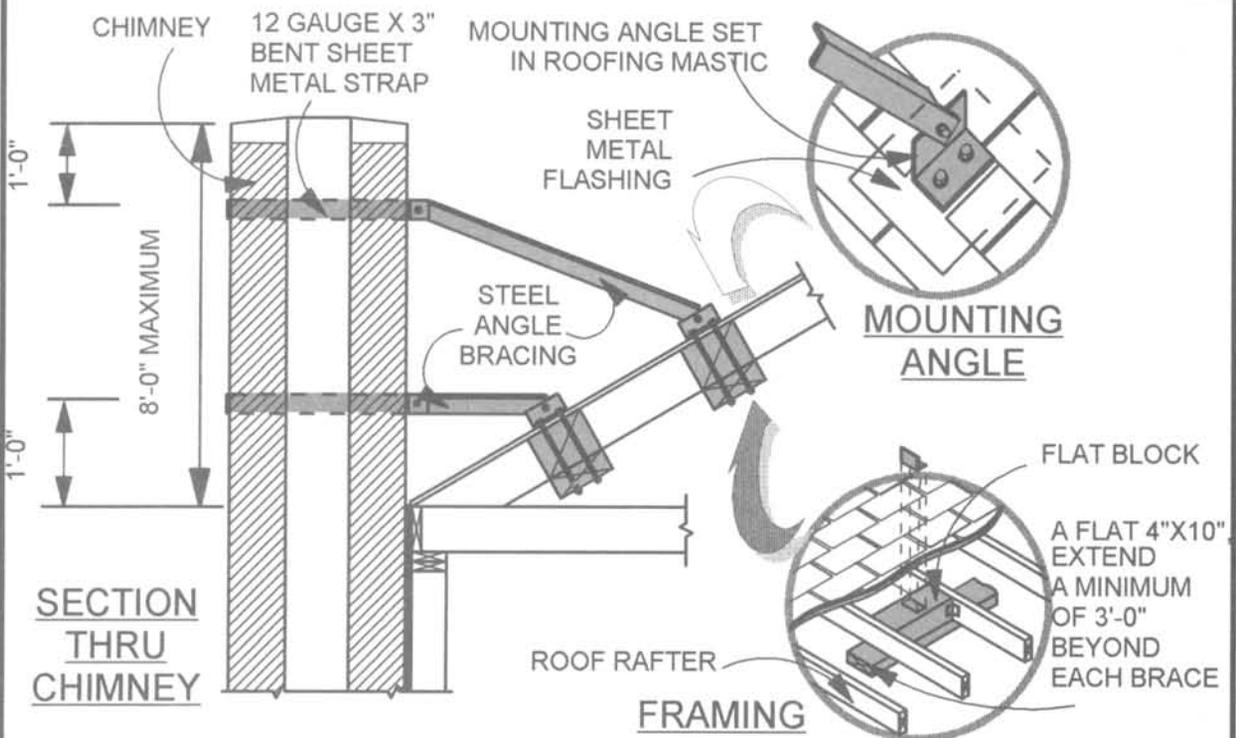


RESIDENTIAL CHIMNEY

ENGINEERING REQUIRED



Earthquake Damage: 1989, Loma Prieta, California
Photo Credit: California Office of Emergency Services, Earthquake Program



Upgrade Detail U38 (Recommended only for areas of low to moderate seismicity).
Approximate Cost: \$1,000

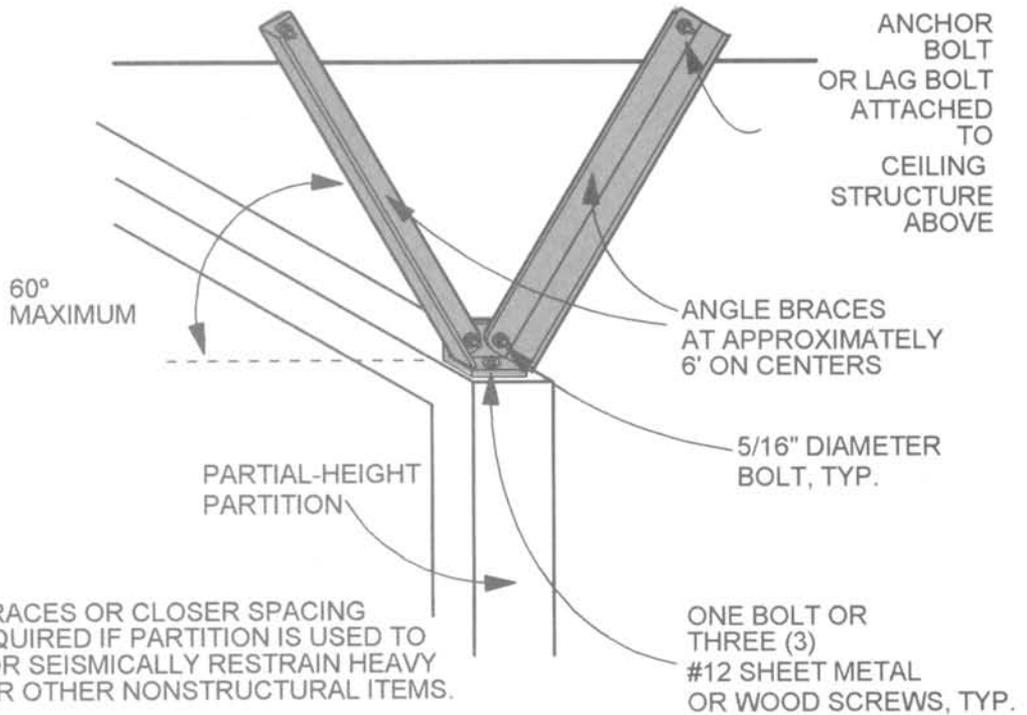
U38

BUILT-IN PARTIAL-HEIGHT PARTITIONS

ENGINEERING REQUIRED



Earthquake Damage: 1994, Northridge, California
Photo Credit: Wiss, Janney, Elstner Associates, Inc.



Schematic Upgrade Detail A2a

Approximate Cost: Varies - \$20 - \$40 per lineal foot

