X=93.82571 Y=7.722622 Z=26
 146 X=93.82571 Y=-7.339878 Z=26
 147 X=93.82571 Y=-13.33988 Z=26
 148 X=93.88821 Y=-22.33988 Z=26
 149 X=93.82571 Y=-37.33988 Z=26
 150 X=93.88821 Y=-52.33988 Z=26
 151 X=93.88821 Y=-61.33988 Z=26
 152 X=93.82571 Y=-67.33987 Z=26
 153 X=93.82571 Y=-82.33987 Z=26
 154 X=78.82571 Y=-82.33987 Z=26
 155 X=72.82571 Y=-82.27737 Z=26
 156 X=63.88807 Y=-82.33987 Z=26
 157 X=48.82571 Y=-82.33987 Z=26
 158 X=33.82571 Y=-82.40237 Z=26
 159 X=24.82571 Y=-82.33987 Z=26
 160 X=18.82571 Y=-82.33987 Z=26
 161 X=18.82571 Y=-67.33987 Z=26
 162 X=18.82571 Y=-52.33988 Z=26
 163 X=18.82571 Y=-37.33988 Z=26
 164 X=18.82571 Y=-22.33988 Z=26
 165 X=18.82571 Y=-7.339878 Z=26
 166 X=33.82571 Y=-7.339878 Z=26
 167 X=33.82571 Y=-22.33988 Z=26
 168 X=33.82571 Y=-37.34739 Z=26
 169 X=33.82571 Y=-52.33988 Z=26
 170 X=33.82571 Y=-56.33988 Z=26
 171 X=33.82571 Y=-67.33987 Z=26
 172 X=48.88821 Y=-73.33987 Z=26
 173 X=48.82571 Y=-67.33987 Z=26
 174 X=48.85696 Y=-52.33988 Z=26
 175 X=63.82571 Y=-52.33988 Z=26
 176 X=67.82571 Y=-52.33988 Z=26
 177 X=78.82571 Y=-52.33988 Z=26
 178 X=78.82571 Y=-67.37112 Z=26
 179 X=63.82571 Y=-67.33987 Z=26
 180 X=63.82571 Y=-37.33988 Z=26
 181 X=63.82571 Y=-22.33988 Z=26
 182 X=63.88821 Y=-18.33988 Z=26
 183 X=63.82571 Y=-7.339878 Z=26
 184 X=78.82571 Y=-7.339878 Z=26
 185 X=78.82571 Y=-22.33988 Z=26
 186 X=78.82571 Y=-37.33988 Z=26
 187 X=84.82571 Y=-37.33988 Z=26
 188 X=12.82571 Y=-37.33988 Z=26
 189 X=29.82571 Y=-22.33988 Z=26
 190 X=48.82571 Y=-22.33988 Z=26
 191 X=48.82571 Y=-7.339878 Z=26
 192 X=48.82571 Y=-1.339878 Z=26
 193 X=3.825708 Y=7.660122 Z=39
 194 X=3.825708 Y=-7.339878 Z=39
 195 X=3.825708 Y=-13.33988 Z=39
 196 X=3.825708 Y=-22.33988 Z=39
 197 X=3.825708 Y=-37.33988 Z=39
 198 X=3.825708 Y=-52.33988 Z=39
 199 X=3.825708 Y=-61.33988 Z=39
 200 X=3.825708 Y=-67.33987 Z=39
 201 X=3.825708 Y=-82.33987 Z=39
 202 X=18.82571 Y=7.660122 Z=39
 203 X=24.82571 Y=7.660122 Z=39
 204 X=33.82571 Y=7.660122 Z=39
 205 X=48.82571 Y=7.660122 Z=39
 206 X=63.82571 Y=7.660122 Z=39
 207 X=72.82571 Y=7.660122 Z=39
 208 X=78.82571 Y=7.660122 Z=39
 209 X=93.82571 Y=7.722622 Z=39
 210 X=93.82571 Y=-7.339878 Z=39
 211 X=93.82571 Y=-13.33988 Z=39
 212 X=93.88821 Y=-22.33988 Z=39
 213 X=93.82571 Y=-37.33988
Z=39
 214 X=93.88821 Y=-52.33988
Z=39
 215 X=93.88821 Y=-61.33988
Z=39
 216 X=93.82571 Y=-67.33987
Z=39
 217 X=93.82571 Y=-82.33987
Z=39
 218 X=78.82571 Y=-82.33987
Z=39
 219 X=72.82571 Y=-82.27737
Z=39
 220 X=63.88807 Y=-82.33987
Z=39
 221 X=48.82571 Y=-82.33987
Z=39
 222 X=33.82571 Y=-82.40237
Z=39
 223 X=24.82571 Y=-82.33987
Z=39
 224 X=18.82571 Y=-82.33987
Z=39
 225 X=18.82571 Y=-67.33987
Z=39
 226 X=18.82571 Y=-52.33988
Z=39
 227 X=18.82571 Y=-37.33988
Z=39
 228 X=18.82571 Y=-22.33988
Z=39
 229 X=18.82571 Y=-7.339878
Z=39
 230 X=33.82571 Y=-7.339878
Z=39
 231 X=33.82571 Y=-22.33988
Z=39
 232 X=33.82571 Y=-37.34739
Z=39
 233 X=33.82571 Y=-52.33988
Z=39
 234 X=33.82571 Y=-56.33988
Z=39
 235 X=33.82571 Y=-67.33987
Z=39
 236 X=48.88821 Y=-73.33987
Z=39
 237 X=48.82571 Y=-67.33987
Z=39
 238 X=48.85696 Y=-52.33988
Z=39
 239 X=63.82571 Y=-52.33988
Z=39
 240 X=67.82571 Y=-52.33988
Z=39
 241 X=78.82571 Y=-52.33988
Z=39
 242 X=78.82571 Y=-67.37112
Z=39
 243 X=63.82571 Y=-67.33987
Z=39
 244 X=63.82571 Y=-37.33988
Z=39
 245 X=63.82571 Y=-22.33988
Z=39
 246 X=63.88821 Y=-18.33988
Z=39
 247 X=63.82571 Y=-7.339878
Z=39
 248 X=78.82571 Y=-7.339878
Z=39
 249 X=78.82571 Y=-22.33988
Z=39
 250 X=78.82571 Y=-37.33988
Z=39
 251 X=84.82571 Y=-37.33988
Z=39
 252 X=12.82571 Y=-37.33988
Z=39
 253 X=29.82571 Y=-22.33988
Z=39
 254 X=48.82571 Y=-22.33988
Z=39
 255 X=48.82571 Y=-7.339878
Z=39
```

256 X=48.82571 Y=-1.339878 Z=39
257 X=3.825708 Y=7.660122 Z=52
258 X=3.825708 Y=-7.339878 Z=52
259 X=3.825708 Y=-13.33988 Z=52
260 X=3.825708 Y=-22.33988 Z=52
261 X=3.825708 Y=-37.33988 Z=52
262 X=3.825708 Y=-52.33988 Z=52
263 X=3.825708 Y=-61.33988 Z=52
264 X=3.825708 Y=-67.33987 Z=52
265 X=3.825708 Y=-82.33987 Z=52
266 X=18.82571 Y=7.660122 Z=52
267 X=24.82571 Y=7.660122 Z=52
268 X=33.82571 Y=7.660122 Z=52
269 X=48.82571 Y=7.660122 Z=52
270 X=63.82571 Y=7.660122 Z=52
271 X=72.82571 Y=7.660122 Z=52
272 X=78.82571 Y=7.660122 Z=52
273 X=93.82571 Y=7.722622 Z=52
274 X=93.82571 Y=-7.339878 Z=52
275 X=93.82571 Y=-13.33988 Z=52
276 X=93.88821 Y=-22.33988 Z=52
277 X=93.82571 Y=-37.33988 Z=52
278 X=93.88821 Y=-52.33988 Z=52
279 X=93.88821 Y=-61.33988 Z=52
280 X=93.82571 Y=-67.33987 Z=52
281 X=93.82571 Y=-82.33987 Z=52
282 X=78.82571 Y=-82.33987 Z=52
283 X=72.82571 Y=-82.27737 Z=52
284 X=63.88807 Y=-82.33987 Z=52
285 X=48.82571 Y=-82.33987 Z=52
286 X=33.82571 Y=-82.40237 Z=52
287 X=24.82571 Y=-82.33987 Z=52
288 X=18.82571 Y=-82.33987 Z=52
289 X=18.82571 Y=-67.33987 Z=52
290 X=18.82571 Y=-52.33988 Z=52
291 X=18.82571 Y=-37.33988 Z=52
292 X=18.82571 Y=-22.33988 Z=52
293 X=18.82571 Y=-7.339878 Z=52
294 X=33.82571 Y=-7.339878 Z=52
295 X=33.82571 Y=-22.33988 Z=52
296 X=33.82571 Y=-37.34739 Z=52
297 X=33.82571 Y=-52.33988 Z=52
298 X=33.82571 Y=-56.33988 Z=52
299 X=33.82571 Y=-67.33987 Z=52
300 X=48.88821 Y=-73.33987 Z=52
301 X=48.82571 Y=-67.33987 Z=52
302 X=48.85696 Y=-52.33988 Z=52
303 X=63.82571 Y=-52.33988 Z=52
304 X=67.82571 Y=-52.33988 Z=52
305 X=78.82571 Y=-52.33988 Z=52
306 X=78.82571 Y=-67.37112 Z=52
307 X=63.82571 Y=-67.33987 Z=52
308 X=63.82571 Y=-37.33988 Z=52
309 X=63.82571 Y=-22.33988 Z=52
310 X=63.88821 Y=-18.33988 Z=52
311 X=63.82571 Y=-7.339878 Z=52
312 X=78.82571 Y=-7.339878 Z=52
313 X=78.82571 Y=-22.33988 Z=52
314 X=78.82571 Y=-37.33988 Z=52
315 X=84.82571 Y=-37.33988 Z=52
316 X=12.82571 Y=-37.33988 Z=52
317 X=29.82571 Y=-22.33988 Z=52
318 X=48.82571 Y=-22.33988 Z=52
319 X=48.82571 Y=-7.339878 Z=52
320 X=48.82571 Y=-1.339878 Z=52
321 X=3.825708 Y=7.660122 Z=65
322 X=3.825708 Y=-7.339878 Z=65
323 X=3.825708 Y=-13.33988 Z=65
324 X=3.825708 Y=-22.33988 Z=65
325 X=3.825708 Y=-37.33988 Z=65
326 X=3.825708 Y=-52.33988 Z=65
327 X=3.825708 Y=-61.33988 Z=65
328 X=3.825708 Y=-67.33987 Z=65
329 X=3.825708 Y=-82.33987 Z=65
330 X=18.82571 Y=7.660122 Z=65
331 X=24.82571 Y=7.660122 Z=65
332 X=33.82571 Y=7.660122 Z=65
333 X=48.82571 Y=7.660122 Z=65
334 X=63.82571 Y=7.660122 Z=65
335 X=72.82571 Y=7.660122 Z=65
336 X=78.82571 Y=7.660122 Z=65
337 X=93.82571 Y=7.722622 Z=65
338 X=93.82571 Y=-7.339878 Z=65
339 X=93.82571 Y=-13.33988 Z=65
340 X=93.88821 Y=-22.33988 Z=65
341 X=93.82571 Y=-37.33988 Z=65
342 X=93.88821 Y=-52.33988 Z=65
343 X=93.88821 Y=-61.33988 Z=65
344 X=93.82571 Y=-67.33987 Z=65
345 X=93.82571 Y=-82.33987 Z=65
346 X=78.82571 Y=-82.33987 Z=65
347 X=72.82571 Y=-82.27737 Z=65
348 X=63.88807 Y=-82.33987 Z=65
349 X=48.82571 Y=-82.33987 Z=65
350 X=33.82571 Y=-82.40237 Z=65
351 X=24.82571 Y=-82.33987 Z=65
352 X=18.82571 Y=-82.33987 Z=65
353 X=18.82571 Y=-67.33987 Z=65
354 X=18.82571 Y=-52.33988 Z=65
355 X=18.82571 Y=-37.33988 Z=65
356 X=18.82571 Y=-22.33988 Z=65
357 X=18.82571 Y=-7.339878 Z=65
358 X=33.82571 Y=-7.339878 Z=65
359 X=33.82571 Y=-22.33988 Z=65
360 X=33.82571 Y=-37.34739 Z=65
361 X=33.82571 Y=-52.33988 Z=65
362 X=33.82571 Y=-56.33988 Z=65
363 X=33.82571 Y=-67.33987 Z=65
364 X=48.88821 Y=-73.33987 Z=65
365 X=48.82571 Y=-67.33987 Z=65
366 X=48.85696 Y=-52.33988 Z=65
367 X=63.82571 Y=-52.33988 Z=65
368 X=67.82571 Y=-52.33988 Z=65
369 X=78.82571 Y=-52.33988 Z=65
370 X=78.82571 Y=-67.37112 Z=65
371 X=63.82571 Y=-67.33987 Z=65
372 X=63.82571 Y=-37.33988 Z=65
373 X=63.82571 Y=-22.33988 Z=65
374 X=63.88821 Y=-18.33988 Z=65
375 X=63.82571 Y=-7.339878 Z=65
376 X=78.82571 Y=-7.339878 Z=65
377 X=78.82571 Y=-22.33988 Z=65
378 X=78.82571 Y=-37.33988 Z=65
379 X=84.82571 Y=-37.33988 Z=65
380 X=12.82571 Y=-37.33988 Z=65
381 X=29.82571 Y=-22.33988 Z=65
382 X=48.82571 Y=-22.33988 Z=65
383 X=48.82571 Y=-7.339878 Z=65
384 X=48.82571 Y=-1.339878 Z=65
385 X=3.825708 Y=7.660122 Z=78
386 X=3.825708 Y=-7.339878 Z=78
387 X=3.825708 Y=-13.33988 Z=78
388 X=3.825708 Y=-22.33988 Z=78
389 X=3.825708 Y=-37.33988 Z=78
390 X=3.825708 Y=-52.33988 Z=78
391 X=3.825708 Y=-61.33988 Z=78
392 X=3.825708 Y=-67.33987 Z=78
393 X=3.825708 Y=-82.33987 Z=78
394 X=18.82571 Y=7.660122 Z=78
395 X=24.82571 Y=7.660122 Z=78
396 X=33.82571 Y=7.660122 Z=78
397 X=48.82571 Y=7.660122 Z=78
398 X=63.82571 Y=7.660122 Z=78
399 X=72.82571 Y=7.660122 Z=78
400 X=78.82571 Y=7.660122 Z=78
401 X=93.82571 Y=7.722622 Z=78
402 X=93.82571 Y=-7.339878 Z=78
403 X=93.82571 Y=-13.33988 Z=78
404 X=93.88821 Y=-22.33988 Z=78
405 X=93.82571 Y=-37.33988 Z=78
406 X=93.88821 Y=-52.33988 Z=78
407 X=93.88821 Y=-61.33988 Z=78
408 X=93.82571 Y=-67.33987 Z=78
409 X=93.82571 Y=-82.33987 Z=78
410 X=78.82571 Y=-82.33987 Z=78
411 X=72.82571 Y=-82.27737 Z=78
412 X=63.88807 Y=-82.33987 Z=78
413 X=48.82571 Y=-82.33987 Z=78
414 X=33.82571 Y=-82.40237 Z=78
415 X=24.82571 Y=-82.33987 Z=78
416 X=18.82571 Y=-82.33987 Z=78
417 X=18.82571 Y=-67.33987 Z=78
418 X=18.82571 Y=-52.33988 Z=78
419 X=18.82571 Y=-37.33988 Z=78
420 X=18.82571 Y=-22.33988 Z=78
421 X=18.82571 Y=-7.339878 Z=78
422 X=33.82571 Y=-7.339878 Z=78
423 X=33.82571 Y=-22.33988 Z=78
424 X=33.82571 Y=-37.34739 Z=78
425 X=33.82571 Y=-52.33988 Z=78
426 X=33.82571 Y=-56.33988 Z=78
427 X=33.82571 Y=-67.33987 Z=78
428 X=48.88821 Y=-73.33987 Z=78
429 X=48.82571 Y=-67.33987 Z=78
430 X=48.85696 Y=-52.33988 Z=78
431 X=63.82571 Y=-52.33988 Z=78
432 X=67.82571 Y=-52.33988 Z=78
433 X=78.82571 Y=-52.33988 Z=78
434 X=78.82571 Y=-67.37112 Z=78
435 X=63.82571 Y=-67.33987 Z=78
436 X=63.82571 Y=-37.33988 Z=78
437 X=63.82571 Y=-22.33988 Z=78
438 X=63.88821 Y=-18.33988 Z=78
439 X=63.82571 Y=-7.339878 Z=78
440 X=78.82571 Y=-7.339878 Z=78
441 X=78.82571 Y=-22.33988 Z=78
442 X=78.82571 Y=-37.33988 Z=78
443 X=84.82571 Y=-37.33988 Z=78
444 X=12.82571 Y=-37.33988 Z=78
445 X=29.82571 Y=-22.33988 Z=78
446 X=48.82571 Y=-22.33988 Z=78
447 X=48.82571 Y=-7.339878 Z=78
448 X=48.82571 Y=-1.339878 Z=78
449 X=3.825708 Y=7.660122 Z=91
450 X=3.825708 Y=-7.339878 Z=91
451 X=3.825708 Y=-13.33988 Z=91
452 X=3.825708 Y=-22.33988 Z=91
453 X=3.825708 Y=-37.33988 Z=91
454 X=3.825708 Y=-52.33988 Z=91
455 X=3.825708 Y=-61.33988 Z=91
456 X=3.825708 Y=-67.33987 Z=91
457 X=3.825708 Y=-82.33987 Z=91
458 X=18.82571 Y=7.660122 Z=91
459 X=24.82571 Y=7.660122 Z=91
460 X=33.82571 Y=7.660122 Z=91
461 X=48.82571 Y=7.660122 Z=91
462 X=63.82571 Y=7.660122 Z=91
463 X=72.82571 Y=7.660122 Z=91
464 X=78.82571 Y=7.660122 Z=91
465 X=93.82571 Y=7.722622 Z=91
466 X=93.82571 Y=-7.339878 Z=91
467 X=93.82571 Y=-13.33988 Z=91
468 X=93.88821 Y=-22.33988 Z=91
469 X=93.82571 Y=-37.33988 Z=91
470 X=93.88821 Y=-52.33988 Z=91
471 X=93.88821 Y=-61.33988 Z=91
472 X=93.82571 Y=-67.33987 Z=91
473 X=93.82571 Y=-82.33987 Z=91
474 X=78.82571 Y=-82.33987 Z=91
475 X=72.82571 Y=-82.27737 Z=91
476 X=63.88807 Y=-82.33987 Z=91
477 X=48.82571 Y=-82.33987 Z=91
478 X=33.82571 Y=-82.40237 Z=91
479 X=24.82571 Y=-82.33987 Z=91
480 X=18.82571 Y=-82.33987 Z=91
481 X=18.82571 Y=-67.33987 Z=91
482 X=18.82571 Y=-52.33988 Z=91
483 X=18.82571 Y=-37.33988 Z=91
484 X=18.82571 Y=-22.33988 Z=91
485 X=18.82571 Y=-7.339878 Z=91
486 X=33.82571 Y=-7.339878 Z=91
487 X=33.82571 Y=-22.33988 Z=91
488 X=33.82571 Y=-37.34739 Z=91
489 X=33.82571 Y=-52.33988 Z=91
490 X=33.82571 Y=-56.33988 Z=91
491 X=33.82571 Y=-67.33987 Z=91
492 X=48.88821 Y=-73.33987 Z=91
493 X=48.82571 Y=-67.33987 Z=91
494 X=48.85696 Y=-52.33988 Z=91
495 X=63.82571 Y=-52.33988 Z=91
496 X=67.82571 Y=-52.33988 Z=91
497 X=78.82571 Y=-52.33988 Z=91
498 X=78.82571 Y=-67.37112 Z=91
499 X=63.82571 Y=-67.33987 Z=91
500 X=63.82571 Y=-37.33988 Z=91
501 X=63.82571 Y=-22.33988 Z=91
502 X=63.88821 Y=-18.33988 Z=91
503 X=63.82571 Y=-7.339878 Z=91
504 X=78.82571 Y=-7.339878 Z=91
505 X=78.82571 Y=-22.33988 Z=91
506 X=78.82571 Y=-37.33988 Z=91
507 X=84.82571 Y=-37.33988 Z=91
508 X=12.82571 Y=-37.33988 Z=91
509 X=29.82571 Y=-22.33988 Z=91
510 X=48.82571 Y=-22.33988 Z=91
511 X=48.82571 Y=-7.339878 Z=91
512 X=48.82571 Y=-1.339878 Z=91
513 X=3.825708 Y=7.660122 Z=104
514 X=3.825708 Y=-7.339878 Z=104
515 X=3.825708 Y=-13.33988 Z=104
516 X=3.825708 Y=-22.33988 Z=104
517 X=3.825708 Y=-37.33988 Z=104
518 X=3.825708 Y=-52.33988 Z=104
519 X=3.825708 Y=-61.33988 Z=104
520 X=3.825708 Y=-67.33987 Z=104
521 X=3.825708 Y=-82.33987 Z=104
522 X=18.82571 Y=7.660122 Z=104
523 X=24.82571 Y=7.660122 Z=104
524 X=33.82571 Y=7.660122 Z=104
525 X=48.82571 Y=7.660122 Z=104
526 X=63.82571 Y=7.660122 Z=104
527 X=72.82571 Y=7.660122 Z=104

528 X=78.82571 Y=7.660122
Z=104
529 X=93.82571 Y=7.722622
Z=104
530 X=93.82571 Y=-7.339878
Z=104
531 X=93.82571 Y=-13.33988
Z=104
532 X=93.88821 Y=-22.33988
Z=104
533 X=93.82571 Y=-37.33988
Z=104
534 X=93.88821 Y=-52.33988
Z=104
535 X=93.88821 Y=-61.33988
Z=104
536 X=93.82571 Y=-67.33987
Z=104
537 X=93.82571 Y=-82.33987
Z=104
538 X=78.82571 Y=-82.33987
Z=104
539 X=72.82571 Y=-82.27737
Z=104
540 X=63.88807 Y=-82.33987
Z=104
541 X=48.82571 Y=-82.33987
Z=104
542 X=33.82571 Y=-82.40237
Z=104
543 X=24.82571 Y=-82.33987
Z=104
544 X=18.82571 Y=-82.33987
Z=104
545 X=18.82571 Y=-67.33987
Z=104
546 X=18.82571 Y=-52.33988
Z=104
547 X=18.82571 Y=-37.33988
Z=104
548 X=18.82571 Y=-22.33988
Z=104
549 X=18.82571 Y=-7.339878
Z=104
550 X=33.82571 Y=-7.339878
Z=104
551 X=33.82571 Y=-22.33988
Z=104
552 X=33.82571 Y=-37.34739
Z=104
553 X=33.82571 Y=-52.33988
Z=104
554 X=33.82571 Y=-56.33988
Z=104
555 X=33.82571 Y=-67.33987
Z=104
556 X=48.88821 Y=-73.33987
Z=104
557 X=48.82571 Y=-67.33987
Z=104
558 X=48.85696 Y=-52.33988
Z=104
559 X=63.82571 Y=-52.33988
Z=104
560 X=67.82571 Y=-52.33988
Z=104
561 X=78.82571 Y=-52.33988
Z=104
562 X=78.82571 Y=-67.37112
Z=104
563 X=63.82571 Y=-67.33987
Z=104
564 X=63.82571 Y=-37.33988
Z=104
565 X=63.82571 Y=-22.33988
Z=104
566 X=63.88821 Y=-18.33988
Z=104
567 X=63.82571 Y=-7.339878
Z=104
568 X=78.82571 Y=-7.339878
Z=104
569 X=78.82571 Y=-22.33988
Z=104
570 X=78.82571 Y=-37.33988
Z=104
571 X=84.82571 Y=-37.33988
Z=104
572 X=12.82571 Y=-37.33988
Z=104
573 X=29.82571 Y=-22.33988
Z=104
574 X=48.82571 Y=-22.33988
Z=104
575 X=48.82571 Y=-7.339878
Z=104
576 X=48.82571 Y=-1.339878
Z=104
577 X=3.825708 Y=7.660122 Z=117
578 X=3.825708 Y=-7.339878
Z=117
579 X=3.825708 Y=-13.33988
Z=117
580 X=3.825708 Y=-22.33988
Z=117
581 X=3.825708 Y=-37.33988
Z=117
582 X=3.825708 Y=-52.33988
Z=117
583 X=3.825708 Y=-61.33988
Z=117
584 X=3.825708 Y=-67.33987
Z=117
585 X=3.825708 Y=-82.33987
Z=117
586 X=18.82571 Y=7.660122 Z=117
587 X=24.82571 Y=7.660122 Z=117
588 X=33.82571 Y=7.660122 Z=117
589 X=48.82571 Y=7.660122 Z=117
590 X=63.82571 Y=7.660122 Z=117
591 X=72.82571 Y=7.660122 Z=117
592 X=78.82571 Y=7.660122 Z=117
593 X=93.82571 Y=7.722622 Z=117
594 X=93.82571 Y=-7.339878
Z=117
595 X=93.82571 Y=-13.33988
Z=117
596 X=93.88821 Y=-22.33988
Z=117
597 X=93.82571 Y=-37.33988
Z=117
598 X=93.88821 Y=-52.33988
Z=117
599 X=93.88821 Y=-61.33988
Z=117
600 X=93.82571 Y=-67.33987
Z=117
601 X=93.82571 Y=-82.33987
Z=117
602 X=78.82571 Y=-82.33987
Z=117
603 X=72.82571 Y=-82.27737
Z=117
604 X=63.88807 Y=-82.33987
Z=117
605 X=48.82571 Y=-82.33987
Z=117
606 X=33.82571 Y=-82.40237
Z=117
607 X=24.82571 Y=-82.33987
Z=117
608 X=18.82571 Y=-82.33987
Z=117
609 X=18.82571 Y=-67.33987
Z=117
610 X=18.82571 Y=-52.33988
Z=117
611 X=18.82571 Y=-37.33988
Z=117
612 X=18.82571 Y=-22.33988
Z=117
613 X=18.82571 Y=-7.339878
Z=117
614 X=33.82571 Y=-7.339878
Z=117
615 X=33.82571 Y=-22.33988
Z=117
616 X=33.82571 Y=-37.34739
Z=117
617 X=33.82571 Y=-52.33988
Z=117
618 X=33.82571 Y=-56.33988
Z=117
619 X=33.82571 Y=-67.33987
Z=117
620 X=48.88821 Y=-73.33987
Z=117
621 X=48.82571 Y=-67.33987
Z=117
622 X=48.85696 Y=-52.33988
Z=117
623 X=63.82571 Y=-52.33988
Z=117
624 X=67.82571 Y=-52.33988
Z=117
625 X=78.82571 Y=-52.33988
Z=117
626 X=78.82571 Y=-67.37112
Z=117
627 X=63.82571 Y=-67.33987
Z=117
628 X=63.82571 Y=-37.33988
Z=117
629 X=63.82571 Y=-22.33988
Z=117
630 X=63.88821 Y=-18.33988
Z=117
631 X=63.82571 Y=-7.339878
Z=117
632 X=78.82571 Y=-7.339878
Z=117
633 X=78.82571 Y=-22.33988
Z=117
634 X=78.82571 Y=-37.33988
Z=117
635 X=84.82571 Y=-37.33988
Z=117
636 X=12.82571 Y=-37.33988
Z=117
637 X=29.82571 Y=-22.33988
Z=117
638 X=48.82571 Y=-22.33988
Z=117
639 X=48.82571 Y=-7.339878
Z=117
640 X=48.82571 Y=-1.339878
Z=117
641 X=3.825708 Y=7.660122 Z=130
642 X=3.825708 Y=-7.339878
Z=130
643 X=3.825708 Y=-13.33988
Z=130
644 X=3.825708 Y=-22.33988
Z=130
645 X=3.825708 Y=-37.33988
Z=130
646 X=3.825708 Y=-52.33988
Z=130
647 X=3.825708 Y=-61.33988
Z=130
648 X=3.825708 Y=-67.33987
Z=130
649 X=3.825708 Y=-82.33987
Z=130
650 X=18.82571 Y=7.660122 Z=130
651 X=24.82571 Y=7.660122 Z=130
652 X=33.82571 Y=7.660122 Z=130
653 X=48.82571 Y=7.660122 Z=130
654 X=63.82571 Y=7.660122 Z=130
655 X=72.82571 Y=7.660122 Z=130
656 X=78.82571 Y=7.660122 Z=130
657 X=93.82571 Y=7.722622 Z=130
658 X=93.82571 Y=-7.339878
Z=130
659 X=93.82571 Y=-13.33988
Z=130
660 X=93.88821 Y=-22.33988
Z=130
661 X=93.82571 Y=-37.33988
Z=130
662 X=93.88821 Y=-52.33988
Z=130
663 X=93.88821 Y=-61.33988
Z=130
664 X=93.82571 Y=-67.33987
Z=130
665 X=93.82571 Y=-82.33987
Z=130
666 X=78.82571 Y=-82.33987
Z=130
667 X=72.82571 Y=-82.27737
Z=130
668 X=63.88807 Y=-82.33987
Z=130
669 X=48.82571 Y=-82.33987
Z=130
670 X=33.82571 Y=-82.40237
Z=130
671 X=24.82571 Y=-82.33987
Z=130
672 X=18.82571 Y=-82.33987
Z=130
673 X=18.82571 Y=-67.33987
Z=130
674 X=18.82571 Y=-52.33988
Z=130
675 X=18.82571 Y=-37.33988
Z=130
676 X=18.82571 Y=-22.33988
Z=130
677 X=18.82571 Y=-7.339878
Z=130
678 X=33.82571 Y=-7.339878
Z=130
679 X=33.82571 Y=-22.33988
Z=130
680 X=33.82571 Y=-37.34739
Z=130
681 X=33.82571 Y=-52.33988
Z=130
682 X=33.82571 Y=-56.33988
Z=130
683 X=33.82571 Y=-67.33987
Z=130
684 X=48.88821 Y=-73.33987
Z=130
685 X=48.82571 Y=-67.33987
Z=130
686 X=48.85696 Y=-52.33988
Z=130
687 X=63.82571 Y=-52.33988
Z=130
688 X=67.82571 Y=-52.33988
Z=130
689 X=78.82571 Y=-52.33988
Z=130
690 X=78.82571 Y=-67.37112
Z=130
691 X=63.82571 Y=-67.33987
Z=130
692 X=63.82571 Y=-37.33988
Z=130
693 X=63.82571 Y=-22.33988
Z=130
694 X=63.88821 Y=-18.33988
Z=130
695 X=63.82571 Y=-7.339878
Z=130
696 X=78.82571 Y=-7.339878
Z=130
697 X=78.82571 Y=-22.33988
Z=130
698 X=78.82571 Y=-37.33988
Z=130
699 X=84.82571 Y=-37.33988
Z=130
700 X=12.82571 Y=-37.33988
Z=130
701 X=29.82571 Y=-22.33988
Z=130
702 X=48.82571 Y=-22.33988
Z=130
703 X=48.82571 Y=-7.339878
Z=130
704 X=48.82571 Y=-1.339878
Z=130

RESTRAINT
ADD=1
DOF=U1,U2,U3,R1,R2,R3
ADD=2
DOF=U1,U2,U3,R1,R2,R3
ADD=3
DOF=U1,U2,U3,R1,R2,R3
ADD=4
DOF=U1,U2,U3,R1,R2,R3
ADD=5
DOF=U1,U2,U3,R1,R2,R3
ADD=6
DOF=U1,U2,U3,R1,R2,R3
ADD=7
DOF=U1,U2,U3,R1,R2,R3
ADD=8
DOF=U1,U2,U3,R1,R2,R3
ADD=9
DOF=U1,U2,U3,R1,R2,R3
ADD=10
DOF=U1,U2,U3,R1,R2,R3
ADD=11
DOF=U1,U2,U3,R1,R2,R3
ADD=12
DOF=U1,U2,U3,R1,R2,R3

```
 ADD=13
DOF=U1,U2,U3,R1,R2,R3
 ADD=14
DOF=U1,U2,U3,R1,R2,R3
 ADD=15
DOF=U1,U2,U3,R1,R2,R3
 ADD=16
DOF=U1,U2,U3,R1,R2,R3
 ADD=17
DOF=U1,U2,U3,R1,R2,R3
 ADD=18
DOF=U1,U2,U3,R1,R2,R3
 ADD=19
DOF=U1,U2,U3,R1,R2,R3
 ADD=20
DOF=U1,U2,U3,R1,R2,R3
 ADD=21
DOF=U1,U2,U3,R1,R2,R3
 ADD=22
DOF=U1,U2,U3,R1,R2,R3
 ADD=23
DOF=U1,U2,U3,R1,R2,R3
 ADD=24
DOF=U1,U2,U3,R1,R2,R3
 ADD=25
DOF=U1,U2,U3,R1,R2,R3
 ADD=26
DOF=U1,U2,U3,R1,R2,R3
 ADD=27
DOF=U1,U2,U3,R1,R2,R3
 ADD=28
DOF=U1,U2,U3,R1,R2,R3
 ADD=29
DOF=U1,U2,U3,R1,R2,R3
 ADD=30
DOF=U1,U2,U3,R1,R2,R3
 ADD=31
DOF=U1,U2,U3,R1,R2,R3
 ADD=32
DOF=U1,U2,U3,R1,R2,R3
 ADD=33
DOF=U1,U2,U3,R1,R2,R3
 ADD=34
DOF=U1,U2,U3,R1,R2,R3
 ADD=35
DOF=U1,U2,U3,R1,R2,R3
 ADD=36
DOF=U1,U2,U3,R1,R2,R3
 ADD=37
DOF=U1,U2,U3,R1,R2,R3
 ADD=38
DOF=U1,U2,U3,R1,R2,R3
 ADD=39
DOF=U1,U2,U3,R1,R2,R3
 ADD=40
DOF=U1,U2,U3,R1,R2,R3
 ADD=41
DOF=U1,U2,U3,R1,R2,R3
 ADD=42
DOF=U1,U2,U3,R1,R2,R3
 ADD=43
DOF=U1,U2,U3,R1,R2,R3
 ADD=44
DOF=U1,U2,U3,R1,R2,R3
 ADD=45
DOF=U1,U2,U3,R1,R2,R3
 ADD=46
DOF=U1,U2,U3,R1,R2,R3
 ADD=47
DOF=U1,U2,U3,R1,R2,R3
 ADD=48
DOF=U1,U2,U3,R1,R2,R3
 ADD=49
DOF=U1,U2,U3,R1,R2,R3
 ADD=50
DOF=U1,U2,U3,R1,R2,R3
 ADD=51
DOF=U1,U2,U3,R1,R2,R3
 ADD=52
DOF=U1,U2,U3,R1,R2,R3
 ADD=53
DOF=U1,U2,U3,R1,R2,R3
 ADD=54
DOF=U1,U2,U3,R1,R2,R3
 ADD=55
DOF=U1,U2,U3,R1,R2,R3
 ADD=56
DOF=U1,U2,U3,R1,R2,R3
 ADD=57
DOF=U1,U2,U3,R1,R2,R3
 ADD=58 DOF=U1,U2,U3,R1,R2,R3
 ADD=59 DOF=U1,U2,U3,R1,R2,R3
 ADD=60 DOF=U1,U2,U3,R1,R2,R3
 ADD=61 DOF=U1,U2,U3,R1,R2,R3
 ADD=62 DOF=U1,U2,U3,R1,R2,R3
 ADD=63 DOF=U1,U2,U3,R1,R2,R3
 ADD=64 DOF=U1,U2,U3,R1,R2,R3

PATTERN
 NAME=DEFAULT

MATERIAL
 NAME=STEEL IDES=S
M=1.518708E-02 W=.489024
  T=0 E=4176000 U=.3 A=.0000065
FY=5184
 NAME=CONC IDES=C
M=4.658087E-03 W=.1499904
  T=0 E=518400 U=.2 A=.0000055
 NAME=OTHER IDES=N
  T=0 E=1000 U=.2 A=.0000055
 NAME=WOOD IDES=N M=.000918
W=.0294
  T=0 E=244800 U=.33 A=.0000065

FRAME SECTION
 NAME=BEAM MAT=WOOD SH=R
T=1.333,.667 A=.889111 J=9.050453E-
02 I=.1316543,3.296297E-02
AS=.7409258,.7409258
 NAME=12X14 MAT=WOOD SH=R
T=1,1.16667 A=1.16667 J=.188336
I=.0972225,.1323314
AS=.972225,.972225
 NAME=8X8 MAT=WOOD SH=R
T=.667,.667 A=.444889 J=2.787461E-
02 I=1.649385E-02,1.649385E-02
AS=.3707408,.3707408
 NAME=14X16 MAT=WOOD SH=R
T=1.3333,1.16667 A=1.555521
J=.3357012 I=.2304361,.1764374
AS=1.296268,1.296268
 NAME=14X14 MAT=WOOD SH=R
T=1.1667,1.1667 A=1.361189
J=.260941 I=.1544029,.1544029
AS=1.134324,1.134324

SHELL SECTION
 NAME=SSEC1 MAT=CONC
TYPE=Shell,Thin TH=1
 NAME=73SHRS MAT=WOOD
TYPE=Shell,Thick TH=.1608
 NAME=FLOORS MAT=WOOD
TYPE=Shell,Thick TH=.1
 NAME=96SHRS MAT=WOOD
TYPE=Shell,Thick TH=.18
 NAME=045SHRS MAT=WOOD
TYPE=Shell,Thick TH=.1375
 NAME=FACADE MAT=OTHER
TYPE=Shell,Thick TH=1

FRAME
 1 J=1,2 SEC=BEAM NSEG=4
ANG=0
 2 J=2,3 SEC=BEAM NSEG=4
ANG=0
 3 J=3,4 SEC=BEAM NSEG=4
ANG=0
 4 J=4,5 SEC=BEAM NSEG=4
ANG=0
 5 J=5,6 SEC=BEAM NSEG=4
ANG=0
 6 J=6,7 SEC=BEAM NSEG=4
ANG=0
 7 J=7,8 SEC=BEAM NSEG=4
ANG=0
 8 J=8,9 SEC=BEAM NSEG=4
ANG=0
 9 J=1,10 SEC=BEAM NSEG=4
ANG=0
 10 J=10,11 SEC=BEAM NSEG=4
ANG=0
 11 J=11,12 SEC=BEAM NSEG=4
ANG=0
 12 J=12,13 SEC=BEAM NSEG=4
ANG=0
 13 J=13,14 SEC=BEAM NSEG=4
ANG=0
 14 J=14,15 SEC=BEAM NSEG=4
ANG=0
 15 J=15,16 SEC=BEAM NSEG=4
ANG=0
 16 J=17,18 SEC=BEAM NSEG=4
ANG=0
 17 J=16,17 SEC=BEAM NSEG=4
ANG=0
 18 J=18,19 SEC=BEAM NSEG=4
ANG=0
 19 J=19,20 SEC=BEAM NSEG=4
ANG=0
 20 J=20,21 SEC=BEAM NSEG=4
ANG=0
 21 J=21,22 SEC=BEAM NSEG=4
ANG=0
 22 J=22,23 SEC=BEAM NSEG=4
ANG=0
 23 J=23,24 SEC=BEAM NSEG=4
ANG=0
 24 J=24,25 SEC=BEAM NSEG=4
ANG=0
 25 J=25,26 SEC=BEAM NSEG=4
ANG=0
 26 J=26,27 SEC=BEAM NSEG=4
ANG=0
 27 J=27,28 SEC=BEAM NSEG=4
ANG=0
 28 J=28,29 SEC=BEAM NSEG=4
ANG=0
 29 J=29,30 SEC=BEAM NSEG=4
ANG=0
 30 J=30,31 SEC=BEAM NSEG=4
ANG=0
 31 J=31,32 SEC=BEAM NSEG=4
ANG=0
 32 J=32,9 SEC=BEAM NSEG=4
ANG=0
 33 J=32,33 SEC=BEAM NSEG=4
ANG=0
 34 J=33,34 SEC=BEAM NSEG=4
ANG=0
 35 J=34,35 SEC=BEAM NSEG=4
ANG=0
 36 J=35,36 SEC=BEAM NSEG=4
ANG=0
 37 J=36,37 SEC=BEAM NSEG=4
ANG=0
 38 J=37,10 SEC=BEAM NSEG=4
ANG=0
 39 J=12,38 SEC=BEAM NSEG=4
ANG=0
 40 J=38,39 SEC=BEAM NSEG=4
ANG=0
 41 J=39,40 SEC=BEAM NSEG=4
ANG=0
 42 J=40,41 SEC=BEAM NSEG=4
ANG=0
 43 J=41,42 SEC=BEAM NSEG=4
ANG=0
 44 J=42,43 SEC=BEAM NSEG=4
ANG=0
 45 J=43,30 SEC=BEAM NSEG=4
ANG=0
 46 J=29,44 SEC=BEAM NSEG=4
ANG=0
 47 J=44,45 SEC=BEAM NSEG=4
ANG=0
 48 J=45,46 SEC=BEAM NSEG=4
ANG=0
 49 J=46,47 SEC=BEAM NSEG=4
ANG=0
 50 J=48,49 SEC=BEAM NSEG=4
ANG=0
 51 J=49,22 SEC=BEAM NSEG=4
ANG=0
 52 J=24,50 SEC=BEAM NSEG=4
ANG=0
 53 J=50,51 SEC=BEAM NSEG=4
ANG=0
 54 J=51,45 SEC=BEAM NSEG=4
ANG=0
 55 J=28,51 SEC=BEAM NSEG=4
ANG=0
 56 J=51,47 SEC=BEAM NSEG=4
ANG=0
 57 J=47,52 SEC=BEAM NSEG=4
ANG=0
 58 J=52,53 SEC=BEAM NSEG=4
ANG=0
 59 J=53,54 SEC=BEAM NSEG=4
ANG=0
 60 J=54,55 SEC=BEAM
NSEG=4 ANG=0
 61 J=55,14 SEC=BEAM
NSEG=4 ANG=0
 62 J=16,56 SEC=BEAM
NSEG=4 ANG=0
 63 J=56,57 SEC=BEAM
NSEG=4 ANG=0
 64 J=57,58 SEC=BEAM
NSEG=4 ANG=0
 65 J=58,49 SEC=BEAM
NSEG=4 ANG=0
 66 J=49,50 SEC=BEAM
NSEG=4 ANG=0
 67 J=50,26 SEC=BEAM
NSEG=4 ANG=0
 68 J=21,59 SEC=BEAM
NSEG=4 ANG=0
 69 J=59,58 SEC=BEAM
NSEG=4 ANG=0
 70 J=58,52 SEC=BEAM
NSEG=4 ANG=0
 71 J=45,43 SEC=BEAM
NSEG=4 ANG=0
 72 J=43,33 SEC=BEAM
NSEG=4 ANG=0
 73 J=33,8 SEC=BEAM
NSEG=4 ANG=0
 74 J=6,34 SEC=BEAM
NSEG=4 ANG=0
 75 J=34,41 SEC=BEAM
NSEG=4 ANG=0
 76 J=5,60 SEC=BEAM
NSEG=4 ANG=0
 77 J=60,35 SEC=BEAM
NSEG=4 ANG=0
 78 J=35,40 SEC=BEAM
NSEG=4 ANG=0
 79 J=4,36 SEC=BEAM
NSEG=4 ANG=0
 80 J=36,61 SEC=BEAM
NSEG=4 ANG=0
 81 J=61,39 SEC=BEAM
NSEG=4 ANG=0
 82 J=39,62 SEC=BEAM
NSEG=4 ANG=0
 83 J=62,53 SEC=BEAM
NSEG=4 ANG=0
 84 J=53,57 SEC=BEAM
NSEG=4 ANG=0
 85 J=57,20 SEC=BEAM
NSEG=4 ANG=0
 86 J=41,46 SEC=BEAM
NSEG=4 ANG=0
 87 J=2,37 SEC=BEAM
NSEG=4 ANG=0
 88 J=37,38 SEC=BEAM
NSEG=4 ANG=0
 89 J=38,63 SEC=BEAM
NSEG=4 ANG=0
 90 J=63,55 SEC=BEAM
NSEG=4 ANG=0
 91 J=55,56 SEC=BEAM
NSEG=4 ANG=0
 92 J=56,18 SEC=BEAM
NSEG=4 ANG=0
 93 J=13,64 SEC=BEAM
NSEG=4 ANG=0
 94 J=63,62 SEC=BEAM
NSEG=4 ANG=0
 95 J=64,63 SEC=BEAM
NSEG=4 ANG=0
 96 J=47,48 SEC=BEAM
NSEG=4 ANG=0
 97 J=65,66 SEC=BEAM
NSEG=4 ANG=0
 98 J=66,67 SEC=BEAM
NSEG=4 ANG=0
 99 J=67,68 SEC=BEAM
NSEG=4 ANG=0
 100 J=68,69 SEC=BEAM
NSEG=4 ANG=0
 101 J=69,70 SEC=BEAM
NSEG=4 ANG=0
 102 J=70,71 SEC=BEAM
NSEG=4 ANG=0
 103 J=71,72 SEC=BEAM
NSEG=4 ANG=0
 104 J=72,73 SEC=BEAM
NSEG=4 ANG=0
```

105 J=65,74 SEC=BEAM
NSEG=4 ANG=0
106 J=74,75 SEC=BEAM
NSEG=4 ANG=0
107 J=75,76 SEC=BEAM
NSEG=4 ANG=0
108 J=76,77 SEC=BEAM
NSEG=4 ANG=0
109 J=77,78 SEC=BEAM
NSEG=4 ANG=0
110 J=78,79 SEC=BEAM
NSEG=4 ANG=0
111 J=79,80 SEC=BEAM
NSEG=4 ANG=0
112 J=81,82 SEC=BEAM
NSEG=4 ANG=0
113 J=80,81 SEC=BEAM
NSEG=4 ANG=0
114 J=82,83 SEC=BEAM
NSEG=4 ANG=0
115 J=83,84 SEC=BEAM
NSEG=4 ANG=0
116 J=84,85 SEC=BEAM
NSEG=4 ANG=0
117 J=85,86 SEC=BEAM
NSEG=4 ANG=0
118 J=86,87 SEC=BEAM
NSEG=4 ANG=0
119 J=87,88 SEC=BEAM
NSEG=4 ANG=0
120 J=88,89 SEC=BEAM
NSEG=4 ANG=0
121 J=89,90 SEC=BEAM
NSEG=4 ANG=0
122 J=90,91 SEC=BEAM
NSEG=4 ANG=0
123 J=91,92 SEC=BEAM
NSEG=4 ANG=0
124 J=92,93 SEC=BEAM
NSEG=4 ANG=0
125 J=93,94 SEC=BEAM
NSEG=4 ANG=0
126 J=94,95 SEC=BEAM
NSEG=4 ANG=0
127 J=95,96 SEC=BEAM
NSEG=4 ANG=0
128 J=96,73 SEC=BEAM
NSEG=4 ANG=0
129 J=96,97 SEC=BEAM
NSEG=4 ANG=0
130 J=97,98 SEC=BEAM
NSEG=4 ANG=0
131 J=98,99 SEC=BEAM
NSEG=4 ANG=0
132 J=99,100 SEC=BEAM
NSEG=4 ANG=0
133 J=100,101 SEC=BEAM
NSEG=4 ANG=0
134 J=101,74 SEC=BEAM
NSEG=4 ANG=0
135 J=76,102 SEC=BEAM
NSEG=4 ANG=0
136 J=102,103 SEC=BEAM
NSEG=4 ANG=0
137 J=103,104 SEC=BEAM
NSEG=4 ANG=0
138 J=104,105 SEC=BEAM
NSEG=4 ANG=0
139 J=105,106 SEC=BEAM
NSEG=4 ANG=0
140 J=106,107 SEC=BEAM
NSEG=4 ANG=0
141 J=107,94 SEC=BEAM
NSEG=4 ANG=0
142 J=93,108 SEC=BEAM
NSEG=4 ANG=0
143 J=108,109 SEC=BEAM
NSEG=4 ANG=0
144 J=109,110 SEC=BEAM
NSEG=4 ANG=0
145 J=110,111 SEC=BEAM
NSEG=4 ANG=0
146 J=112,113 SEC=BEAM
NSEG=4 ANG=0
147 J=113,86 SEC=BEAM
NSEG=4 ANG=0
148 J=88,114 SEC=BEAM
NSEG=4 ANG=0
149 J=114,115 SEC=BEAM
NSEG=4 ANG=0
150 J=115,109 SEC=BEAM
NSEG=4 ANG=0
151 J=92,115 SEC=BEAM NSEG=4
ANG=0
152 J=115,111 SEC=BEAM
NSEG=4 ANG=0
153 J=111,116 SEC=BEAM
NSEG=4 ANG=0
154 J=116,117 SEC=BEAM
NSEG=4 ANG=0
155 J=117,118 SEC=BEAM
NSEG=4 ANG=0
156 J=118,119 SEC=BEAM
NSEG=4 ANG=0
157 J=119,78 SEC=BEAM NSEG=4
ANG=0
158 J=80,120 SEC=BEAM NSEG=4
ANG=0
159 J=120,121 SEC=BEAM
NSEG=4 ANG=0
160 J=121,122 SEC=BEAM
NSEG=4 ANG=0
161 J=122,113 SEC=BEAM
NSEG=4 ANG=0
162 J=113,114 SEC=BEAM
NSEG=4 ANG=0
163 J=114,90 SEC=BEAM NSEG=4
ANG=0
164 J=85,123 SEC=BEAM NSEG=4
ANG=0
165 J=123,122 SEC=BEAM
NSEG=4 ANG=0
166 J=122,116 SEC=BEAM
NSEG=4 ANG=0
167 J=109,107 SEC=BEAM
NSEG=4 ANG=0
168 J=107,97 SEC=BEAM NSEG=4
ANG=0
169 J=97,72 SEC=BEAM NSEG=4
ANG=0
170 J=70,98 SEC=BEAM NSEG=4
ANG=0
171 J=98,105 SEC=BEAM NSEG=4
ANG=0
172 J=69,124 SEC=BEAM NSEG=4
ANG=0
173 J=124,99 SEC=BEAM NSEG=4
ANG=0
174 J=99,104 SEC=BEAM NSEG=4
ANG=0
175 J=68,100 SEC=BEAM NSEG=4
ANG=0
176 J=100,125 SEC=BEAM
NSEG=4 ANG=0
177 J=125,103 SEC=BEAM
NSEG=4 ANG=0
178 J=103,126 SEC=BEAM
NSEG=4 ANG=0
179 J=126,117 SEC=BEAM
NSEG=4 ANG=0
180 J=117,121 SEC=BEAM
NSEG=4 ANG=0
181 J=121,84 SEC=BEAM NSEG=4
ANG=0
182 J=105,110 SEC=BEAM
NSEG=4 ANG=0
183 J=66,101 SEC=BEAM NSEG=4
ANG=0
184 J=101,102 SEC=BEAM
NSEG=4 ANG=0
185 J=102,127 SEC=BEAM
NSEG=4 ANG=0
186 J=127,119 SEC=BEAM
NSEG=4 ANG=0
187 J=119,120 SEC=BEAM
NSEG=4 ANG=0
188 J=120,82 SEC=BEAM NSEG=4
ANG=0
189 J=77,128 SEC=BEAM NSEG=4
ANG=0
190 J=127,126 SEC=BEAM
NSEG=4 ANG=0
191 J=128,127 SEC=BEAM
NSEG=4 ANG=0
192 J=111,112 SEC=BEAM
NSEG=4 ANG=0
193 J=65,1 SEC=12X14 NSEG=2
ANG=0
194 J=66,2 SEC=8X8 NSEG=2
ANG=0
195 J=67,3 SEC=8X8 NSEG=2
ANG=0
196 J=68,4 SEC=12X14 NSEG=2
ANG=0
197 J=10,74 SEC=8X8 NSEG=2
ANG=0
198 J=75,11 SEC=8X8 NSEG=2
ANG=0
199 J=101,37 SEC=12X14 NSEG=2
ANG=0
200 J=76,12 SEC=12X14 NSEG=2
ANG=0
201 J=100,36 SEC=14X14 NSEG=2
ANG=0
202 J=69,5 SEC=12X14 NSEG=2
ANG=0
203 J=124,60 SEC=8X8 NSEG=2
ANG=0
204 J=99,35 SEC=14X16 NSEG=2
ANG=0
205 J=125,61 SEC=14X16 NSEG=2
ANG=0
206 J=103,39 SEC=14X16 NSEG=2
ANG=0
207 J=77,13 SEC=12X14 NSEG=2
ANG=0
208 J=102,38 SEC=12X14 NSEG=2
ANG=0
209 J=128,64 SEC=8X8 NSEG=2
ANG=0
210 J=14,78 SEC=12X14 NSEG=2
ANG=0
211 J=79,15 SEC=8X8 NSEG=2
ANG=0
212 J=80,16 SEC=8X8 NSEG=2
ANG=0
213 J=81,17 SEC=12X14 NSEG=2
ANG=0
214 J=127,63 SEC=14X16 NSEG=2
ANG=0
215 J=119,55 SEC=14X14 NSEG=2
ANG=0
216 J=120,56 SEC=12X14 NSEG=2
ANG=0
217 J=82,18 SEC=8X8 NSEG=2
ANG=0
218 J=118,54 SEC=14X16 NSEG=2
ANG=0
219 J=117,53 SEC=14X16 NSEG=2
ANG=0
220 J=121,57 SEC=12X14 NSEG=2
ANG=0
221 J=83,19 SEC=8X8 NSEG=2
ANG=0
222 J=84,20 SEC=12X14 NSEG=2
ANG=0
223 J=126,62 SEC=14X16 NSEG=2
ANG=0
224 J=104,40 SEC=14X16 NSEG=2
ANG=0
225 J=70,6 SEC=12X14 NSEG=2
ANG=0
226 J=71,7 SEC=8X8 NSEG=2
ANG=0
227 J=72,8 SEC=8X8 NSEG=2
ANG=0
228 J=73,9 SEC=12X14 NSEG=2
ANG=0
229 J=96,32 SEC=8X8 NSEG=2
ANG=0
230 J=31,95 SEC=8X8 NSEG=2
ANG=0
231 J=33,97 SEC=12X14 NSEG=2
ANG=0
232 J=34,98 SEC=12X14 NSEG=2
ANG=0
233 J=105,41 SEC=14X16 NSEG=2
ANG=0
234 J=106,42 SEC=14X16 NSEG=2
ANG=0
235 J=107,43 SEC=14X14 NSEG=2
ANG=0
236 J=110,46 SEC=14X16 NSEG=2
ANG=0
237 J=116,52 SEC=14X16 NSEG=2
ANG=0
238 J=30,94 SEC=12X14 NSEG=2
ANG=0
239 J=29,93 SEC=12X14 NSEG=2
ANG=0
240 J=21,85 SEC=12X14
NSEG=2 ANG=0
241 J=59,123 SEC=8X8
NSEG=2 ANG=0
242 J=58,122 SEC=14X16
NSEG=2 ANG=0
243 J=86,22 SEC=12X14
NSEG=2 ANG=0
244 J=87,23 SEC=8X8
NSEG=2 ANG=0
245 J=88,24 SEC=8X8
NSEG=2 ANG=0
246 J=89,25 SEC=12X14
NSEG=2 ANG=0
247 J=90,26 SEC=8X8
NSEG=2 ANG=0
248 J=91,27 SEC=8X8
NSEG=2 ANG=0
249 J=92,28 SEC=12X14
NSEG=2 ANG=0
250 J=114,50 SEC=12X14
NSEG=2 ANG=0
251 J=111,47 SEC=14X16
NSEG=2 ANG=0
252 J=112,48 SEC=14X16
NSEG=2 ANG=0
253 J=113,49 SEC=14X14
NSEG=2 ANG=0
254 J=109,45 SEC=14X16
NSEG=2 ANG=0
255 J=108,44 SEC=8X8
NSEG=2 ANG=0
256 J=115,51 SEC=12X14
NSEG=2 ANG=0
257 J=129,130 SEC=BEAM
NSEG=4 ANG=0
258 J=130,131 SEC=BEAM
NSEG=4 ANG=0
259 J=131,132 SEC=BEAM
NSEG=4 ANG=0
260 J=132,133 SEC=BEAM
NSEG=4 ANG=0
261 J=133,134 SEC=BEAM
NSEG=4 ANG=0
262 J=134,135 SEC=BEAM
NSEG=4 ANG=0
263 J=135,136 SEC=BEAM
NSEG=4 ANG=0
264 J=136,137 SEC=BEAM
NSEG=4 ANG=0
265 J=129,138 SEC=BEAM
NSEG=4 ANG=0
266 J=138,139 SEC=BEAM
NSEG=4 ANG=0
267 J=139,140 SEC=BEAM
NSEG=4 ANG=0
268 J=140,141 SEC=BEAM
NSEG=4 ANG=0
269 J=141,142 SEC=BEAM
NSEG=4 ANG=0
270 J=142,143 SEC=BEAM
NSEG=4 ANG=0
271 J=143,144 SEC=BEAM
NSEG=4 ANG=0
272 J=145,146 SEC=BEAM
NSEG=4 ANG=0
273 J=144,145 SEC=BEAM
NSEG=4 ANG=0
274 J=146,147 SEC=BEAM
NSEG=4 ANG=0
275 J=147,148 SEC=BEAM
NSEG=4 ANG=0
276 J=148,149 SEC=BEAM
NSEG=4 ANG=0
277 J=149,150 SEC=BEAM
NSEG=4 ANG=0
278 J=150,151 SEC=BEAM
NSEG=4 ANG=0
279 J=151,152 SEC=BEAM
NSEG=4 ANG=0
280 J=152,153 SEC=BEAM
NSEG=4 ANG=0
281 J=153,154 SEC=BEAM
NSEG=4 ANG=0
282 J=154,155 SEC=BEAM
NSEG=4 ANG=0
283 J=155,156 SEC=BEAM
NSEG=4 ANG=0
284 J=156,157 SEC=BEAM
NSEG=4 ANG=0

```
285 J=157,158 SEC=BEAM
NSEG=4 ANG=0
286 J=158,159 SEC=BEAM
NSEG=4 ANG=0
287 J=159,160 SEC=BEAM
NSEG=4 ANG=0
288 J=160,137 SEC=BEAM
NSEG=4 ANG=0
289 J=160,161 SEC=BEAM
NSEG=4 ANG=0
290 J=161,162 SEC=BEAM
NSEG=4 ANG=0
291 J=162,163 SEC=BEAM
NSEG=4 ANG=0
292 J=163,164 SEC=BEAM
NSEG=4 ANG=0
293 J=164,165 SEC=BEAM
NSEG=4 ANG=0
294 J=165,138 SEC=BEAM
NSEG=4 ANG=0
295 J=140,166 SEC=BEAM
NSEG=4 ANG=0
296 J=166,167 SEC=BEAM
NSEG=4 ANG=0
297 J=167,168 SEC=BEAM
NSEG=4 ANG=0
298 J=168,169 SEC=BEAM
NSEG=4 ANG=0
299 J=169,170 SEC=BEAM
NSEG=4 ANG=0
300 J=170,171 SEC=BEAM
NSEG=4 ANG=0
301 J=171,158 SEC=BEAM
NSEG=4 ANG=0
302 J=157,172 SEC=BEAM
NSEG=4 ANG=0
303 J=172,173 SEC=BEAM
NSEG=4 ANG=0
304 J=173,174 SEC=BEAM
NSEG=4 ANG=0
305 J=174,175 SEC=BEAM
NSEG=4 ANG=0
306 J=176,177 SEC=BEAM
NSEG=4 ANG=0
307 J=177,150 SEC=BEAM
NSEG=4 ANG=0
308 J=152,178 SEC=BEAM
NSEG=4 ANG=0
309 J=178,179 SEC=BEAM
NSEG=4 ANG=0
310 J=179,173 SEC=BEAM
NSEG=4 ANG=0
311 J=156,179 SEC=BEAM
NSEG=4 ANG=0
312 J=179,175 SEC=BEAM
NSEG=4 ANG=0
313 J=175,180 SEC=BEAM
NSEG=4 ANG=0
314 J=180,181 SEC=BEAM
NSEG=4 ANG=0
315 J=181,182 SEC=BEAM
NSEG=4 ANG=0
316 J=182,183 SEC=BEAM
NSEG=4 ANG=0
317 J=183,142 SEC=BEAM
NSEG=4 ANG=0
318 J=144,184 SEC=BEAM
NSEG=4 ANG=0
319 J=184,185 SEC=BEAM
NSEG=4 ANG=0
320 J=185,186 SEC=BEAM
NSEG=4 ANG=0
321 J=186,177 SEC=BEAM
NSEG=4 ANG=0
322 J=177,178 SEC=BEAM
NSEG=4 ANG=0
323 J=178,154 SEC=BEAM
NSEG=4 ANG=0
324 J=149,187 SEC=BEAM
NSEG=4 ANG=0
325 J=187,186 SEC=BEAM
NSEG=4 ANG=0
326 J=186,180 SEC=BEAM
NSEG=4 ANG=0
327 J=173,171 SEC=BEAM
NSEG=4 ANG=0
328 J=171,161 SEC=BEAM
NSEG=4 ANG=0
329 J=161,136 SEC=BEAM
NSEG=4 ANG=0
330 J=134,162 SEC=BEAM
NSEG=4 ANG=0
331 J=162,169 SEC=BEAM
NSEG=4 ANG=0
332 J=133,188 SEC=BEAM
NSEG=4 ANG=0
333 J=188,163 SEC=BEAM
NSEG=4 ANG=0
334 J=163,168 SEC=BEAM
NSEG=4 ANG=0
335 J=132,164 SEC=BEAM
NSEG=4 ANG=0
336 J=164,189 SEC=BEAM
NSEG=4 ANG=0
337 J=189,167 SEC=BEAM
NSEG=4 ANG=0
338 J=167,190 SEC=BEAM
NSEG=4 ANG=0
339 J=190,181 SEC=BEAM
NSEG=4 ANG=0
340 J=181,185 SEC=BEAM
NSEG=4 ANG=0
341 J=185,148 SEC=BEAM
NSEG=4 ANG=0
342 J=169,174 SEC=BEAM
NSEG=4 ANG=0
343 J=130,165 SEC=BEAM
NSEG=4 ANG=0
344 J=165,166 SEC=BEAM
NSEG=4 ANG=0
345 J=166,191 SEC=BEAM
NSEG=4 ANG=0
346 J=191,183 SEC=BEAM
NSEG=4 ANG=0
347 J=183,184 SEC=BEAM
NSEG=4 ANG=0
348 J=184,146 SEC=BEAM
NSEG=4 ANG=0
349 J=141,192 SEC=BEAM
NSEG=4 ANG=0
350 J=191,190 SEC=BEAM
NSEG=4 ANG=0
351 J=192,191 SEC=BEAM
NSEG=4 ANG=0
352 J=175,176 SEC=BEAM
NSEG=4 ANG=0
353 J=129,65 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
354 J=130,66 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
355 J=131,67 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
356 J=132,68 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
357 J=74,138 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
358 J=139,75 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
359 J=165,101 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
360 J=140,76 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
361 J=164,100 SEC=14X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
362 J=133,69 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
363 J=188,124 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
364 J=163,99 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
365 J=189,125 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
366 J=167,103 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
367 J=141,77 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
368 J=166,102 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
369 J=192,128 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
370 J=78,142 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
371 J=143,79 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
372 J=144,80 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
373 J=145,81 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
374 J=191,127 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
375 J=183,119 SEC=14X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
376 J=184,120 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
377 J=146,82 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
378 J=182,118 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
379 J=181,117 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
380 J=185,121 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
381 J=147,83 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
382 J=148,84 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
383 J=190,126 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
384 J=168,104 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
385 J=134,70 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
386 J=135,71 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
387 J=136,72 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
388 J=137,73 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
389 J=160,96 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
390 J=95,159 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
391 J=97,161 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
392 J=98,162 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
393 J=169,105 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
394 J=170,106 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
395 J=171,107 SEC=14X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
396 J=174,110 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
397 J=180,116 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
398 J=94,158 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
399 J=93,157 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
400 J=85,149 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
401 J=123,187 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
402 J=122,186 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
403 J=150,86 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
404 J=151,87 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
405 J=152,88 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
406 J=153,89 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
407 J=154,90 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
408 J=155,91 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
409 J=156,92 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
410 J=178,114 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
411 J=175,111 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
412 J=176,112 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
413 J=177,113 SEC=14X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
414 J=173,109 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
415 J=172,108 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
416 J=179,115 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
417 J=193,194 SEC=BEAM
NSEG=4 ANG=0
418 J=194,195 SEC=BEAM
NSEG=4 ANG=0
419 J=195,196 SEC=BEAM
NSEG=4 ANG=0
420 J=196,197 SEC=BEAM
NSEG=4 ANG=0
421 J=197,198 SEC=BEAM
NSEG=4 ANG=0
422 J=198,199 SEC=BEAM
NSEG=4 ANG=0
423 J=199,200 SEC=BEAM
NSEG=4 ANG=0
424 J=200,201 SEC=BEAM
NSEG=4 ANG=0
425 J=193,202 SEC=BEAM
NSEG=4 ANG=0
426 J=202,203 SEC=BEAM
NSEG=4 ANG=0
427 J=203,204 SEC=BEAM
NSEG=4 ANG=0
428 J=204,205 SEC=BEAM
NSEG=4 ANG=0
429 J=205,206 SEC=BEAM
NSEG=4 ANG=0
430 J=206,207 SEC=BEAM
NSEG=4 ANG=0
431 J=207,208 SEC=BEAM
NSEG=4 ANG=0
432 J=209,210 SEC=BEAM
NSEG=4 ANG=0
433 J=208,209 SEC=BEAM
NSEG=4 ANG=0
434 J=210,211 SEC=BEAM
NSEG=4 ANG=0
435 J=211,212 SEC=BEAM
NSEG=4 ANG=0
436 J=212,213 SEC=BEAM
NSEG=4 ANG=0
437 J=213,214 SEC=BEAM
NSEG=4 ANG=0
438 J=214,215 SEC=BEAM
NSEG=4 ANG=0
439 J=215,216 SEC=BEAM
NSEG=4 ANG=0
440 J=216,217 SEC=BEAM
NSEG=4 ANG=0
441 J=217,218 SEC=BEAM
NSEG=4 ANG=0
442 J=218,219 SEC=BEAM
NSEG=4 ANG=0
443 J=219,220 SEC=BEAM
NSEG=4 ANG=0
444 J=220,221 SEC=BEAM
NSEG=4 ANG=0
445 J=221,222 SEC=BEAM
NSEG=4 ANG=0
446 J=222,223 SEC=BEAM
NSEG=4 ANG=0
447 J=223,224 SEC=BEAM
NSEG=4 ANG=0
448 J=224,201 SEC=BEAM
NSEG=4 ANG=0
449 J=224,225 SEC=BEAM
NSEG=4 ANG=0
450 J=225,226 SEC=BEAM
NSEG=4 ANG=0
451 J=226,227 SEC=BEAM
NSEG=4 ANG=0
452 J=227,228 SEC=BEAM
NSEG=4 ANG=0
453 J=228,229 SEC=BEAM
NSEG=4 ANG=0
454 J=229,202 SEC=BEAM
NSEG=4 ANG=0
455 J=204,230 SEC=BEAM
NSEG=4 ANG=0
456 J=230,231 SEC=BEAM
NSEG=4 ANG=0
457 J=231,232 SEC=BEAM
NSEG=4 ANG=0
458 J=232,233 SEC=BEAM
NSEG=4 ANG=0
459 J=233,234 SEC=BEAM
NSEG=4 ANG=0
460 J=234,235 SEC=BEAM
NSEG=4 ANG=0
461 J=235,222 SEC=BEAM
NSEG=4 ANG=0
462 J=221,236 SEC=BEAM
NSEG=4 ANG=0
463 J=236,237 SEC=BEAM
NSEG=4 ANG=0
464 J=237,238 SEC=BEAM
NSEG=4 ANG=0
```

465 J=238,239 SEC=BEAM NSEG=4 ANG=0
466 J=240,241 SEC=BEAM NSEG=4 ANG=0
467 J=241,214 SEC=BEAM NSEG=4 ANG=0
468 J=216,242 SEC=BEAM NSEG=4 ANG=0
469 J=242,243 SEC=BEAM NSEG=4 ANG=0
470 J=243,237 SEC=BEAM NSEG=4 ANG=0
471 J=220,243 SEC=BEAM NSEG=4 ANG=0
472 J=243,239 SEC=BEAM NSEG=4 ANG=0
473 J=239,244 SEC=BEAM NSEG=4 ANG=0
474 J=244,245 SEC=BEAM NSEG=4 ANG=0
475 J=245,246 SEC=BEAM NSEG=4 ANG=0
476 J=246,247 SEC=BEAM NSEG=4 ANG=0
477 J=247,206 SEC=BEAM NSEG=4 ANG=0
478 J=208,248 SEC=BEAM NSEG=4 ANG=0
479 J=248,249 SEC=BEAM NSEG=4 ANG=0
480 J=249,250 SEC=BEAM NSEG=4 ANG=0
481 J=250,241 SEC=BEAM NSEG=4 ANG=0
482 J=241,242 SEC=BEAM NSEG=4 ANG=0
483 J=242,218 SEC=BEAM NSEG=4 ANG=0
484 J=213,251 SEC=BEAM NSEG=4 ANG=0
485 J=251,250 SEC=BEAM NSEG=4 ANG=0
486 J=250,244 SEC=BEAM NSEG=4 ANG=0
487 J=237,235 SEC=BEAM NSEG=4 ANG=0
488 J=235,225 SEC=BEAM NSEG=4 ANG=0
489 J=225,200 SEC=BEAM NSEG=4 ANG=0
490 J=198,226 SEC=BEAM NSEG=4 ANG=0
491 J=226,233 SEC=BEAM NSEG=4 ANG=0
492 J=197,252 SEC=BEAM NSEG=4 ANG=0
493 J=252,227 SEC=BEAM NSEG=4 ANG=0
494 J=227,232 SEC=BEAM NSEG=4 ANG=0
495 J=196,228 SEC=BEAM NSEG=4 ANG=0
496 J=228,253 SEC=BEAM NSEG=4 ANG=0
497 J=253,231 SEC=BEAM NSEG=4 ANG=0
498 J=231,254 SEC=BEAM NSEG=4 ANG=0
499 J=254,245 SEC=BEAM NSEG=4 ANG=0
500 J=245,249 SEC=BEAM NSEG=4 ANG=0
501 J=249,212 SEC=BEAM NSEG=4 ANG=0
502 J=233,238 SEC=BEAM NSEG=4 ANG=0
503 J=194,229 SEC=BEAM NSEG=4 ANG=0
504 J=229,230 SEC=BEAM NSEG=4 ANG=0
505 J=230,255 SEC=BEAM NSEG=4 ANG=0
506 J=255,247 SEC=BEAM NSEG=4 ANG=0
507 J=247,248 SEC=BEAM NSEG=4 ANG=0
508 J=248,210 SEC=BEAM NSEG=4 ANG=0
509 J=205,256 SEC=BEAM NSEG=4 ANG=0
510 J=255,254 SEC=BEAM NSEG=4 ANG=0
511 J=256,255 SEC=BEAM NSEG=4 ANG=0
512 J=239,240 SEC=BEAM NSEG=4 ANG=0
513 J=193,129 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
514 J=194,130 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
515 J=195,131 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
516 J=196,132 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
517 J=138,202 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
518 J=203,139 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
519 J=229,165 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
520 J=204,140 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
521 J=228,164 SEC=14X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
522 J=197,133 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
523 J=252,188 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
524 J=227,163 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
525 J=253,189 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
526 J=231,167 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
527 J=205,141 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
528 J=230,166 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
529 J=256,192 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
530 J=142,206 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
531 J=207,143 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
532 J=208,144 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
533 J=209,145 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
534 J=255,191 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
535 J=247,183 SEC=14X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
536 J=248,184 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
537 J=210,146 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
538 J=246,182 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
539 J=245,181 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
540 J=249,185 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
541 J=211,147 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
542 J=212,148 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
543 J=254,190 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
544 J=232,168 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
545 J=198,134 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
546 J=199,135 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
547 J=200,136 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
548 J=201,137 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
549 J=224,160 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
550 J=159,223 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
551 J=161,225 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
552 J=162,226 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
553 J=233,169 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
554 J=234,170 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
555 J=235,171 SEC=14X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
556 J=238,174 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
557 J=244,180 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
558 J=158,222 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
559 J=157,221 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
560 J=149,213 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
561 J=187,251 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
562 J=186,250 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
563 J=214,150 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
564 J=215,151 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
565 J=216,152 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
566 J=217,153 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
567 J=218,154 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
568 J=219,155 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
569 J=220,156 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
570 J=242,178 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
571 J=239,175 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
572 J=240,176 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
573 J=241,177 SEC=14X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
574 J=237,173 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
575 J=236,172 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
576 J=243,179 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
577 J=257,258 SEC=BEAM NSEG=4 ANG=0
578 J=258,259 SEC=BEAM NSEG=4 ANG=0
579 J=259,260 SEC=BEAM NSEG=4 ANG=0
580 J=260,261 SEC=BEAM NSEG=4 ANG=0
581 J=261,262 SEC=BEAM NSEG=4 ANG=0
582 J=262,263 SEC=BEAM NSEG=4 ANG=0
583 J=263,264 SEC=BEAM NSEG=4 ANG=0
584 J=264,265 SEC=BEAM NSEG=4 ANG=0
585 J=257,266 SEC=BEAM NSEG=4 ANG=0
586 J=266,267 SEC=BEAM NSEG=4 ANG=0
587 J=267,268 SEC=BEAM NSEG=4 ANG=0
588 J=268,269 SEC=BEAM NSEG=4 ANG=0
589 J=269,270 SEC=BEAM NSEG=4 ANG=0
590 J=270,271 SEC=BEAM NSEG=4 ANG=0
591 J=271,272 SEC=BEAM NSEG=4 ANG=0
592 J=273,274 SEC=BEAM NSEG=4 ANG=0
593 J=272,273 SEC=BEAM NSEG=4 ANG=0
594 J=274,275 SEC=BEAM NSEG=4 ANG=0
595 J=275,276 SEC=BEAM NSEG=4 ANG=0
596 J=276,277 SEC=BEAM NSEG=4 ANG=0
597 J=277,278 SEC=BEAM NSEG=4 ANG=0
598 J=278,279 SEC=BEAM NSEG=4 ANG=0
599 J=279,280 SEC=BEAM NSEG=4 ANG=0
600 J=280,281 SEC=BEAM NSEG=4 ANG=0
601 J=281,282 SEC=BEAM NSEG=4 ANG=0
602 J=282,283 SEC=BEAM NSEG=4 ANG=0
603 J=283,284 SEC=BEAM NSEG=4 ANG=0
604 J=284,285 SEC=BEAM NSEG=4 ANG=0
605 J=285,286 SEC=BEAM NSEG=4 ANG=0
606 J=286,287 SEC=BEAM NSEG=4 ANG=0
607 J=287,288 SEC=BEAM NSEG=4 ANG=0
608 J=288,265 SEC=BEAM NSEG=4 ANG=0
609 J=288,289 SEC=BEAM NSEG=4 ANG=0
610 J=289,290 SEC=BEAM NSEG=4 ANG=0
611 J=290,291 SEC=BEAM NSEG=4 ANG=0
612 J=291,292 SEC=BEAM NSEG=4 ANG=0
613 J=292,293 SEC=BEAM NSEG=4 ANG=0
614 J=293,266 SEC=BEAM NSEG=4 ANG=0
615 J=268,294 SEC=BEAM NSEG=4 ANG=0
616 J=294,295 SEC=BEAM NSEG=4 ANG=0
617 J=295,296 SEC=BEAM NSEG=4 ANG=0
618 J=296,297 SEC=BEAM NSEG=4 ANG=0
619 J=297,298 SEC=BEAM NSEG=4 ANG=0
620 J=298,299 SEC=BEAM NSEG=4 ANG=0
621 J=299,286 SEC=BEAM NSEG=4 ANG=0
622 J=285,300 SEC=BEAM NSEG=4 ANG=0
623 J=300,301 SEC=BEAM NSEG=4 ANG=0
624 J=301,302 SEC=BEAM NSEG=4 ANG=0
625 J=302,303 SEC=BEAM NSEG=4 ANG=0
626 J=304,305 SEC=BEAM NSEG=4 ANG=0
627 J=305,278 SEC=BEAM NSEG=4 ANG=0
628 J=280,306 SEC=BEAM NSEG=4 ANG=0
629 J=306,307 SEC=BEAM NSEG=4 ANG=0
630 J=307,301 SEC=BEAM NSEG=4 ANG=0
631 J=284,307 SEC=BEAM NSEG=4 ANG=0
632 J=307,303 SEC=BEAM NSEG=4 ANG=0
633 J=303,308 SEC=BEAM NSEG=4 ANG=0
634 J=308,309 SEC=BEAM NSEG=4 ANG=0
635 J=309,310 SEC=BEAM NSEG=4 ANG=0
636 J=310,311 SEC=BEAM NSEG=4 ANG=0
637 J=311,270 SEC=BEAM NSEG=4 ANG=0
638 J=272,312 SEC=BEAM NSEG=4 ANG=0
639 J=312,313 SEC=BEAM NSEG=4 ANG=0
640 J=313,314 SEC=BEAM NSEG=4 ANG=0
641 J=314,305 SEC=BEAM NSEG=4 ANG=0
642 J=305,306 SEC=BEAM NSEG=4 ANG=0
643 J=306,282 SEC=BEAM NSEG=4 ANG=0
644 J=277,315 SEC=BEAM NSEG=4 ANG=0

645 J=315,314 SEC=BEAM
NSEG=4 ANG=0
646 J=314,308 SEC=BEAM
NSEG=4 ANG=0
647 J=301,299 SEC=BEAM
NSEG=4 ANG=0
648 J=299,289 SEC=BEAM
NSEG=4 ANG=0
649 J=289,264 SEC=BEAM
NSEG=4 ANG=0
650 J=262,290 SEC=BEAM
NSEG=4 ANG=0
651 J=290,297 SEC=BEAM
NSEG=4 ANG=0
652 J=261,316 SEC=BEAM
NSEG=4 ANG=0
653 J=316,291 SEC=BEAM
NSEG=4 ANG=0
654 J=291,296 SEC=BEAM
NSEG=4 ANG=0
655 J=260,292 SEC=BEAM
NSEG=4 ANG=0
656 J=292,317 SEC=BEAM
NSEG=4 ANG=0
657 J=317,295 SEC=BEAM
NSEG=4 ANG=0
658 J=295,318 SEC=BEAM
NSEG=4 ANG=0
659 J=318,309 SEC=BEAM
NSEG=4 ANG=0
660 J=309,313 SEC=BEAM
NSEG=4 ANG=0
661 J=313,276 SEC=BEAM
NSEG=4 ANG=0
662 J=297,302 SEC=BEAM
NSEG=4 ANG=0
663 J=258,293 SEC=BEAM
NSEG=4 ANG=0
664 J=293,294 SEC=BEAM
NSEG=4 ANG=0
665 J=294,319 SEC=BEAM
NSEG=4 ANG=0
666 J=319,311 SEC=BEAM
NSEG=4 ANG=0
667 J=311,312 SEC=BEAM
NSEG=4 ANG=0
668 J=312,274 SEC=BEAM
NSEG=4 ANG=0
669 J=269,320 SEC=BEAM
NSEG=4 ANG=0
670 J=319,318 SEC=BEAM
NSEG=4 ANG=0
671 J=320,319 SEC=BEAM
NSEG=4 ANG=0
672 J=303,304 SEC=BEAM
NSEG=4 ANG=0
673 J=257,193 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
674 J=258,194 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
675 J=259,195 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
676 J=260,196 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
677 J=202,266 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
678 J=267,203 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
679 J=293,229 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
680 J=268,204 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
681 J=292,228 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
682 J=261,197 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
683 J=316,252 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
684 J=291,227 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
685 J=317,253 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
686 J=295,231 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
687 J=269,205 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
688 J=294,230 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
689 J=320,256 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
690 J=206,270 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
691 J=271,207 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
692 J=272,208 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
693 J=273,209 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
694 J=319,255 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
695 J=311,247 SEC=14X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
696 J=312,248 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
697 J=274,210 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
698 J=310,246 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
699 J=309,245 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
700 J=313,249 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
701 J=275,211 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
702 J=276,212 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
703 J=318,254 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
704 J=296,232 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
705 J=262,198 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
706 J=263,199 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
707 J=264,200 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
708 J=265,201 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
709 J=288,224 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
710 J=223,287 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
711 J=225,289 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
712 J=226,290 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
713 J=297,233 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
714 J=298,234 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
715 J=299,235 SEC=14X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
716 J=302,238 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
717 J=308,244 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
718 J=222,286 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
719 J=221,285 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
720 J=213,277 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
721 J=251,315 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
722 J=250,314 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
723 J=278,214 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
724 J=279,215 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
725 J=280,216 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
726 J=281,217 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
727 J=282,218 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
728 J=283,219 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
729 J=284,220 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
730 J=306,242 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
731 J=303,239 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
732 J=304,240 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
733 J=305,241 SEC=14X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
734 J=301,237 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
735 J=300,236 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
736 J=307,243 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
737 J=321,322 SEC=BEAM
NSEG=4 ANG=0
738 J=322,323 SEC=BEAM
NSEG=4 ANG=0
739 J=323,324 SEC=BEAM
NSEG=4 ANG=0
740 J=324,325 SEC=BEAM
NSEG=4 ANG=0
741 J=325,326 SEC=BEAM
NSEG=4 ANG=0
742 J=326,327 SEC=BEAM
NSEG=4 ANG=0
743 J=327,328 SEC=BEAM
NSEG=4 ANG=0
744 J=328,329 SEC=BEAM
NSEG=4 ANG=0
745 J=321,330 SEC=BEAM
NSEG=4 ANG=0
746 J=330,331 SEC=BEAM
NSEG=4 ANG=0
747 J=331,332 SEC=BEAM
NSEG=4 ANG=0
748 J=332,333 SEC=BEAM
NSEG=4 ANG=0
749 J=333,334 SEC=BEAM
NSEG=4 ANG=0
750 J=334,335 SEC=BEAM
NSEG=4 ANG=0
751 J=335,336 SEC=BEAM
NSEG=4 ANG=0
752 J=337,338 SEC=BEAM
NSEG=4 ANG=0
753 J=336,337 SEC=BEAM
NSEG=4 ANG=0
754 J=338,339 SEC=BEAM
NSEG=4 ANG=0
755 J=339,340 SEC=BEAM
NSEG=4 ANG=0
756 J=340,341 SEC=BEAM
NSEG=4 ANG=0
757 J=341,342 SEC=BEAM
NSEG=4 ANG=0
758 J=342,343 SEC=BEAM
NSEG=4 ANG=0
759 J=343,344 SEC=BEAM
NSEG=4 ANG=0
760 J=344,345 SEC=BEAM
NSEG=4 ANG=0
761 J=345,346 SEC=BEAM
NSEG=4 ANG=0
762 J=346,347 SEC=BEAM
NSEG=4 ANG=0
763 J=347,348 SEC=BEAM
NSEG=4 ANG=0
764 J=348,349 SEC=BEAM
NSEG=4 ANG=0
765 J=349,350 SEC=BEAM
NSEG=4 ANG=0
766 J=350,351 SEC=BEAM
NSEG=4 ANG=0
767 J=351,352 SEC=BEAM
NSEG=4 ANG=0
768 J=352,329 SEC=BEAM
NSEG=4 ANG=0
769 J=352,353 SEC=BEAM
NSEG=4 ANG=0
770 J=353,354 SEC=BEAM
NSEG=4 ANG=0
771 J=354,355 SEC=BEAM
NSEG=4 ANG=0
772 J=355,356 SEC=BEAM
NSEG=4 ANG=0
773 J=356,357 SEC=BEAM
NSEG=4 ANG=0
774 J=357,330 SEC=BEAM
NSEG=4 ANG=0
775 J=332,358 SEC=BEAM
NSEG=4 ANG=0
776 J=358,359 SEC=BEAM
NSEG=4 ANG=0
777 J=359,360 SEC=BEAM
NSEG=4 ANG=0
778 J=360,361 SEC=BEAM
NSEG=4 ANG=0
779 J=361,362 SEC=BEAM
NSEG=4 ANG=0
780 J=362,363 SEC=BEAM
NSEG=4 ANG=0
781 J=363,350 SEC=BEAM
NSEG=4 ANG=0
782 J=349,364 SEC=BEAM
NSEG=4 ANG=0
783 J=364,365 SEC=BEAM
NSEG=4 ANG=0
784 J=365,366 SEC=BEAM
NSEG=4 ANG=0
785 J=366,367 SEC=BEAM
NSEG=4 ANG=0
786 J=368,369 SEC=BEAM
NSEG=4 ANG=0
787 J=369,342 SEC=BEAM
NSEG=4 ANG=0
788 J=344,370 SEC=BEAM
NSEG=4 ANG=0
789 J=370,371 SEC=BEAM
NSEG=4 ANG=0
790 J=371,365 SEC=BEAM
NSEG=4 ANG=0
791 J=348,371 SEC=BEAM
NSEG=4 ANG=0
792 J=371,367 SEC=BEAM
NSEG=4 ANG=0
793 J=367,372 SEC=BEAM
NSEG=4 ANG=0
794 J=372,373 SEC=BEAM
NSEG=4 ANG=0
795 J=373,374 SEC=BEAM
NSEG=4 ANG=0
796 J=374,375 SEC=BEAM
NSEG=4 ANG=0
797 J=375,334 SEC=BEAM
NSEG=4 ANG=0
798 J=336,376 SEC=BEAM
NSEG=4 ANG=0
799 J=376,377 SEC=BEAM
NSEG=4 ANG=0
800 J=377,378 SEC=BEAM
NSEG=4 ANG=0
801 J=378,369 SEC=BEAM
NSEG=4 ANG=0
802 J=369,370 SEC=BEAM
NSEG=4 ANG=0
803 J=370,346 SEC=BEAM
NSEG=4 ANG=0
804 J=341,379 SEC=BEAM
NSEG=4 ANG=0
805 J=379,378 SEC=BEAM
NSEG=4 ANG=0
806 J=378,372 SEC=BEAM
NSEG=4 ANG=0
807 J=365,363 SEC=BEAM
NSEG=4 ANG=0
808 J=363,353 SEC=BEAM
NSEG=4 ANG=0
809 J=353,328 SEC=BEAM
NSEG=4 ANG=0
810 J=326,354 SEC=BEAM
NSEG=4 ANG=0
811 J=354,361 SEC=BEAM
NSEG=4 ANG=0
812 J=325,380 SEC=BEAM
NSEG=4 ANG=0
813 J=380,355 SEC=BEAM
NSEG=4 ANG=0
814 J=355,360 SEC=BEAM
NSEG=4 ANG=0
815 J=324,356 SEC=BEAM
NSEG=4 ANG=0
816 J=356,381 SEC=BEAM
NSEG=4 ANG=0
817 J=381,359 SEC=BEAM
NSEG=4 ANG=0
818 J=359,382 SEC=BEAM
NSEG=4 ANG=0

819 J=382,373 SEC=BEAM
NSEG=4 ANG=0
820 J=373,377 SEC=BEAM
NSEG=4 ANG=0
821 J=377,340 SEC=BEAM
NSEG=4 ANG=0
822 J=361,366 SEC=BEAM
NSEG=4 ANG=0
823 J=322,357 SEC=BEAM
NSEG=4 ANG=0
824 J=357,358 SEC=BEAM
NSEG=4 ANG=0
825 J=358,383 SEC=BEAM
NSEG=4 ANG=0
826 J=383,375 SEC=BEAM
NSEG=4 ANG=0
827 J=375,376 SEC=BEAM
NSEG=4 ANG=0
828 J=376,338 SEC=BEAM
NSEG=4 ANG=0
829 J=333,384 SEC=BEAM
NSEG=4 ANG=0
830 J=383,382 SEC=BEAM
NSEG=4 ANG=0
831 J=384,383 SEC=BEAM
NSEG=4 ANG=0
832 J=367,368 SEC=BEAM
NSEG=4 ANG=0
833 J=321,257 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
834 J=322,258 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
835 J=323,259 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
836 J=324,260 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
837 J=266,330 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
838 J=331,267 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
839 J=357,293 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
840 J=332,268 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
841 J=356,292 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
842 J=325,261 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
843 J=380,316 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
844 J=355,291 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
845 J=381,317 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
846 J=359,295 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
847 J=333,269 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
848 J=358,294 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
849 J=384,320 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
850 J=270,334 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
851 J=335,271 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
852 J=336,272 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
853 J=337,273 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
854 J=383,319 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
855 J=375,311 SEC=14X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
856 J=376,312 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
857 J=338,274 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
858 J=374,310 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
859 J=373,309 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
860 J=377,313 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
861 J=339,275 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
862 J=340,276 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
863 J=382,318 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
864 J=360,296 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
865 J=326,262 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
866 J=327,263 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
867 J=328,264 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
868 J=329,265 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
869 J=352,288 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
870 J=287,351 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
871 J=289,353 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
872 J=290,354 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
873 J=361,297 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
874 J=362,298 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
875 J=363,299 SEC=14X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
876 J=366,302 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
877 J=372,308 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
878 J=286,350 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
879 J=285,349 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
880 J=277,341 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
881 J=315,379 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
882 J=314,378 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
883 J=342,278 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
884 J=343,279 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
885 J=344,280 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
886 J=345,281 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
887 J=346,282 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
888 J=347,283 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
889 J=348,284 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
890 J=370,306 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
891 J=367,303 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
892 J=368,304 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
893 J=369,305 SEC=14X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
894 J=365,301 SEC=14X16 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
895 J=364,300 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
896 J=371,307 SEC=12X14 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
897 J=385,386 SEC=BEAM
NSEG=4 ANG=0
898 J=386,387 SEC=BEAM
NSEG=4 ANG=0
899 J=387,388 SEC=BEAM
NSEG=4 ANG=0
900 J=388,389 SEC=BEAM
NSEG=4 ANG=0
901 J=389,390 SEC=BEAM
NSEG=4 ANG=0
902 J=390,391 SEC=BEAM
NSEG=4 ANG=0
903 J=391,392 SEC=BEAM
NSEG=4 ANG=0
904 J=392,393 SEC=BEAM
NSEG=4 ANG=0
905 J=385,394 SEC=BEAM
NSEG=4 ANG=0
906 J=394,395 SEC=BEAM
NSEG=4 ANG=0
907 J=395,396 SEC=BEAM
NSEG=4 ANG=0
908 J=396,397 SEC=BEAM
NSEG=4 ANG=0
909 J=397,398 SEC=BEAM
NSEG=4 ANG=0
910 J=398,399 SEC=BEAM
NSEG=4 ANG=0
911 J=399,400 SEC=BEAM
NSEG=4 ANG=0
912 J=401,402 SEC=BEAM
NSEG=4 ANG=0
913 J=400,401 SEC=BEAM
NSEG=4 ANG=0
914 J=402,403 SEC=BEAM
NSEG=4 ANG=0
915 J=403,404 SEC=BEAM
NSEG=4 ANG=0
916 J=404,405 SEC=BEAM
NSEG=4 ANG=0
917 J=405,406 SEC=BEAM
NSEG=4 ANG=0
918 J=406,407 SEC=BEAM
NSEG=4 ANG=0
919 J=407,408 SEC=BEAM
NSEG=4 ANG=0
920 J=408,409 SEC=BEAM
NSEG=4 ANG=0
921 J=409,410 SEC=BEAM
NSEG=4 ANG=0
922 J=410,411 SEC=BEAM
NSEG=4 ANG=0
923 J=411,412 SEC=BEAM
NSEG=4 ANG=0
924 J=412,413 SEC=BEAM
NSEG=4 ANG=0
925 J=413,414 SEC=BEAM
NSEG=4 ANG=0
926 J=414,415 SEC=BEAM
NSEG=4 ANG=0
927 J=415,416 SEC=BEAM
NSEG=4 ANG=0
928 J=416,393 SEC=BEAM
NSEG=4 ANG=0
929 J=416,417 SEC=BEAM
NSEG=4 ANG=0
930 J=417,418 SEC=BEAM
NSEG=4 ANG=0
931 J=418,419 SEC=BEAM
NSEG=4 ANG=0
932 J=419,420 SEC=BEAM
NSEG=4 ANG=0
933 J=420,421 SEC=BEAM
NSEG=4 ANG=0
934 J=421,394 SEC=BEAM
NSEG=4 ANG=0
935 J=396,422 SEC=BEAM
NSEG=4 ANG=0
936 J=422,423 SEC=BEAM
NSEG=4 ANG=0
937 J=423,424 SEC=BEAM
NSEG=4 ANG=0
938 J=424,425 SEC=BEAM
NSEG=4 ANG=0
939 J=425,426 SEC=BEAM
NSEG=4 ANG=0
940 J=426,427 SEC=BEAM
NSEG=4 ANG=0
941 J=427,414 SEC=BEAM
NSEG=4 ANG=0
942 J=413,428 SEC=BEAM
NSEG=4 ANG=0
943 J=428,429 SEC=BEAM
NSEG=4 ANG=0
944 J=429,430 SEC=BEAM
NSEG=4 ANG=0
945 J=430,431 SEC=BEAM
NSEG=4 ANG=0
946 J=432,433 SEC=BEAM
NSEG=4 ANG=0
947 J=433,406 SEC=BEAM
NSEG=4 ANG=0
948 J=408,434 SEC=BEAM
NSEG=4 ANG=0
949 J=434,435 SEC=BEAM
NSEG=4 ANG=0
950 J=435,429 SEC=BEAM
NSEG=4 ANG=0
951 J=412,435 SEC=BEAM
NSEG=4 ANG=0
952 J=435,431 SEC=BEAM
NSEG=4 ANG=0
953 J=431,436 SEC=BEAM
NSEG=4 ANG=0
954 J=436,437 SEC=BEAM
NSEG=4 ANG=0
955 J=437,438 SEC=BEAM
NSEG=4 ANG=0
956 J=438,439 SEC=BEAM
NSEG=4 ANG=0
957 J=439,398 SEC=BEAM
NSEG=4 ANG=0
958 J=400,440 SEC=BEAM
NSEG=4 ANG=0
959 J=440,441 SEC=BEAM
NSEG=4 ANG=0
960 J=441,442 SEC=BEAM
NSEG=4 ANG=0
961 J=442,433 SEC=BEAM
NSEG=4 ANG=0
962 J=433,434 SEC=BEAM
NSEG=4 ANG=0
963 J=434,410 SEC=BEAM
NSEG=4 ANG=0
964 J=405,443 SEC=BEAM
NSEG=4 ANG=0
965 J=443,442 SEC=BEAM
NSEG=4 ANG=0
966 J=442,436 SEC=BEAM
NSEG=4 ANG=0
967 J=429,427 SEC=BEAM
NSEG=4 ANG=0
968 J=427,417 SEC=BEAM
NSEG=4 ANG=0
969 J=417,392 SEC=BEAM
NSEG=4 ANG=0
970 J=390,418 SEC=BEAM
NSEG=4 ANG=0
971 J=418,425 SEC=BEAM
NSEG=4 ANG=0
972 J=389,444 SEC=BEAM
NSEG=4 ANG=0
973 J=444,419 SEC=BEAM
NSEG=4 ANG=0
974 J=419,424 SEC=BEAM
NSEG=4 ANG=0
975 J=388,420 SEC=BEAM
NSEG=4 ANG=0
976 J=420,445 SEC=BEAM
NSEG=4 ANG=0
977 J=445,423 SEC=BEAM
NSEG=4 ANG=0
978 J=423,446 SEC=BEAM
NSEG=4 ANG=0
979 J=446,437 SEC=BEAM
NSEG=4 ANG=0
980 J=437,441 SEC=BEAM
NSEG=4 ANG=0
981 J=441,404 SEC=BEAM
NSEG=4 ANG=0
982 J=425,430 SEC=BEAM
NSEG=4 ANG=0
983 J=386,421 SEC=BEAM
NSEG=4 ANG=0
984 J=421,422 SEC=BEAM
NSEG=4 ANG=0
985 J=422,447 SEC=BEAM
NSEG=4 ANG=0
986 J=447,439 SEC=BEAM
NSEG=4 ANG=0
987 J=439,440 SEC=BEAM
NSEG=4 ANG=0
988 J=440,402 SEC=BEAM
NSEG=4 ANG=0

989 J=397,448 SEC=BEAM
NSEG=4 ANG=0
990 J=447,446 SEC=BEAM
NSEG=4 ANG=0
991 J=448,447 SEC=BEAM
NSEG=4 ANG=0
992 J=431,432 SEC=BEAM
NSEG=4 ANG=0
993 J=385,321 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
994 J=386,322 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
995 J=387,323 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
996 J=388,324 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
997 J=330,394 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
998 J=395,331 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
999 J=421,357 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1000 J=396,332 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1001 J=420,356 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1002 J=389,325 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1003 J=444,380 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1004 J=419,355 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1005 J=445,381 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1006 J=423,359 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1007 J=397,333 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1008 J=422,358 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1009 J=448,384 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1010 J=334,398 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1011 J=399,335 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1012 J=400,336 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1013 J=401,337 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1014 J=447,383 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1015 J=439,375 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1016 J=440,376 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1017 J=402,338 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1018 J=438,374 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1019 J=437,373 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1020 J=441,377 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1021 J=403,339 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1022 J=404,340 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1023 J=446,382 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1024 J=424,360 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1025 J=390,326 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1026 J=391,327 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1027 J=392,328 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1028 J=393,329 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1029 J=416,352 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1030 J=351,415 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1031 J=353,417 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1032 J=354,418 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1033 J=425,361 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1034 J=426,362 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1035 J=427,363 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1036 J=430,366 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1037 J=436,372 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1038 J=350,414 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1039 J=349,413 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1040 J=341,405 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1041 J=379,443 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1042 J=378,442 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1043 J=406,342 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1044 J=407,343 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1045 J=408,344 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1046 J=409,345 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1047 J=410,346 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1048 J=411,347 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1049 J=412,348 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1050 J=434,370 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1051 J=431,367 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1052 J=432,368 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1053 J=433,369 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1054 J=429,365 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1055 J=428,364 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1056 J=435,371 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1057 J=449,450 SEC=BEAM
NSEG=4 ANG=0
1058 J=450,451 SEC=BEAM
NSEG=4 ANG=0
1059 J=451,452 SEC=BEAM
NSEG=4 ANG=0
1060 J=452,453 SEC=BEAM
NSEG=4 ANG=0
1061 J=453,454 SEC=BEAM
NSEG=4 ANG=0
1062 J=454,455 SEC=BEAM
NSEG=4 ANG=0
1063 J=455,456 SEC=BEAM
NSEG=4 ANG=0
1064 J=456,457 SEC=BEAM
NSEG=4 ANG=0
1065 J=449,458 SEC=BEAM
NSEG=4 ANG=0
1066 J=458,459 SEC=BEAM
NSEG=4 ANG=0
1067 J=459,460 SEC=BEAM
NSEG=4 ANG=0
1068 J=460,461 SEC=BEAM
NSEG=4 ANG=0
1069 J=461,462 SEC=BEAM
NSEG=4 ANG=0
1070 J=462,463 SEC=BEAM
NSEG=4 ANG=0
1071 J=463,464 SEC=BEAM
NSEG=4 ANG=0
1072 J=465,466 SEC=BEAM
NSEG=4 ANG=0
1073 J=464,465 SEC=BEAM
NSEG=4 ANG=0
1074 J=466,467 SEC=BEAM
NSEG=4 ANG=0
1075 J=467,468 SEC=BEAM
NSEG=4 ANG=0
1076 J=468,469 SEC=BEAM
NSEG=4 ANG=0
1077 J=469,470 SEC=BEAM
NSEG=4 ANG=0
1078 J=470,471 SEC=BEAM
NSEG=4 ANG=0
1079 J=471,472 SEC=BEAM
NSEG=4 ANG=0
1080 J=472,473 SEC=BEAM
NSEG=4 ANG=0
1081 J=473,474 SEC=BEAM
NSEG=4 ANG=0
1082 J=474,475 SEC=BEAM
NSEG=4 ANG=0
1083 J=475,476 SEC=BEAM
NSEG=4 ANG=0
1084 J=476,477 SEC=BEAM
NSEG=4 ANG=0
1085 J=477,478 SEC=BEAM
NSEG=4 ANG=0
1086 J=478,479 SEC=BEAM
NSEG=4 ANG=0
1087 J=479,480 SEC=BEAM
NSEG=4 ANG=0
1088 J=480,457 SEC=BEAM
NSEG=4 ANG=0
1089 J=480,481 SEC=BEAM
NSEG=4 ANG=0
1090 J=481,482 SEC=BEAM
NSEG=4 ANG=0
1091 J=482,483 SEC=BEAM
NSEG=4 ANG=0
1092 J=483,484 SEC=BEAM
NSEG=4 ANG=0
1093 J=484,485 SEC=BEAM
NSEG=4 ANG=0
1094 J=485,458 SEC=BEAM
NSEG=4 ANG=0
1095 J=460,486 SEC=BEAM
NSEG=4 ANG=0
1096 J=486,487 SEC=BEAM
NSEG=4 ANG=0
1097 J=487,488 SEC=BEAM
NSEG=4 ANG=0
1098 J=488,489 SEC=BEAM
NSEG=4 ANG=0
1099 J=489,490 SEC=BEAM
NSEG=4 ANG=0
1100 J=490,491 SEC=BEAM
NSEG=4 ANG=0
1101 J=491,478 SEC=BEAM
NSEG=4 ANG=0
1102 J=477,492 SEC=BEAM
NSEG=4 ANG=0
1103 J=492,493 SEC=BEAM
NSEG=4 ANG=0
1104 J=493,494 SEC=BEAM
NSEG=4 ANG=0
1105 J=494,495 SEC=BEAM
NSEG=4 ANG=0
1106 J=496,497 SEC=BEAM
NSEG=4 ANG=0
1107 J=497,470 SEC=BEAM
NSEG=4 ANG=0
1108 J=472,498 SEC=BEAM
NSEG=4 ANG=0
1109 J=498,499 SEC=BEAM
NSEG=4 ANG=0
1110 J=499,493 SEC=BEAM
NSEG=4 ANG=0
1111 J=476,499 SEC=BEAM
NSEG=4 ANG=0
1112 J=499,495 SEC=BEAM
NSEG=4 ANG=0
1113 J=495,500 SEC=BEAM
NSEG=4 ANG=0
1114 J=500,501 SEC=BEAM
NSEG=4 ANG=0
1115 J=501,502 SEC=BEAM
NSEG=4 ANG=0
1116 J=502,503 SEC=BEAM
NSEG=4 ANG=0
1117 J=503,462 SEC=BEAM
NSEG=4 ANG=0
1118 J=464,504 SEC=BEAM
NSEG=4 ANG=0
1119 J=504,505 SEC=BEAM
NSEG=4 ANG=0
1120 J=505,506 SEC=BEAM
NSEG=4 ANG=0
1121 J=506,497 SEC=BEAM
NSEG=4 ANG=0
1122 J=497,498 SEC=BEAM
NSEG=4 ANG=0
1123 J=498,474 SEC=BEAM
NSEG=4 ANG=0
1124 J=469,507 SEC=BEAM
NSEG=4 ANG=0
1125 J=507,506 SEC=BEAM
NSEG=4 ANG=0
1126 J=506,500 SEC=BEAM
NSEG=4 ANG=0
1127 J=493,491 SEC=BEAM
NSEG=4 ANG=0
1128 J=491,481 SEC=BEAM
NSEG=4 ANG=0
1129 J=481,456 SEC=BEAM
NSEG=4 ANG=0
1130 J=454,482 SEC=BEAM
NSEG=4 ANG=0
1131 J=482,489 SEC=BEAM
NSEG=4 ANG=0
1132 J=453,508 SEC=BEAM
NSEG=4 ANG=0
1133 J=508,483 SEC=BEAM
NSEG=4 ANG=0
1134 J=483,488 SEC=BEAM
NSEG=4 ANG=0
1135 J=452,484 SEC=BEAM
NSEG=4 ANG=0
1136 J=484,509 SEC=BEAM
NSEG=4 ANG=0
1137 J=509,487 SEC=BEAM
NSEG=4 ANG=0
1138 J=487,510 SEC=BEAM
NSEG=4 ANG=0
1139 J=510,501 SEC=BEAM
NSEG=4 ANG=0
1140 J=501,505 SEC=BEAM
NSEG=4 ANG=0
1141 J=505,468 SEC=BEAM
NSEG=4 ANG=0

1142 J=489,494 SEC=BEAM
NSEG=4 ANG=0
1143 J=450,485 SEC=BEAM
NSEG=4 ANG=0
1144 J=485,486 SEC=BEAM
NSEG=4 ANG=0
1145 J=486,511 SEC=BEAM
NSEG=4 ANG=0
1146 J=511,503 SEC=BEAM
NSEG=4 ANG=0
1147 J=503,504 SEC=BEAM
NSEG=4 ANG=0
1148 J=504,466 SEC=BEAM
NSEG=4 ANG=0
1149 J=461,512 SEC=BEAM
NSEG=4 ANG=0
1150 J=511,510 SEC=BEAM
NSEG=4 ANG=0
1151 J=512,511 SEC=BEAM
NSEG=4 ANG=0
1152 J=495,496 SEC=BEAM
NSEG=4 ANG=0
1153 J=449,385 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1154 J=450,386 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1155 J=451,387 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1156 J=452,388 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1157 J=394,458 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1158 J=459,395 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1159 J=485,421 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1160 J=460,396 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1161 J=484,420 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1162 J=453,389 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1163 J=508,444 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1164 J=483,419 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1165 J=509,445 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1166 J=487,423 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1167 J=461,397 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1168 J=486,422 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1169 J=512,448 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1170 J=398,462 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1171 J=463,399 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1172 J=464,400 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1173 J=465,401 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1174 J=511,447 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1175 J=503,439 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1176 J=504,440 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1177 J=466,402 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1178 J=502,438 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1179 J=501,437 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1180 J=505,441 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1181 J=467,403 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1182 J=468,404 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1183 J=510,446 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1184 J=488,424 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1185 J=454,390 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1186 J=455,391 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1187 J=456,392 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1188 J=457,393 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1189 J=480,416 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1190 J=415,479 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1191 J=417,481 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1192 J=418,482 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1193 J=489,425 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1194 J=490,426 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1195 J=491,427 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1196 J=494,430 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1197 J=500,436 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1198 J=414,478 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1199 J=413,477 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1200 J=405,469 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1201 J=443,507 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1202 J=442,506 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1203 J=470,406 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1204 J=471,407 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1205 J=472,408 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1206 J=473,409 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1207 J=474,410 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1208 J=475,411 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1209 J=476,412 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1210 J=498,434 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1211 J=495,431 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1212 J=496,432 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1213 J=497,433 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1214 J=493,429 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1215 J=492,428 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1216 J=499,435 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1217 J=513,514 SEC=BEAM
NSEG=4 ANG=0
1218 J=514,515 SEC=BEAM
NSEG=4 ANG=0
1219 J=515,516 SEC=BEAM
NSEG=4 ANG=0
1220 J=516,517 SEC=BEAM
NSEG=4 ANG=0
1221 J=517,518 SEC=BEAM
NSEG=4 ANG=0
1222 J=518,519 SEC=BEAM
NSEG=4 ANG=0
1223 J=519,520 SEC=BEAM
NSEG=4 ANG=0
1224 J=520,521 SEC=BEAM
NSEG=4 ANG=0
1225 J=513,522 SEC=BEAM
NSEG=4 ANG=0
1226 J=522,523 SEC=BEAM
NSEG=4 ANG=0
1227 J=523,524 SEC=BEAM
NSEG=4 ANG=0
1228 J=524,525 SEC=BEAM
NSEG=4 ANG=0
1229 J=525,526 SEC=BEAM
NSEG=4 ANG=0
1230 J=526,527 SEC=BEAM
NSEG=4 ANG=0
1231 J=527,528 SEC=BEAM
NSEG=4 ANG=0
1232 J=529,530 SEC=BEAM
NSEG=4 ANG=0
1233 J=528,529 SEC=BEAM
NSEG=4 ANG=0
1234 J=530,531 SEC=BEAM
NSEG=4 ANG=0
1235 J=531,532 SEC=BEAM
NSEG=4 ANG=0
1236 J=532,533 SEC=BEAM
NSEG=4 ANG=0
1237 J=533,534 SEC=BEAM
NSEG=4 ANG=0
1238 J=534,535 SEC=BEAM
NSEG=4 ANG=0
1239 J=535,536 SEC=BEAM
NSEG=4 ANG=0
1240 J=536,537 SEC=BEAM
NSEG=4 ANG=0
1241 J=537,538 SEC=BEAM
NSEG=4 ANG=0
1242 J=538,539 SEC=BEAM
NSEG=4 ANG=0
1243 J=539,540 SEC=BEAM
NSEG=4 ANG=0
1244 J=540,541 SEC=BEAM
NSEG=4 ANG=0
1245 J=541,542 SEC=BEAM
NSEG=4 ANG=0
1246 J=542,543 SEC=BEAM
NSEG=4 ANG=0
1247 J=543,544 SEC=BEAM
NSEG=4 ANG=0
1248 J=544,521 SEC=BEAM
NSEG=4 ANG=0
1249 J=544,545 SEC=BEAM
NSEG=4 ANG=0
1250 J=545,546 SEC=BEAM
NSEG=4 ANG=0
1251 J=546,547 SEC=BEAM
NSEG=4 ANG=0
1252 J=547,548 SEC=BEAM
NSEG=4 ANG=0
1253 J=548,549 SEC=BEAM
NSEG=4 ANG=0
1254 J=549,522 SEC=BEAM
NSEG=4 ANG=0
1255 J=524,550 SEC=BEAM
NSEG=4 ANG=0
1256 J=550,551 SEC=BEAM
NSEG=4 ANG=0
1257 J=551,552 SEC=BEAM
NSEG=4 ANG=0
1258 J=552,553 SEC=BEAM
NSEG=4 ANG=0
1259 J=553,554 SEC=BEAM
NSEG=4 ANG=0
1260 J=554,555 SEC=BEAM
NSEG=4 ANG=0
1261 J=555,542 SEC=BEAM
NSEG=4 ANG=0
1262 J=541,556 SEC=BEAM
NSEG=4 ANG=0
1263 J=556,557 SEC=BEAM
NSEG=4 ANG=0
1264 J=557,558 SEC=BEAM
NSEG=4 ANG=0
1265 J=558,559 SEC=BEAM
NSEG=4 ANG=0
1266 J=560,561 SEC=BEAM
NSEG=4 ANG=0
1267 J=561,534 SEC=BEAM
NSEG=4 ANG=0
1268 J=536,562 SEC=BEAM
NSEG=4 ANG=0
1269 J=562,563 SEC=BEAM
NSEG=4 ANG=0
1270 J=563,557 SEC=BEAM
NSEG=4 ANG=0
1271 J=540,563 SEC=BEAM
NSEG=4 ANG=0
1272 J=563,559 SEC=BEAM
NSEG=4 ANG=0
1273 J=559,564 SEC=BEAM
NSEG=4 ANG=0
1274 J=564,565 SEC=BEAM
NSEG=4 ANG=0
1275 J=565,566 SEC=BEAM
NSEG=4 ANG=0
1276 J=566,567 SEC=BEAM
NSEG=4 ANG=0
1277 J=567,526 SEC=BEAM
NSEG=4 ANG=0
1278 J=528,568 SEC=BEAM
NSEG=4 ANG=0
1279 J=568,569 SEC=BEAM
NSEG=4 ANG=0
1280 J=569,570 SEC=BEAM
NSEG=4 ANG=0
1281 J=570,561 SEC=BEAM
NSEG=4 ANG=0
1282 J=561,562 SEC=BEAM
NSEG=4 ANG=0
1283 J=562,538 SEC=BEAM
NSEG=4 ANG=0
1284 J=533,571 SEC=BEAM
NSEG=4 ANG=0
1285 J=571,570 SEC=BEAM
NSEG=4 ANG=0
1286 J=570,564 SEC=BEAM
NSEG=4 ANG=0
1287 J=557,555 SEC=BEAM
NSEG=4 ANG=0
1288 J=555,545 SEC=BEAM
NSEG=4 ANG=0
1289 J=545,520 SEC=BEAM
NSEG=4 ANG=0
1290 J=518,546 SEC=BEAM
NSEG=4 ANG=0
1291 J=546,553 SEC=BEAM
NSEG=4 ANG=0
1292 J=517,572 SEC=BEAM
NSEG=4 ANG=0
1293 J=572,547 SEC=BEAM
NSEG=4 ANG=0
1294 J=547,552 SEC=BEAM
NSEG=4 ANG=0
1295 J=516,548 SEC=BEAM
NSEG=4 ANG=0
1296 J=548,573 SEC=BEAM
NSEG=4 ANG=0

1297 J=573,551 SEC=BEAM NSEG=4 ANG=0
1298 J=551,574 SEC=BEAM NSEG=4 ANG=0
1299 J=574,565 SEC=BEAM NSEG=4 ANG=0
1300 J=565,569 SEC=BEAM NSEG=4 ANG=0
1301 J=569,532 SEC=BEAM NSEG=4 ANG=0
1302 J=553,558 SEC=BEAM NSEG=4 ANG=0
1303 J=514,549 SEC=BEAM NSEG=4 ANG=0
1304 J=549,550 SEC=BEAM NSEG=4 ANG=0
1305 J=550,575 SEC=BEAM NSEG=4 ANG=0
1306 J=575,567 SEC=BEAM NSEG=4 ANG=0
1307 J=567,568 SEC=BEAM NSEG=4 ANG=0
1308 J=568,530 SEC=BEAM NSEG=4 ANG=0
1309 J=525,576 SEC=BEAM NSEG=4 ANG=0
1310 J=575,574 SEC=BEAM NSEG=4 ANG=0
1311 J=576,575 SEC=BEAM NSEG=4 ANG=0
1312 J=559,560 SEC=BEAM NSEG=4 ANG=0
1313 J=513,449 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1314 J=514,450 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1315 J=515,451 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1316 J=516,452 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1317 J=458,522 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1318 J=523,459 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1319 J=549,485 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1320 J=524,460 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1321 J=548,484 SEC=14X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1322 J=517,453 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1323 J=572,508 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1324 J=547,483 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1325 J=573,509 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1326 J=551,487 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1327 J=525,461 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1328 J=550,486 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1329 J=576,512 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1330 J=462,526 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1331 J=527,463 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1332 J=528,464 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1333 J=529,465 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1334 J=575,511 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1335 J=567,503 SEC=14X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1336 J=568,504 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1337 J=530,466 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1338 J=566,502 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1339 J=565,501 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1340 J=569,505 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1341 J=531,467 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1342 J=532,468 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1343 J=574,510 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1344 J=552,488 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1345 J=518,454 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1346 J=519,455 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1347 J=520,456 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1348 J=521,457 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1349 J=544,480 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1350 J=479,543 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1351 J=481,545 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1352 J=482,546 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1353 J=553,489 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1354 J=554,490 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1355 J=555,491 SEC=14X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1356 J=558,494 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1357 J=564,500 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1358 J=478,542 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1359 J=477,541 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1360 J=469,533 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1361 J=507,571 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1362 J=506,570 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1363 J=534,470 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1364 J=535,471 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1365 J=536,472 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1366 J=537,473 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1367 J=538,474 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1368 J=539,475 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1369 J=540,476 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1370 J=562,498 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1371 J=559,495 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1372 J=560,496 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1373 J=561,497 SEC=14X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1374 J=557,493 SEC=14X16 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1375 J=556,492 SEC=8X8 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1376 J=563,499 SEC=12X14 NSEG=2 ANG=0 IREL=R2,R3 JREL=R2,R3
1377 J=577,578 SEC=BEAM NSEG=4 ANG=0
1378 J=578,579 SEC=BEAM NSEG=4 ANG=0
1379 J=579,580 SEC=BEAM NSEG=4 ANG=0
1380 J=580,581 SEC=BEAM NSEG=4 ANG=0
1381 J=581,582 SEC=BEAM NSEG=4 ANG=0
1382 J=582,583 SEC=BEAM NSEG=4 ANG=0
1383 J=583,584 SEC=BEAM NSEG=4 ANG=0
1384 J=584,585 SEC=BEAM NSEG=4 ANG=0
1385 J=577,586 SEC=BEAM NSEG=4 ANG=0
1386 J=586,587 SEC=BEAM NSEG=4 ANG=0
1387 J=587,588 SEC=BEAM NSEG=4 ANG=0
1388 J=588,589 SEC=BEAM NSEG=4 ANG=0
1389 J=589,590 SEC=BEAM NSEG=4 ANG=0
1390 J=590,591 SEC=BEAM NSEG=4 ANG=0
1391 J=591,592 SEC=BEAM NSEG=4 ANG=0
1392 J=593,594 SEC=BEAM NSEG=4 ANG=0
1393 J=592,593 SEC=BEAM NSEG=4 ANG=0
1394 J=594,595 SEC=BEAM NSEG=4 ANG=0
1395 J=595,596 SEC=BEAM NSEG=4 ANG=0
1396 J=596,597 SEC=BEAM NSEG=4 ANG=0
1397 J=597,598 SEC=BEAM NSEG=4 ANG=0
1398 J=598,599 SEC=BEAM NSEG=4 ANG=0
1399 J=599,600 SEC=BEAM NSEG=4 ANG=0
1400 J=600,601 SEC=BEAM NSEG=4 ANG=0
1401 J=601,602 SEC=BEAM NSEG=4 ANG=0
1402 J=602,603 SEC=BEAM NSEG=4 ANG=0
1403 J=603,604 SEC=BEAM NSEG=4 ANG=0
1404 J=604,605 SEC=BEAM NSEG=4 ANG=0
1405 J=605,606 SEC=BEAM NSEG=4 ANG=0
1406 J=606,607 SEC=BEAM NSEG=4 ANG=0
1407 J=607,608 SEC=BEAM NSEG=4 ANG=0
1408 J=608,585 SEC=BEAM NSEG=4 ANG=0
1409 J=608,609 SEC=BEAM NSEG=4 ANG=0
1410 J=609,610 SEC=BEAM NSEG=4 ANG=0
1411 J=610,611 SEC=BEAM NSEG=4 ANG=0
1412 J=611,612 SEC=BEAM NSEG=4 ANG=0
1413 J=612,613 SEC=BEAM NSEG=4 ANG=0
1414 J=613,586 SEC=BEAM NSEG=4 ANG=0
1415 J=588,614 SEC=BEAM NSEG=4 ANG=0
1416 J=614,615 SEC=BEAM NSEG=4 ANG=0
1417 J=615,616 SEC=BEAM NSEG=4 ANG=0
1418 J=616,617 SEC=BEAM NSEG=4 ANG=0
1419 J=617,618 SEC=BEAM NSEG=4 ANG=0
1420 J=618,619 SEC=BEAM NSEG=4 ANG=0
1421 J=619,606 SEC=BEAM NSEG=4 ANG=0
1422 J=605,620 SEC=BEAM NSEG=4 ANG=0
1423 J=620,621 SEC=BEAM NSEG=4 ANG=0
1424 J=621,622 SEC=BEAM NSEG=4 ANG=0
1425 J=622,623 SEC=BEAM NSEG=4 ANG=0
1426 J=624,625 SEC=BEAM NSEG=4 ANG=0
1427 J=625,598 SEC=BEAM NSEG=4 ANG=0
1428 J=600,626 SEC=BEAM NSEG=4 ANG=0
1429 J=626,627 SEC=BEAM NSEG=4 ANG=0
1430 J=627,621 SEC=BEAM NSEG=4 ANG=0
1431 J=604,627 SEC=BEAM NSEG=4 ANG=0
1432 J=627,623 SEC=BEAM NSEG=4 ANG=0
1433 J=623,628 SEC=BEAM NSEG=4 ANG=0
1434 J=628,629 SEC=BEAM NSEG=4 ANG=0
1435 J=629,630 SEC=BEAM NSEG=4 ANG=0
1436 J=630,631 SEC=BEAM NSEG=4 ANG=0
1437 J=631,590 SEC=BEAM NSEG=4 ANG=0
1438 J=592,632 SEC=BEAM NSEG=4 ANG=0
1439 J=632,633 SEC=BEAM NSEG=4 ANG=0
1440 J=633,634 SEC=BEAM NSEG=4 ANG=0
1441 J=634,625 SEC=BEAM NSEG=4 ANG=0
1442 J=625,626 SEC=BEAM NSEG=4 ANG=0
1443 J=626,602 SEC=BEAM NSEG=4 ANG=0
1444 J=597,635 SEC=BEAM NSEG=4 ANG=0
1445 J=635,634 SEC=BEAM NSEG=4 ANG=0
1446 J=634,628 SEC=BEAM NSEG=4 ANG=0
1447 J=621,619 SEC=BEAM NSEG=4 ANG=0
1448 J=619,609 SEC=BEAM NSEG=4 ANG=0
1449 J=609,584 SEC=BEAM NSEG=4 ANG=0
1450 J=582,610 SEC=BEAM NSEG=4 ANG=0

1451 J=610,617 SEC=BEAM
NSEG=4 ANG=0
1452 J=581,636 SEC=BEAM
NSEG=4 ANG=0
1453 J=636,611 SEC=BEAM
NSEG=4 ANG=0
1454 J=611,616 SEC=BEAM
NSEG=4 ANG=0
1455 J=580,612 SEC=BEAM
NSEG=4 ANG=0
1456 J=612,637 SEC=BEAM
NSEG=4 ANG=0
1457 J=637,615 SEC=BEAM
NSEG=4 ANG=0
1458 J=615,638 SEC=BEAM
NSEG=4 ANG=0
1459 J=638,629 SEC=BEAM
NSEG=4 ANG=0
1460 J=629,633 SEC=BEAM
NSEG=4 ANG=0
1461 J=633,596 SEC=BEAM
NSEG=4 ANG=0
1462 J=617,622 SEC=BEAM
NSEG=4 ANG=0
1463 J=578,613 SEC=BEAM
NSEG=4 ANG=0
1464 J=613,614 SEC=BEAM
NSEG=4 ANG=0
1465 J=614,639 SEC=BEAM
NSEG=4 ANG=0
1466 J=639,631 SEC=BEAM
NSEG=4 ANG=0
1467 J=631,632 SEC=BEAM
NSEG=4 ANG=0
1468 J=632,594 SEC=BEAM
NSEG=4 ANG=0
1469 J=589,640 SEC=BEAM
NSEG=4 ANG=0
1470 J=639,638 SEC=BEAM
NSEG=4 ANG=0
1471 J=640,639 SEC=BEAM
NSEG=4 ANG=0
1472 J=623,624 SEC=BEAM
NSEG=4 ANG=0
1473 J=577,513 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1474 J=578,514 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1475 J=579,515 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1476 J=580,516 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1477 J=522,586 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1478 J=587,523 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1479 J=613,549 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1480 J=588,524 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1481 J=612,548 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1482 J=581,517 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1483 J=636,572 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1484 J=611,547 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1485 J=637,573 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1486 J=615,551 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1487 J=589,525 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1488 J=614,550 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1489 J=640,576 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1490 J=526,590 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1491 J=591,527 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1492 J=592,528 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1493 J=593,529 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1494 J=639,575 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1495 J=631,567 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1496 J=632,568 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1497 J=594,530 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1498 J=630,566 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1499 J=629,565 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1500 J=633,569 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1501 J=595,531 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1502 J=596,532 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1503 J=638,574 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1504 J=616,552 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1505 J=582,518 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1506 J=583,519 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1507 J=584,520 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1508 J=585,521 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1509 J=608,544 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1510 J=543,607 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1511 J=545,609 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1512 J=546,610 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1513 J=617,553 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1514 J=618,554 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1515 J=619,555 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1516 J=622,558 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1517 J=628,564 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1518 J=542,606 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1519 J=541,605 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1520 J=533,597 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1521 J=571,635 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1522 J=570,634 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1523 J=598,534 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1524 J=599,535 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1525 J=600,536 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1526 J=601,537 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1527 J=602,538 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1528 J=603,539 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1529 J=604,540 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1530 J=626,562 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1531 J=623,559 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1532 J=624,560 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1533 J=625,561 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1534 J=621,557 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1535 J=620,556 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1536 J=627,563 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1537 J=641,642 SEC=BEAM
NSEG=4 ANG=0
1538 J=642,643 SEC=BEAM
NSEG=4 ANG=0
1539 J=643,644 SEC=BEAM
NSEG=4 ANG=0
1540 J=644,645 SEC=BEAM
NSEG=4 ANG=0
1541 J=645,646 SEC=BEAM
NSEG=4 ANG=0
1542 J=646,647 SEC=BEAM
NSEG=4 ANG=0
1543 J=647,648 SEC=BEAM
NSEG=4 ANG=0
1544 J=648,649 SEC=BEAM
NSEG=4 ANG=0
1545 J=641,650 SEC=BEAM
NSEG=4 ANG=0
1546 J=650,651 SEC=BEAM
NSEG=4 ANG=0
1547 J=651,652 SEC=BEAM
NSEG=4 ANG=0
1548 J=652,653 SEC=BEAM
NSEG=4 ANG=0
1549 J=653,654 SEC=BEAM
NSEG=4 ANG=0
1550 J=654,655 SEC=BEAM
NSEG=4 ANG=0
1551 J=655,656 SEC=BEAM
NSEG=4 ANG=0
1552 J=657,658 SEC=BEAM
NSEG=4 ANG=0
1553 J=656,657 SEC=BEAM
NSEG=4 ANG=0
1554 J=658,659 SEC=BEAM
NSEG=4 ANG=0
1555 J=659,660 SEC=BEAM
NSEG=4 ANG=0
1556 J=660,661 SEC=BEAM
NSEG=4 ANG=0
1557 J=661,662 SEC=BEAM
NSEG=4 ANG=0
1558 J=662,663 SEC=BEAM
NSEG=4 ANG=0
1559 J=663,664 SEC=BEAM
NSEG=4 ANG=0
1560 J=664,665 SEC=BEAM
NSEG=4 ANG=0
1561 J=665,666 SEC=BEAM
NSEG=4 ANG=0
1562 J=666,667 SEC=BEAM
NSEG=4 ANG=0
1563 J=667,668 SEC=BEAM
NSEG=4 ANG=0
1564 J=668,669 SEC=BEAM
NSEG=4 ANG=0
1565 J=669,670 SEC=BEAM
NSEG=4 ANG=0
1566 J=670,671 SEC=BEAM
NSEG=4 ANG=0
1567 J=671,672 SEC=BEAM
NSEG=4 ANG=0
1568 J=672,649 SEC=BEAM
NSEG=4 ANG=0
1569 J=672,673 SEC=BEAM
NSEG=4 ANG=0
1570 J=673,674 SEC=BEAM
NSEG=4 ANG=0
1571 J=674,675 SEC=BEAM
NSEG=4 ANG=0
1572 J=675,676 SEC=BEAM
NSEG=4 ANG=0
1573 J=676,677 SEC=BEAM
NSEG=4 ANG=0
1574 J=677,650 SEC=BEAM
NSEG=4 ANG=0
1575 J=652,678 SEC=BEAM
NSEG=4 ANG=0
1576 J=678,679 SEC=BEAM
NSEG=4 ANG=0
1577 J=679,680 SEC=BEAM
NSEG=4 ANG=0
1578 J=680,681 SEC=BEAM
NSEG=4 ANG=0
1579 J=681,682 SEC=BEAM
NSEG=4 ANG=0
1580 J=682,683 SEC=BEAM
NSEG=4 ANG=0
1581 J=683,670 SEC=BEAM
NSEG=4 ANG=0
1582 J=669,684 SEC=BEAM
NSEG=4 ANG=0
1583 J=684,685 SEC=BEAM
NSEG=4 ANG=0
1584 J=685,686 SEC=BEAM
NSEG=4 ANG=0
1585 J=686,687 SEC=BEAM
NSEG=4 ANG=0
1586 J=688,689 SEC=BEAM
NSEG=4 ANG=0
1587 J=689,662 SEC=BEAM
NSEG=4 ANG=0
1588 J=664,690 SEC=BEAM
NSEG=4 ANG=0
1589 J=690,691 SEC=BEAM
NSEG=4 ANG=0
1590 J=691,685 SEC=BEAM
NSEG=4 ANG=0
1591 J=668,691 SEC=BEAM
NSEG=4 ANG=0
1592 J=691,687 SEC=BEAM
NSEG=4 ANG=0
1593 J=687,692 SEC=BEAM
NSEG=4 ANG=0
1594 J=692,693 SEC=BEAM
NSEG=4 ANG=0
1595 J=693,694 SEC=BEAM
NSEG=4 ANG=0
1596 J=694,695 SEC=BEAM
NSEG=4 ANG=0
1597 J=695,654 SEC=BEAM
NSEG=4 ANG=0
1598 J=656,696 SEC=BEAM
NSEG=4 ANG=0
1599 J=696,697 SEC=BEAM
NSEG=4 ANG=0
1600 J=697,698 SEC=BEAM
NSEG=4 ANG=0
1601 J=698,689 SEC=BEAM
NSEG=4 ANG=0
1602 J=689,690 SEC=BEAM
NSEG=4 ANG=0
1603 J=690,666 SEC=BEAM
NSEG=4 ANG=0
1604 J=661,699 SEC=BEAM
NSEG=4 ANG=0
1605 J=699,698 SEC=BEAM
NSEG=4 ANG=0

```
1606 J=698,692 SEC=BEAM
NSEG=4 ANG=0
1607 J=685,683 SEC=BEAM
NSEG=4 ANG=0
1608 J=683,673 SEC=BEAM
NSEG=4 ANG=0
1609 J=673,648 SEC=BEAM
NSEG=4 ANG=0
1610 J=646,674 SEC=BEAM
NSEG=4 ANG=0
1611 J=674,681 SEC=BEAM
NSEG=4 ANG=0
1612 J=645,700 SEC=BEAM
NSEG=4 ANG=0
1613 J=700,675 SEC=BEAM
NSEG=4 ANG=0
1614 J=675,680 SEC=BEAM
NSEG=4 ANG=0
1615 J=644,676 SEC=BEAM
NSEG=4 ANG=0
1616 J=676,701 SEC=BEAM
NSEG=4 ANG=0
1617 J=701,679 SEC=BEAM
NSEG=4 ANG=0
1618 J=679,702 SEC=BEAM
NSEG=4 ANG=0
1619 J=702,693 SEC=BEAM
NSEG=4 ANG=0
1620 J=693,697 SEC=BEAM
NSEG=4 ANG=0
1621 J=697,660 SEC=BEAM
NSEG=4 ANG=0
1622 J=681,686 SEC=BEAM
NSEG=4 ANG=0
1623 J=642,677 SEC=BEAM
NSEG=4 ANG=0
1624 J=677,678 SEC=BEAM
NSEG=4 ANG=0
1625 J=678,703 SEC=BEAM
NSEG=4 ANG=0
1626 J=703,695 SEC=BEAM
NSEG=4 ANG=0
1627 J=695,696 SEC=BEAM
NSEG=4 ANG=0
1628 J=696,658 SEC=BEAM
NSEG=4 ANG=0
1629 J=653,704 SEC=BEAM
NSEG=4 ANG=0
1630 J=703,702 SEC=BEAM
NSEG=4 ANG=0
1631 J=704,703 SEC=BEAM
NSEG=4 ANG=0
1632 J=687,688 SEC=BEAM
NSEG=4 ANG=0
1633 J=641,577 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1634 J=642,578 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1635 J=643,579 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1636 J=644,580 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1637 J=586,650 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1638 J=651,587 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1639 J=677,613 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1640 J=652,588 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1641 J=676,612 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1642 J=645,581 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1643 J=700,636 SEC=8X8
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1644 J=675,611 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1645 J=701,637 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1646 J=679,615 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1647 J=653,589 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1648 J=678,614 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1649 J=704,640 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1650 J=590,654 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1651 J=655,591 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1652 J=656,592 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1653 J=657,593 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1654 J=703,639 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1655 J=695,631 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1656 J=696,632 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1657 J=658,594 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1658 J=694,630 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1659 J=693,629 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1660 J=697,633 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1661 J=659,595 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1662 J=660,596 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1663 J=702,638 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1664 J=680,616 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1665 J=646,582 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1666 J=647,583 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1667 J=648,584 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1668 J=649,585 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1669 J=672,608 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1670 J=607,671 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1671 J=609,673 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1672 J=610,674 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1673 J=681,617 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1674 J=682,618 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1675 J=683,619 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1676 J=686,622 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1677 J=692,628 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1678 J=606,670 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1679 J=605,669 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1680 J=597,661 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1681 J=635,699 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1682 J=634,698 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1683 J=662,598 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1684 J=663,599 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1685 J=664,600 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1686 J=665,601 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1687 J=666,602 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1688 J=667,603 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1689 J=668,604 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1690 J=690,626 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1691 J=687,623 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1692 J=688,624 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1693 J=689,625 SEC=14X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1694 J=685,621 SEC=14X16
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3
1695 J=684,620 SEC=8X8 NSEG=2
ANG=0 IREL=R2,R3 JREL=R2,R3
1696 J=691,627 SEC=12X14
NSEG=2 ANG=0 IREL=R2,R3
JREL=R2,R3

SHELL
1 J=75,11,74,10 SEC=73SHRS
2 J=66,2,67,3 SEC=73SHRS
3 J=103,39,125,61 SEC=96SHRS
4 J=103,39,104,40 SEC=96SHRS
5 J=100,36,99,35 SEC=045SHRS
6 J=99,35,124,60 SEC=73SHRS
7 J=71,7,72,8 SEC=73SHRS
8 J=95,31,96,32 SEC=73SHRS
9 J=110,46,105,41 SEC=96SHRS
10 J=105,41,106,42 SEC=96SHRS
11 J=108,109,44,45 SEC=73SHRS
12 J=109,45,107,43 SEC=045SHRS
13 J=90,26,91,27 SEC=73SHRS
14 J=88,87,24,23 SEC=73SHRS
15 J=123,59,122,58 SEC=73SHRS
16 J=122,58,113,49 SEC=045SHRS
17 J=112,48,111,47 SEC=96SHRS
18 J=47,111,52,116 SEC=96SHRS
19 J=82,18,83,19 SEC=73SHRS
20 J=80,16,79,15 SEC=73SHRS
21 J=128,64,127,63 SEC=73SHRS
22 J=63,127,55,119 SEC=045SHRS
23 J=118,54,117,53 SEC=96SHRS
24 J=117,53,126,62 SEC=96SHRS
25 J=139,75,138,74 SEC=73SHRS
26 J=130,66,131,67 SEC=73SHRS
27 J=167,103,189,125 SEC=96SHRS
28 J=167,103,168,104 SEC=96SHRS
29 J=164,100,163,99 SEC=045SHRS
30 J=163,99,188,124 SEC=73SHRS
31 J=135,71,136,72 SEC=73SHRS
32 J=159,95,160,96 SEC=73SHRS
33 J=174,110,169,105 SEC=96SHRS
34 J=169,105,170,106 SEC=96SHRS
35 J=172,173,108,109 SEC=73SHRS
36 J=173,109,171,107
SEC=045SHRS
37 J=154,90,155,91 SEC=73SHRS
38 J=152,151,88,87
SEC=73SHRS
39 J=187,123,186,122
SEC=73SHRS
40 J=186,122,177,113
SEC=045SHRS
41 J=176,112,175,111
SEC=96SHRS
42 J=111,175,116,180
SEC=96SHRS
43 J=146,82,147,83
SEC=73SHRS
44 J=144,80,143,79
SEC=73SHRS
45 J=192,128,191,127
SEC=73SHRS
46 J=127,191,119,183
SEC=045SHRS
47 J=182,118,181,117
SEC=96SHRS
48 J=181,117,190,126
SEC=96SHRS
49 J=129,130,138,165
SEC=FLOORS
50 J=130,132,165,164
SEC=FLOORS
51 J=132,133,164,163
SEC=FLOORS
52 J=133,134,163,162
SEC=FLOORS
53 J=134,136,162,161
SEC=FLOORS
54 J=136,137,161,160
SEC=FLOORS
55 J=173,171,157,158
SEC=FLOORS
56 J=173,157,179,156
SEC=FLOORS
57 J=171,161,158,160
SEC=FLOORS
58 J=179,156,178,154
SEC=FLOORS
59 J=154,153,178,152
SEC=FLOORS
60 J=152,150,178,177
SEC=FLOORS
61 J=178,177,179,175
SEC=FLOORS
62 J=179,175,173,174
SEC=FLOORS
63 J=174,169,173,171
SEC=FLOORS
64 J=169,162,171,161
SEC=FLOORS
65 J=163,162,168,169
SEC=FLOORS
66 J=164,163,167,168
SEC=FLOORS
67 J=164,167,165,166
SEC=FLOORS
68 J=165,166,138,140
SEC=FLOORS
69 J=140,166,141,191
SEC=FLOORS
70 J=166,167,191,190
SEC=FLOORS
71 J=190,181,191,183
SEC=FLOORS
72 J=191,183,141,142
SEC=FLOORS
73 J=142,183,144,184
SEC=FLOORS
74 J=183,181,184,185
SEC=FLOORS
75 J=181,180,185,186
SEC=FLOORS
76 J=180,175,186,177
SEC=FLOORS
77 J=177,150,186,149
SEC=FLOORS
78 J=186,149,185,148
SEC=FLOORS
79 J=148,146,185,184
SEC=FLOORS
80 J=184,146,144,145
SEC=FLOORS
81 J=129,65,130,66
SEC=FACADE
82 J=131,67,132,68
SEC=FACADE
```

83 J=68,69,132,133
SEC=FACADE
84 J=133,69,134,70
SEC=FACADE
85 J=70,71,134,135
SEC=FACADE
86 J=72,73,136,137
SEC=FACADE
93 J=203,139,202,138
SEC=73SHRS
94 J=194,130,195,131
SEC=73SHRS
95 J=231,167,253,189
SEC=96SHRS
96 J=231,167,232,168
SEC=96SHRS
97 J=228,164,227,163
SEC=045SHRS
98 J=227,163,252,188
SEC=73SHRS
99 J=65,1,66,2
SEC=FACADE
100 J=67,3,68,4
SEC=FACADE
101 J=4,5,68,69
SEC=FACADE
102 J=69,5,70,6
SEC=FACADE
103 J=6,7,70,71
SEC=FACADE
104 J=8,9,72,73
SEC=FACADE
105 J=199,135,200,136
SEC=73SHRS
106 J=223,159,224,160
SEC=73SHRS
107 J=238,174,233,169
SEC=96SHRS
108 J=233,169,234,170
SEC=96SHRS
109 J=236,237,172,173
SEC=73SHRS
110 J=237,173,235,171
SEC=045SHRS
111 J=218,154,219,155
SEC=73SHRS
112 J=216,215,152,151
SEC=73SHRS
113 J=251,187,250,186
SEC=73SHRS
114 J=250,186,241,177
SEC=045SHRS
115 J=240,176,239,175
SEC=96SHRS
116 J=175,239,180,244
SEC=96SHRS
117 J=210,146,211,147
SEC=73SHRS
118 J=208,144,207,143
SEC=73SHRS
119 J=256,192,255,191
SEC=73SHRS
120 J=191,255,183,247
SEC=045SHRS
121 J=246,182,245,181
SEC=96SHRS
122 J=245,181,254,190
SEC=96SHRS
123 J=193,194,202,229
SEC=FLOORS
124 J=194,196,229,228
SEC=FLOORS
125 J=196,197,228,227
SEC=FLOORS
126 J=197,198,227,226
SEC=FLOORS
127 J=198,200,226,225
SEC=FLOORS
128 J=200,201,225,224
SEC=FLOORS
129 J=237,235,221,222
SEC=FLOORS
130 J=237,221,243,220
SEC=FLOORS
131 J=235,225,222,224
SEC=FLOORS
132 J=243,220,242,218
SEC=FLOORS
133 J=218,217,242,216
SEC=FLOORS
134 J=216,214,242,241
SEC=FLOORS
135 J=242,241,243,239
SEC=FLOORS
136 J=243,239,237,238
SEC=FLOORS
137 J=238,233,237,235
SEC=FLOORS
138 J=233,226,235,225
SEC=FLOORS
139 J=227,226,232,233
SEC=FLOORS
140 J=228,227,231,232
SEC=FLOORS
141 J=228,231,229,230
SEC=FLOORS
142 J=229,230,202,204
SEC=FLOORS
143 J=204,230,205,255
SEC=FLOORS
144 J=230,231,255,254
SEC=FLOORS
145 J=254,245,255,247
SEC=FLOORS
146 J=255,247,205,206
SEC=FLOORS
147 J=206,247,208,248
SEC=FLOORS
148 J=247,245,248,249
SEC=FLOORS
149 J=245,244,249,250
SEC=FLOORS
150 J=244,239,250,241
SEC=FLOORS
151 J=241,214,250,213
SEC=FLOORS
152 J=250,213,249,212
SEC=FLOORS
153 J=212,210,249,248
SEC=FLOORS
154 J=248,210,208,209
SEC=FLOORS
155 J=193,129,194,130
SEC=FACADE
156 J=195,131,196,132
SEC=FACADE
157 J=132,133,196,197
SEC=FACADE
158 J=197,133,198,134
SEC=FACADE
159 J=134,135,198,199
SEC=FACADE
160 J=136,137,200,201
SEC=FACADE
167 J=267,203,266,202
SEC=73SHRS
168 J=258,194,259,195
SEC=73SHRS
169 J=295,231,317,253
SEC=96SHRS
170 J=295,231,296,232
SEC=96SHRS
171 J=292,228,291,227
SEC=045SHRS
172 J=291,227,316,252
SEC=73SHRS
173 J=263,199,264,200
SEC=73SHRS
174 J=287,223,288,224
SEC=73SHRS
175 J=302,238,297,233
SEC=96SHRS
176 J=297,233,298,234
SEC=96SHRS
177 J=300,301,236,237
SEC=73SHRS
178 J=301,237,299,235
SEC=045SHRS
179 J=282,218,283,219
SEC=73SHRS
180 J=280,279,216,215
SEC=73SHRS
181 J=315,251,314,250
SEC=73SHRS
182 J=314,250,305,241
SEC=045SHRS
183 J=304,240,303,239
SEC=96SHRS
184 J=239,303,244,308
SEC=96SHRS
185 J=274,210,275,211
SEC=73SHRS
186 J=272,208,271,207
SEC=73SHRS
187 J=320,256,319,255
SEC=73SHRS
188 J=255,319,247,311
SEC=045SHRS
189 J=310,246,309,245
SEC=96SHRS
190 J=309,245,318,254
SEC=96SHRS
191 J=257,258,266,293
SEC=FLOORS
192 J=258,260,293,292
SEC=FLOORS
193 J=260,261,292,291
SEC=FLOORS
194 J=261,262,291,290
SEC=FLOORS
195 J=262,264,290,289
SEC=FLOORS
196 J=264,265,289,288
SEC=FLOORS
197 J=301,299,285,286
SEC=FLOORS
198 J=301,285,307,284
SEC=FLOORS
199 J=299,289,286,288
SEC=FLOORS
200 J=307,284,306,282
SEC=FLOORS
201 J=282,281,306,280
SEC=FLOORS
202 J=280,278,306,305
SEC=FLOORS
203 J=306,305,307,303
SEC=FLOORS
204 J=307,303,301,302
SEC=FLOORS
205 J=302,297,301,299
SEC=FLOORS
206 J=297,290,299,289
SEC=FLOORS
207 J=291,290,296,297
SEC=FLOORS
208 J=292,291,295,296
SEC=FLOORS
209 J=292,295,293,294
SEC=FLOORS
210 J=293,294,266,268
SEC=FLOORS
211 J=268,294,269,319
SEC=FLOORS
212 J=294,295,319,318
SEC=FLOORS
213 J=318,309,319,311
SEC=FLOORS
214 J=319,311,269,270
SEC=FLOORS
215 J=270,311,272,312
SEC=FLOORS
216 J=311,309,312,313
SEC=FLOORS
217 J=309,308,313,314
SEC=FLOORS
218 J=308,303,314,305
SEC=FLOORS
219 J=305,278,314,277
SEC=FLOORS
220 J=314,277,313,276
SEC=FLOORS
221 J=276,274,313,312
SEC=FLOORS
222 J=312,274,272,273
SEC=FLOORS
223 J=257,193,258,194
SEC=FACADE
224 J=259,195,260,196
SEC=FACADE
225 J=196,197,260,261
SEC=FACADE
226 J=261,197,262,198
SEC=FACADE
227 J=198,199,262,263
SEC=FACADE
228 J=200,201,264,265
SEC=FACADE
235 J=331,267,330,266
SEC=73SHRS
236 J=322,258,323,259
SEC=73SHRS
237 J=359,295,381,317
SEC=96SHRS
238 J=359,295,360,296
SEC=96SHRS
239 J=356,292,355,291
SEC=045SHRS
240 J=355,291,380,316
SEC=73SHRS
241 J=327,263,328,264
SEC=73SHRS
242 J=351,287,352,288
SEC=73SHRS
243 J=366,302,361,297
SEC=96SHRS
244 J=361,297,362,298
SEC=96SHRS
245 J=364,365,300,301
SEC=73SHRS
246 J=365,301,363,299
SEC=045SHRS
247 J=346,282,347,283
SEC=73SHRS
248 J=344,343,280,279
SEC=73SHRS
249 J=379,315,378,314
SEC=73SHRS
250 J=378,314,369,305
SEC=045SHRS
251 J=368,304,367,303
SEC=96SHRS
252 J=303,367,308,372
SEC=96SHRS
253 J=338,274,339,275
SEC=73SHRS
254 J=336,272,335,271
SEC=73SHRS
255 J=384,320,383,319
SEC=73SHRS
256 J=319,383,311,375
SEC=045SHRS
257 J=374,310,373,309
SEC=96SHRS
258 J=373,309,382,318
SEC=96SHRS
259 J=321,322,330,357
SEC=FLOORS
260 J=322,324,357,356
SEC=FLOORS
261 J=324,325,356,355
SEC=FLOORS
262 J=325,326,355,354
SEC=FLOORS
263 J=326,328,354,353
SEC=FLOORS
264 J=328,329,353,352
SEC=FLOORS
265 J=365,363,349,350
SEC=FLOORS
266 J=365,349,371,348
SEC=FLOORS
267 J=363,353,350,352
SEC=FLOORS
268 J=371,348,370,346
SEC=FLOORS
269 J=346,345,370,344
SEC=FLOORS
270 J=344,342,370,369
SEC=FLOORS
271 J=370,369,371,367
SEC=FLOORS
272 J=371,367,365,366
SEC=FLOORS
273 J=366,361,365,363
SEC=FLOORS
274 J=361,354,363,353
SEC=FLOORS
275 J=355,354,360,361
SEC=FLOORS
276 J=356,355,359,360
SEC=FLOORS
277 J=356,359,357,358
SEC=FLOORS
278 J=357,358,330,332
SEC=FLOORS
279 J=332,358,333,383
SEC=FLOORS
280 J=358,359,383,382
SEC=FLOORS

281 J=382,373,383,375
SEC=FLOORS
282 J=383,375,333,334
SEC=FLOORS
283 J=334,375,336,376
SEC=FLOORS
284 J=375,373,376,377
SEC=FLOORS
285 J=373,372,377,378
SEC=FLOORS
286 J=372,367,378,369
SEC=FLOORS
287 J=369,342,378,341
SEC=FLOORS
288 J=378,341,377,340
SEC=FLOORS
289 J=340,338,377,376
SEC=FLOORS
290 J=376,338,336,337
SEC=FLOORS
291 J=321,257,322,258
SEC=FACADE
292 J=323,259,324,260
SEC=FACADE
293 J=260,261,324,325
SEC=FACADE
294 J=325,261,326,262
SEC=FACADE
295 J=262,263,326,327
SEC=FACADE
296 J=264,265,328,329
SEC=FACADE
303 J=395,331,394,330
SEC=73SHRS
304 J=386,322,387,323
SEC=73SHRS
305 J=423,359,445,381
SEC=96SHRS
306 J=423,359,424,360
SEC=96SHRS
307 J=420,356,419,355
SEC=045SHRS
308 J=419,355,444,380
SEC=73SHRS
309 J=391,327,392,328
SEC=73SHRS
310 J=415,351,416,352
SEC=73SHRS
311 J=430,366,425,361
SEC=96SHRS
312 J=425,361,426,362
SEC=96SHRS
313 J=428,429,364,365
SEC=73SHRS
314 J=429,365,427,363
SEC=045SHRS
315 J=410,346,411,347
SEC=73SHRS
316 J=408,407,344,343
SEC=73SHRS
317 J=443,379,442,378
SEC=73SHRS
318 J=442,378,433,369
SEC=045SHRS
319 J=432,368,431,367
SEC=96SHRS
320 J=367,431,372,436
SEC=96SHRS
321 J=402,338,403,339
SEC=73SHRS
322 J=400,336,399,335
SEC=73SHRS
323 J=448,384,447,383
SEC=73SHRS
324 J=383,447,375,439
SEC=045SHRS
325 J=438,374,437,373
SEC=96SHRS
326 J=437,373,446,382
SEC=96SHRS
327 J=385,386,394,421
SEC=FLOORS
328 J=386,388,421,420
SEC=FLOORS
329 J=388,389,420,419
SEC=FLOORS
330 J=389,390,419,418
SEC=FLOORS
331 J=390,392,418,417
SEC=FLOORS
332 J=392,393,417,416
SEC=FLOORS
333 J=429,427,413,414
SEC=FLOORS
334 J=429,413,435,412
SEC=FLOORS
335 J=427,417,414,416
SEC=FLOORS
336 J=435,412,434,410
SEC=FLOORS
337 J=410,409,434,408
SEC=FLOORS
338 J=408,406,434,433
SEC=FLOORS
345 J=434,433,435,431
SEC=FLOORS
346 J=435,431,429,430
SEC=FLOORS
347 J=430,425,429,427
SEC=FLOORS
348 J=425,418,427,417
SEC=FLOORS
349 J=419,418,424,425
SEC=FLOORS
350 J=420,419,423,424
SEC=FLOORS
351 J=420,423,421,422
SEC=FLOORS
352 J=421,422,394,396
SEC=FLOORS
353 J=396,422,397,447
SEC=FLOORS
354 J=422,423,447,446
SEC=FLOORS
355 J=446,437,447,439
SEC=FLOORS
356 J=447,439,397,398
SEC=FLOORS
357 J=398,439,400,440
SEC=FLOORS
358 J=439,437,440,441
SEC=FLOORS
359 J=437,436,441,442
SEC=FLOORS
360 J=436,431,442,433
SEC=FLOORS
361 J=433,406,442,405
SEC=FLOORS
362 J=442,405,441,404
SEC=FLOORS
363 J=404,402,441,440
SEC=FLOORS
364 J=440,402,400,401
SEC=FLOORS
365 J=385,321,386,322
SEC=FACADE
366 J=387,323,388,324
SEC=FACADE
367 J=324,325,388,389
SEC=FACADE
368 J=389,325,390,326
SEC=FACADE
369 J=326,327,390,391
SEC=FACADE
370 J=328,329,392,393
SEC=FACADE
377 J=459,395,458,394
SEC=73SHRS
378 J=450,386,451,387
SEC=73SHRS
379 J=487,423,509,445
SEC=96SHRS
380 J=487,423,488,424
SEC=96SHRS
381 J=484,420,483,419
SEC=045SHRS
382 J=483,419,508,444
SEC=73SHRS
383 J=455,391,456,392
SEC=73SHRS
384 J=479,415,480,416
SEC=73SHRS
385 J=494,430,489,425
SEC=96SHRS
386 J=489,425,490,426
SEC=96SHRS
387 J=492,493,428,429
SEC=73SHRS
388 J=493,429,491,427
SEC=045SHRS
389 J=474,410,475,411
SEC=73SHRS
390 J=472,471,408,407
SEC=73SHRS
391 J=507,443,506,442
SEC=73SHRS
392 J=506,442,497,433
SEC=045SHRS
393 J=496,432,495,431
SEC=96SHRS
394 J=431,495,436,500
SEC=96SHRS
395 J=466,402,467,403
SEC=73SHRS
396 J=464,400,463,399
SEC=73SHRS
397 J=512,448,511,447
SEC=73SHRS
398 J=447,511,439,503
SEC=045SHRS
399 J=502,438,501,437
SEC=96SHRS
400 J=501,437,510,446
SEC=96SHRS
401 J=449,450,458,485
SEC=FLOORS
402 J=450,452,485,484
SEC=FLOORS
403 J=452,453,484,483
SEC=FLOORS
404 J=453,454,483,482
SEC=FLOORS
405 J=454,456,482,481
SEC=FLOORS
406 J=456,457,481,480
SEC=FLOORS
407 J=493,491,477,478
SEC=FLOORS
408 J=493,477,499,476
SEC=FLOORS
409 J=491,481,478,480
SEC=FLOORS
410 J=499,476,498,474
SEC=FLOORS
411 J=474,473,498,472
SEC=FLOORS
412 J=472,470,498,497
SEC=FLOORS
413 J=498,497,499,495
SEC=FLOORS
414 J=499,495,493,494
SEC=FLOORS
415 J=494,489,493,491
SEC=FLOORS
416 J=489,482,491,481
SEC=FLOORS
417 J=483,482,488,489
SEC=FLOORS
418 J=484,483,487,488
SEC=FLOORS
419 J=484,487,485,486
SEC=FLOORS
420 J=485,486,458,460
SEC=FLOORS
421 J=460,486,461,511
SEC=FLOORS
422 J=486,487,511,510
SEC=FLOORS
423 J=510,501,511,503
SEC=FLOORS
424 J=511,503,461,462
SEC=FLOORS
425 J=462,503,464,504
SEC=FLOORS
426 J=503,501,504,505
SEC=FLOORS
427 J=501,500,505,506
SEC=FLOORS
428 J=500,495,506,497
SEC=FLOORS
429 J=497,470,506,469
SEC=FLOORS
430 J=506,469,505,468
SEC=FLOORS
431 J=468,466,505,504
SEC=FLOORS
432 J=504,466,464,465
SEC=FLOORS
433 J=1,2,10,37 SEC=FLOORS
434 J=2,4,37,36 SEC=FLOORS
435 J=4,5,36,35 SEC=FLOORS
436 J=5,6,35,34
SEC=FLOORS
437 J=6,8,34,33
SEC=FLOORS
438 J=8,9,33,32
SEC=FLOORS
439 J=45,43,29,30
SEC=FLOORS
440 J=45,29,51,28
SEC=FLOORS
441 J=43,33,30,32
SEC=FLOORS
442 J=51,28,50,26
SEC=FLOORS
443 J=449,385,450,386
SEC=FACADE
444 J=451,387,452,388
SEC=FACADE
445 J=26,25,50,24
SEC=FLOORS
446 J=24,22,50,49
SEC=FLOORS
447 J=50,49,51,47
SEC=FLOORS
448 J=51,47,45,46
SEC=FLOORS
449 J=46,41,45,43
SEC=FLOORS
450 J=41,34,43,33
SEC=FLOORS
451 J=35,34,40,41
SEC=FLOORS
452 J=36,35,39,40
SEC=FLOORS
453 J=36,39,37,38
SEC=FLOORS
454 J=37,38,10,12
SEC=FLOORS
455 J=12,38,13,63
SEC=FLOORS
456 J=38,39,63,62
SEC=FLOORS
457 J=62,53,63,55
SEC=FLOORS
458 J=63,55,13,14
SEC=FLOORS
459 J=14,55,16,56
SEC=FLOORS
460 J=55,53,56,57
SEC=FLOORS
461 J=53,52,57,58
SEC=FLOORS
462 J=52,47,58,49
SEC=FLOORS
463 J=49,22,58,21
SEC=FLOORS
464 J=58,21,57,20
SEC=FLOORS
465 J=20,18,57,56
SEC=FLOORS
466 J=56,18,16,17
SEC=FLOORS
467 J=65,66,74,101
SEC=FLOORS
468 J=66,68,101,100
SEC=FLOORS
469 J=68,69,100,99
SEC=FLOORS
470 J=69,70,99,98
SEC=FLOORS
471 J=70,72,98,97
SEC=FLOORS
472 J=72,73,97,96
SEC=FLOORS
473 J=109,107,93,94
SEC=FLOORS
474 J=109,93,115,92
SEC=FLOORS
475 J=107,97,94,96
SEC=FLOORS
476 J=115,92,114,90
SEC=FLOORS
477 J=90,89,114,88
SEC=FLOORS
478 J=88,86,114,113
SEC=FLOORS
479 J=114,113,115,111
SEC=FLOORS
480 J=115,111,109,110
SEC=FLOORS

481 J=110,105,109,107
SEC=FLOORS
482 J=105,98,107,97
SEC=FLOORS
483 J=99,98,104,105
SEC=FLOORS
484 J=100,99,103,104
SEC=FLOORS
485 J=100,103,101,102
SEC=FLOORS
486 J=101,102,74,76
SEC=FLOORS
487 J=76,102,77,127
SEC=FLOORS
488 J=102,103,127,126
SEC=FLOORS
489 J=126,117,127,119
SEC=FLOORS
490 J=127,119,77,78
SEC=FLOORS
491 J=78,119,80,120
SEC=FLOORS
492 J=119,117,120,121
SEC=FLOORS
493 J=117,116,121,122
SEC=FLOORS
494 J=116,111,122,113
SEC=FLOORS
495 J=113,86,122,85
SEC=FLOORS
496 J=122,85,121,84
SEC=FLOORS
497 J=84,82,121,120
SEC=FLOORS
498 J=120,82,80,81
SEC=FLOORS
499 J=388,389,452,453
SEC=FACADE
500 J=453,389,454,390
SEC=FACADE
501 J=390,391,454,455
SEC=FACADE
502 J=392,393,456,457
SEC=FACADE
509 J=523,459,522,458
SEC=73SHRS
510 J=514,450,515,451
SEC=73SHRS
511 J=551,487,573,509
SEC=96SHRS
512 J=551,487,552,488
SEC=96SHRS
513 J=548,484,547,483
SEC=045SHRS
514 J=547,483,572,508
SEC=73SHRS
515 J=519,455,520,456
SEC=73SHRS
516 J=543,479,544,480
SEC=73SHRS
517 J=558,494,553,489
SEC=96SHRS
518 J=553,489,554,490
SEC=96SHRS
519 J=556,557,492,493
SEC=73SHRS
520 J=557,493,555,491
SEC=045SHRS
521 J=538,474,539,475
SEC=73SHRS
522 J=536,535,472,471
SEC=73SHRS
523 J=571,507,570,506
SEC=73SHRS
524 J=570,506,561,497
SEC=045SHRS
525 J=560,496,559,495
SEC=96SHRS
526 J=495,559,500,564
SEC=96SHRS
527 J=530,466,531,467
SEC=73SHRS
528 J=528,464,527,463
SEC=73SHRS
529 J=576,512,575,511
SEC=73SHRS
530 J=511,575,503,567
SEC=045SHRS
531 J=566,502,565,501
SEC=96SHRS
532 J=565,501,574,510
SEC=96SHRS
533 J=513,514,522,549
SEC=FLOORS
534 J=514,516,549,548
SEC=FLOORS
535 J=516,517,548,547
SEC=FLOORS
536 J=517,518,547,546
SEC=FLOORS
537 J=518,520,546,545
SEC=FLOORS
538 J=520,521,545,544
SEC=FLOORS
539 J=557,555,541,542
SEC=FLOORS
540 J=557,541,563,540
SEC=FLOORS
541 J=555,545,542,544
SEC=FLOORS
542 J=563,540,562,538
SEC=FLOORS
543 J=538,537,562,536
SEC=FLOORS
544 J=536,534,562,561
SEC=FLOORS
545 J=562,561,563,559
SEC=FLOORS
546 J=563,559,557,558
SEC=FLOORS
547 J=558,553,557,555
SEC=FLOORS
548 J=553,546,555,545
SEC=FLOORS
549 J=547,546,552,553
SEC=FLOORS
550 J=548,547,551,552
SEC=FLOORS
551 J=548,551,549,550
SEC=FLOORS
552 J=549,550,522,524
SEC=FLOORS
553 J=524,550,525,575
SEC=FLOORS
554 J=550,551,575,574
SEC=FLOORS
555 J=574,565,575,567
SEC=FLOORS
556 J=575,567,525,526
SEC=FLOORS
557 J=526,567,528,568
SEC=FLOORS
558 J=567,565,568,569
SEC=FLOORS
559 J=565,564,569,570
SEC=FLOORS
560 J=564,559,570,561
SEC=FLOORS
561 J=561,534,570,533
SEC=FLOORS
562 J=570,533,569,532
SEC=FLOORS
563 J=532,530,569,568
SEC=FLOORS
564 J=568,530,528,529
SEC=FLOORS
565 J=513,449,514,450
SEC=FACADE
566 J=515,451,516,452
SEC=FACADE
567 J=452,453,516,517
SEC=FACADE
568 J=517,453,518,454
SEC=FACADE
569 J=454,455,518,519
SEC=FACADE
570 J=456,457,520,521
SEC=FACADE
577 J=587,523,586,522
SEC=73SHRS
578 J=578,514,579,515
SEC=73SHRS
579 J=615,551,637,573
SEC=96SHRS
580 J=615,551,616,552
SEC=96SHRS
581 J=612,548,611,547
SEC=045SHRS
582 J=611,547,636,572
SEC=73SHRS
583 J=583,519,584,520
SEC=73SHRS
584 J=607,543,608,544
SEC=73SHRS
585 J=622,558,617,553
SEC=96SHRS
586 J=617,553,618,554
SEC=96SHRS
587 J=620,621,556,557
SEC=73SHRS
588 J=621,557,619,555
SEC=045SHRS
589 J=602,538,603,539
SEC=73SHRS
590 J=600,599,536,535
SEC=73SHRS
591 J=635,571,634,570
SEC=73SHRS
592 J=634,570,625,561
SEC=045SHRS
593 J=624,560,623,559
SEC=96SHRS
594 J=559,623,564,628
SEC=96SHRS
595 J=594,530,595,531
SEC=73SHRS
596 J=592,528,591,527
SEC=73SHRS
597 J=640,576,639,575
SEC=73SHRS
598 J=575,639,567,631
SEC=045SHRS
599 J=630,566,629,565
SEC=96SHRS
600 J=629,565,638,574
SEC=96SHRS
601 J=577,578,586,613
SEC=FLOORS
602 J=578,580,613,612
SEC=FLOORS
603 J=580,581,612,611
SEC=FLOORS
604 J=581,582,611,610
SEC=FLOORS
605 J=582,584,610,609
SEC=FLOORS
606 J=584,585,609,608
SEC=FLOORS
607 J=621,619,605,606
SEC=FLOORS
608 J=621,605,627,604
SEC=FLOORS
609 J=619,609,606,608
SEC=FLOORS
610 J=627,604,626,602
SEC=FLOORS
611 J=602,601,626,600
SEC=FLOORS
612 J=600,598,626,625
SEC=FLOORS
613 J=626,625,627,623
SEC=FLOORS
614 J=627,623,621,622
SEC=FLOORS
615 J=622,617,621,619
SEC=FLOORS
616 J=617,610,619,609
SEC=FLOORS
617 J=611,610,616,617
SEC=FLOORS
618 J=612,611,615,616
SEC=FLOORS
619 J=612,615,613,614
SEC=FLOORS
620 J=613,614,586,588
SEC=FLOORS
621 J=588,614,589,639
SEC=FLOORS
622 J=614,615,639,638
SEC=FLOORS
623 J=638,629,639,631
SEC=FLOORS
624 J=639,631,589,590
SEC=FLOORS
625 J=590,631,592,632
SEC=FLOORS
626 J=631,629,632,633
SEC=FLOORS
627 J=629,628,633,634
SEC=FLOORS
628 J=628,623,634,625
SEC=FLOORS
629 J=625,598,634,597
SEC=FLOORS
630 J=634,597,633,596
SEC=FLOORS
631 J=596,594,633,632
SEC=FLOORS
632 J=632,594,592,593
SEC=FLOORS
633 J=577,513,578,514
SEC=FACADE
634 J=579,515,580,516
SEC=FACADE
635 J=516,517,580,581
SEC=FACADE
636 J=581,517,582,518
SEC=FACADE
637 J=518,519,582,583
SEC=FACADE
638 J=520,521,584,585
SEC=FACADE
645 J=651,587,650,586
SEC=73SHRS
646 J=642,578,643,579
SEC=73SHRS
647 J=679,615,701,637
SEC=96SHRS
648 J=679,615,680,616
SEC=96SHRS
649 J=676,612,675,611
SEC=045SHRS
650 J=675,611,700,636
SEC=73SHRS
651 J=647,583,648,584
SEC=73SHRS
652 J=671,607,672,608
SEC=73SHRS
653 J=686,622,681,617
SEC=96SHRS
654 J=681,617,682,618
SEC=96SHRS
655 J=684,685,620,621
SEC=73SHRS
656 J=685,621,683,619
SEC=045SHRS
657 J=666,602,667,603
SEC=73SHRS
658 J=664,663,600,599
SEC=73SHRS
659 J=699,635,698,634
SEC=73SHRS
660 J=698,634,689,625
SEC=045SHRS
661 J=688,624,687,623
SEC=96SHRS
662 J=623,687,628,692
SEC=96SHRS
663 J=658,594,659,595
SEC=73SHRS
664 J=656,592,655,591
SEC=73SHRS
665 J=704,640,703,639
SEC=73SHRS
666 J=639,703,631,695
SEC=045SHRS
667 J=694,630,693,629
SEC=96SHRS
668 J=693,629,702,638
SEC=96SHRS
669 J=641,642,650,677
SEC=FLOORS
670 J=642,644,677,676
SEC=FLOORS
671 J=644,645,676,675
SEC=FLOORS
672 J=645,646,675,674
SEC=FLOORS
673 J=646,648,674,673
SEC=FLOORS
674 J=648,649,673,672
SEC=FLOORS
675 J=685,683,669,670
SEC=FLOORS
676 J=685,669,691,668
SEC=FLOORS
677 J=683,673,670,672
SEC=FLOORS
678 J=691,668,690,666
SEC=FLOORS

```
 679 J=666,665,690,664
SEC=FLOORS
 680 J=664,662,690,689
SEC=FLOORS
 681 J=690,689,691,687
SEC=FLOORS
 682 J=691,687,685,686
SEC=FLOORS
 683 J=686,681,685,683
SEC=FLOORS
 684 J=681,674,683,673
SEC=FLOORS
 685 J=675,674,680,681
SEC=FLOORS
 686 J=676,675,679,680
SEC=FLOORS
 687 J=676,679,677,678
SEC=FLOORS
 688 J=677,678,650,652
SEC=FLOORS
 689 J=652,678,653,703
SEC=FLOORS
 690 J=678,679,703,702
SEC=FLOORS
 691 J=702,693,703,695
SEC=FLOORS
 692 J=703,695,653,654
SEC=FLOORS
 693 J=654,695,656,696
SEC=FLOORS
 694 J=695,693,696,697
SEC=FLOORS
 695 J=693,692,697,698
SEC=FLOORS
 696 J=692,687,698,689
SEC=FLOORS
 697 J=689,662,698,661
SEC=FLOORS
 698 J=698,661,697,660
SEC=FLOORS
 699 J=660,658,697,696
SEC=FLOORS
 700 J=696,658,656,657
SEC=FLOORS
 701 J=641,577,642,578
SEC=FACADE
 702 J=643,579,644,580
SEC=FACADE
 703 J=580,581,644,645
SEC=FACADE
 704 J=645,581,646,582
SEC=FACADE
 705 J=582,583,646,647
SEC=FACADE
 706 J=584,585,648,649
SEC=FACADE

LOAD
 NAME=DEAD SW=1
CSYS=0
 NAME=LIVE CSYS=0
  TYPE=UNIFORM
   ADD=433 UZ=-.08
   ADD=434 UZ=-.08
   ADD=435 UZ=-.08
   ADD=436 UZ=-.08
   ADD=437 UZ=-.08
   ADD=438 UZ=-.08
   ADD=439 UZ=-.08
   ADD=440 UZ=-.08
   ADD=441 UZ=-.08
   ADD=442 UZ=-.08
   ADD=445 UZ=-.08
   ADD=446 UZ=-.08
   ADD=447 UZ=-.08
   ADD=448 UZ=-.08
   ADD=449 UZ=-.08
   ADD=450 UZ=-.08
   ADD=451 UZ=-.08
   ADD=452 UZ=-.08
   ADD=453 UZ=-.08
   ADD=454 UZ=-.08
   ADD=455 UZ=-.08
   ADD=456 UZ=-.08
   ADD=457 UZ=-.08
   ADD=458 UZ=-.08
   ADD=459 UZ=-.08
   ADD=460 UZ=-.08
   ADD=461 UZ=-.08
   ADD=462 UZ=-.08
   ADD=463 UZ=-.08
   ADD=464 UZ=-.08
   ADD=465 UZ=-.08
   ADD=466 UZ=-.08
   ADD=467 UZ=-.08
   ADD=468 UZ=-.08
   ADD=469 UZ=-.08
   ADD=470 UZ=-.08
   ADD=471 UZ=-.08
   ADD=472 UZ=-.08
   ADD=473 UZ=-.08
   ADD=474 UZ=-.08
   ADD=475 UZ=-.08
   ADD=476 UZ=-.08
   ADD=477 UZ=-.08
   ADD=478 UZ=-.08
   ADD=479 UZ=-.08
   ADD=480 UZ=-.08
   ADD=481 UZ=-.08
   ADD=482 UZ=-.08
   ADD=483 UZ=-.08
   ADD=484 UZ=-.08
   ADD=485 UZ=-.08
   ADD=486 UZ=-.08
   ADD=487 UZ=-.08
   ADD=488 UZ=-.08
   ADD=489 UZ=-.08
   ADD=490 UZ=-.08
   ADD=491 UZ=-.08
   ADD=492 UZ=-.08
   ADD=493 UZ=-.08
   ADD=494 UZ=-.08
   ADD=495 UZ=-.08
   ADD=496 UZ=-.08
   ADD=497 UZ=-.08
   ADD=498 UZ=-.08
   ADD=49 UZ=-.08
   ADD=50 UZ=-.08
   ADD=51 UZ=-.08
   ADD=52 UZ=-.08
   ADD=53 UZ=-.08
   ADD=54 UZ=-.08
   ADD=55 UZ=-.08
   ADD=56 UZ=-.08
   ADD=57 UZ=-.08
   ADD=58 UZ=-.08
   ADD=59 UZ=-.08
   ADD=60 UZ=-.08
   ADD=61 UZ=-.08
   ADD=62 UZ=-.08
   ADD=63 UZ=-.08
   ADD=64 UZ=-.08
   ADD=65 UZ=-.08
   ADD=66 UZ=-.08
   ADD=67 UZ=-.08
   ADD=68 UZ=-.08
   ADD=69 UZ=-.08
   ADD=70 UZ=-.08
   ADD=71 UZ=-.08
   ADD=72 UZ=-.08
   ADD=73 UZ=-.08
   ADD=74 UZ=-.08
   ADD=75 UZ=-.08
   ADD=76 UZ=-.08
   ADD=77 UZ=-.08
   ADD=78 UZ=-.08
   ADD=79 UZ=-.08
   ADD=80 UZ=-.08
   ADD=123 UZ=-.08
   ADD=124 UZ=-.08
   ADD=125 UZ=-.08
   ADD=126 UZ=-.08
   ADD=127 UZ=-.08
   ADD=128 UZ=-.08
   ADD=129 UZ=-.08
   ADD=130 UZ=-.08
   ADD=131 UZ=-.08
   ADD=132 UZ=-.08
   ADD=133 UZ=-.08
   ADD=134 UZ=-.08
   ADD=135 UZ=-.08
   ADD=136 UZ=-.08
   ADD=137 UZ=-.08
   ADD=138 UZ=-.08
   ADD=139 UZ=-.08
   ADD=140 UZ=-.08
   ADD=141 UZ=-.08
   ADD=142 UZ=-.08
   ADD=143 UZ=-.08
   ADD=144 UZ=-.08
   ADD=145 UZ=-.08
   ADD=146 UZ=-.08
   ADD=147 UZ=-.08
   ADD=148 UZ=-.08
   ADD=149 UZ=-.08
   ADD=150 UZ=-.08
   ADD=151 UZ=-.08
   ADD=152 UZ=-.08
   ADD=153 UZ=-.08
   ADD=154 UZ=-.08
   ADD=191 UZ=-.08
   ADD=192 UZ=-.08
   ADD=193 UZ=-.08
   ADD=194 UZ=-.08
   ADD=195 UZ=-.08
   ADD=196 UZ=-.08
   ADD=197 UZ=-.08
   ADD=198 UZ=-.08
   ADD=199 UZ=-.08
   ADD=200 UZ=-.08
   ADD=201 UZ=-.08
   ADD=202 UZ=-.08
   ADD=203 UZ=-.08
   ADD=204 UZ=-.08
   ADD=205 UZ=-.08
   ADD=206 UZ=-.08
   ADD=207 UZ=-.08
   ADD=208 UZ=-.08
   ADD=209 UZ=-.08
   ADD=210 UZ=-.08
   ADD=211 UZ=-.08
   ADD=212 UZ=-.08
   ADD=213 UZ=-.08
   ADD=214 UZ=-.08
   ADD=215 UZ=-.08
   ADD=216 UZ=-.08
   ADD=217 UZ=-.08
   ADD=218 UZ=-.08
   ADD=219 UZ=-.08
   ADD=220 UZ=-.08
   ADD=221 UZ=-.08
   ADD=222 UZ=-.08
   ADD=259 UZ=-.08
   ADD=260 UZ=-.08
   ADD=261 UZ=-.08
   ADD=262 UZ=-.08
   ADD=263 UZ=-.08
   ADD=264 UZ=-.08
   ADD=265 UZ=-.08
   ADD=266 UZ=-.08
   ADD=267 UZ=-.08
   ADD=268 UZ=-.08
   ADD=269 UZ=-.08
   ADD=270 UZ=-.08
   ADD=271 UZ=-.08
   ADD=272 UZ=-.08
   ADD=273 UZ=-.08
   ADD=274 UZ=-.08
   ADD=275 UZ=-.08
   ADD=276 UZ=-.08
   ADD=277 UZ=-.08
   ADD=278 UZ=-.08
   ADD=279 UZ=-.08
   ADD=280 UZ=-.08
   ADD=281 UZ=-.08
   ADD=282 UZ=-.08
   ADD=283 UZ=-.08
   ADD=284 UZ=-.08
   ADD=285 UZ=-.08
   ADD=286 UZ=-.08
   ADD=287 UZ=-.08
   ADD=288 UZ=-.08
   ADD=289 UZ=-.08
   ADD=290 UZ=-.08
   ADD=327 UZ=-.08
   ADD=328 UZ=-.08
   ADD=329 UZ=-.08
   ADD=330 UZ=-.08
   ADD=331 UZ=-.08
   ADD=332 UZ=-.08
   ADD=333 UZ=-.08
   ADD=334 UZ=-.08
   ADD=335 UZ=-.08
   ADD=336 UZ=-.08
   ADD=337 UZ=-.08
   ADD=338 UZ=-.08
   ADD=345 UZ=-.08
   ADD=346 UZ=-.08
   ADD=347 UZ=-.08
   ADD=348 UZ=-.08
   ADD=349 UZ=-.08
   ADD=350 UZ=-.08
   ADD=351 UZ=-.08
   ADD=352 UZ=-.08
   ADD=353 UZ=-.08
   ADD=354 UZ=-.08
   ADD=355 UZ=-.08
   ADD=356 UZ=-.08
   ADD=357 UZ=-.08
   ADD=358 UZ=-.08
   ADD=359 UZ=-.08
   ADD=360 UZ=-.08
   ADD=361 UZ=-.08
   ADD=362 UZ=-.08
   ADD=363 UZ=-.08
   ADD=364 UZ=-.08
   ADD=401 UZ=-.08
   ADD=402 UZ=-.08
   ADD=403 UZ=-.08
   ADD=404 UZ=-.08
   ADD=405 UZ=-.08
   ADD=406 UZ=-.08
   ADD=407 UZ=-.08
   ADD=408 UZ=-.08
   ADD=409 UZ=-.08
   ADD=410 UZ=-.08
   ADD=411 UZ=-.08
   ADD=412 UZ=-.08
   ADD=413 UZ=-.08
   ADD=414 UZ=-.08
   ADD=415 UZ=-.08
   ADD=416 UZ=-.08
   ADD=417 UZ=-.08
   ADD=418 UZ=-.08
   ADD=419 UZ=-.08
   ADD=420 UZ=-.08
   ADD=421 UZ=-.08
   ADD=422 UZ=-.08
   ADD=423 UZ=-.08
   ADD=424 UZ=-.08
   ADD=425 UZ=-.08
   ADD=426 UZ=-.08
   ADD=427 UZ=-.08
   ADD=428 UZ=-.08
   ADD=429 UZ=-.08
   ADD=430 UZ=-.08
   ADD=431 UZ=-.08
   ADD=432 UZ=-.08
   ADD=533 UZ=-.08
   ADD=534 UZ=-.08
   ADD=535 UZ=-.08
   ADD=536 UZ=-.08
   ADD=537 UZ=-.08
   ADD=538 UZ=-.08
   ADD=539 UZ=-.08
   ADD=540 UZ=-.08
   ADD=541 UZ=-.08
   ADD=542 UZ=-.08
   ADD=543 UZ=-.08
   ADD=544 UZ=-.08
   ADD=545 UZ=-.08
   ADD=546 UZ=-.08
   ADD=547 UZ=-.08
   ADD=548 UZ=-.08
   ADD=549 UZ=-.08
   ADD=550 UZ=-.08
   ADD=551 UZ=-.08
   ADD=552 UZ=-.08
   ADD=553 UZ=-.08
   ADD=554 UZ=-.08
   ADD=555 UZ=-.08
   ADD=556 UZ=-.08
   ADD=557 UZ=-.08
   ADD=558 UZ=-.08
   ADD=559 UZ=-.08
   ADD=560 UZ=-.08
   ADD=561 UZ=-.08
   ADD=562 UZ=-.08
   ADD=563 UZ=-.08
   ADD=564 UZ=-.08
   ADD=601 UZ=-.08
   ADD=602 UZ=-.08
   ADD=603 UZ=-.08
   ADD=604 UZ=-.08
   ADD=605 UZ=-.08
   ADD=606 UZ=-.08
   ADD=607 UZ=-.08
   ADD=608 UZ=-.08
   ADD=609 UZ=-.08
   ADD=610 UZ=-.08
   ADD=611 UZ=-.08
   ADD=612 UZ=-.08
   ADD=613 UZ=-.08
   ADD=614 UZ=-.08
```

```
ADD=615 UZ=-.08
ADD=616 UZ=-.08
ADD=617 UZ=-.08
ADD=618 UZ=-.08
ADD=619 UZ=-.08
ADD=620 UZ=-.08
ADD=621 UZ=-.08
ADD=622 UZ=-.08
ADD=623 UZ=-.08
ADD=624 UZ=-.08
ADD=625 UZ=-.08
ADD=626 UZ=-.08
ADD=627 UZ=-.08
ADD=628 UZ=-.08
ADD=629 UZ=-.08
ADD=630 UZ=-.08
ADD=631 UZ=-.08
ADD=632 UZ=-.08
ADD=669 UZ=-.08
ADD=670 UZ=-.08
ADD=671 UZ=-.08
ADD=672 UZ=-.08
ADD=673 UZ=-.08
ADD=674 UZ=-.08
ADD=675 UZ=-.08
ADD=676 UZ=-.08
ADD=677 UZ=-.08
ADD=678 UZ=-.08
ADD=679 UZ=-.08
ADD=680 UZ=-.08
ADD=681 UZ=-.08
ADD=682 UZ=-.08
ADD=683 UZ=-.08
ADD=684 UZ=-.08
ADD=685 UZ=-.08
ADD=686 UZ=-.08
ADD=687 UZ=-.08
ADD=688 UZ=-.08
ADD=689 UZ=-.08
ADD=690 UZ=-.08
ADD=691 UZ=-.08
ADD=692 UZ=-.08
ADD=693 UZ=-.08
ADD=694 UZ=-.08
ADD=695 UZ=-.08
ADD=696 UZ=-.08
 ADD=697 UZ=-.08
 ADD=698 UZ=-.08
 ADD=699 UZ=-.08
 ADD=700 UZ=-.08
NAME=WIND CSYS=0
 TYPE=UNIFORM
  ADD=99 UX=.03
  ADD=100 UX=.03
  ADD=101 UX=.03
  ADD=102 UX=.03
  ADD=103 UX=.03
  ADD=104 UX=.03
  ADD=2 UX=.03
  ADD=7 UX=.03
  ADD=8 UY=-.03
  ADD=13 UY=-.03
  ADD=26 UX=.03
  ADD=31 UX=.03
  ADD=32 UY=-.03
  ADD=37 UY=-.03
  ADD=81 UX=.03
  ADD=82 UX=.03
  ADD=83 UX=.03
  ADD=84 UX=.03
  ADD=85 UX=.03
  ADD=86 UX=.03
  ADD=94 UX=.03
  ADD=105 UX=.03
  ADD=106 UY=-.03
  ADD=111 UY=-.03
  ADD=155 UX=.03
  ADD=156 UX=.03
  ADD=157 UX=.03
  ADD=158 UX=.03
  ADD=159 UX=.03
  ADD=160 UX=.03
  ADD=168 UX=.03
  ADD=173 UX=.03
  ADD=174 UY=-.03
  ADD=179 UY=-.03
  ADD=223 UX=.03
  ADD=224 UX=.03
  ADD=225 UX=.03
  ADD=226 UX=.03
  ADD=227 UX=.03
  ADD=228 UX=.03
  ADD=236 UX=.03
  ADD=241 UX=.03
  ADD=242 UY=-.03
  ADD=247 UY=-.03
  ADD=291 UX=.03
  ADD=292 UX=.03
  ADD=293 UX=.03
  ADD=294 UX=.03
  ADD=295 UX=.03
  ADD=296 UX=.03
  ADD=304 UX=.03
  ADD=309 UX=.03
  ADD=310 UY=-.03
  ADD=315 UY=-.03
  ADD=365 UX=.03
  ADD=366 UX=.03
  ADD=367 UX=.03
  ADD=368 UX=.03
  ADD=369 UX=.03
  ADD=370 UX=.03
  ADD=378 UX=.03
  ADD=383 UX=.03
  ADD=384 UY=-.03
  ADD=389 UY=-.03
  ADD=443 UX=.03
  ADD=444 UX=.03
  ADD=499 UX=.03
  ADD=500 UX=.03
  ADD=501 UX=.03
  ADD=502 UX=.03
  ADD=510 UX=.03
  ADD=515 UX=.03
  ADD=516 UY=-.03
  ADD=521 UY=-.03
  ADD=565 UX=.03
  ADD=566 UX=.03
  ADD=567 UX=.03
  ADD=568 UX=.03
  ADD=569 UX=.03
  ADD=570 UX=.03
  ADD=578 UX=.03
  ADD=583 UX=.03
  ADD=584 UY=-.03
  ADD=589 UY=-.03
  ADD=633 UX=.03
  ADD=634 UX=.03
  ADD=635 UX=.03
  ADD=636 UX=.03
  ADD=637 UX=.03
  ADD=638 UX=.03
  ADD=646 UX=.03
  ADD=651 UX=.03
  ADD=652 UY=-.03
  ADD=657 UY=-.03
  ADD=701 UX=.03
  ADD=702 UX=.03
  ADD=703 UX=.03
  ADD=704 UX=.03
  ADD=705 UX=.03
  ADD=706 UX=.03

MODE
 TYPE=EIGEN N=10
TOL=.00001

COMBO
 NAME=DLW
  LOAD=DEAD SF=1.2
  LOAD=LIVE SF=.5
  LOAD=WIND SF=1.3
 NAME=DW
  LOAD=DEAD SF=.9
  LOAD=WIND SF=1.3
 NAME=DL
  LOAD=DEAD SF=1.2
  LOAD=LIVE SF=1.6

OUTPUT
; No Output Requested

END
 MATERIAL STEEL FY 5184
 MATERIAL CONC
FYREBAR 8640 FYSHEAR
5760 FC 576 FCSHEAR 576
 STATICLOAD DEAD TYPE
DEAD
 STATICLOAD LIVE TYPE
LIVE
 STATICLOAD WIND TYPE
WIND
END SUPPLEMENTAL DATA
```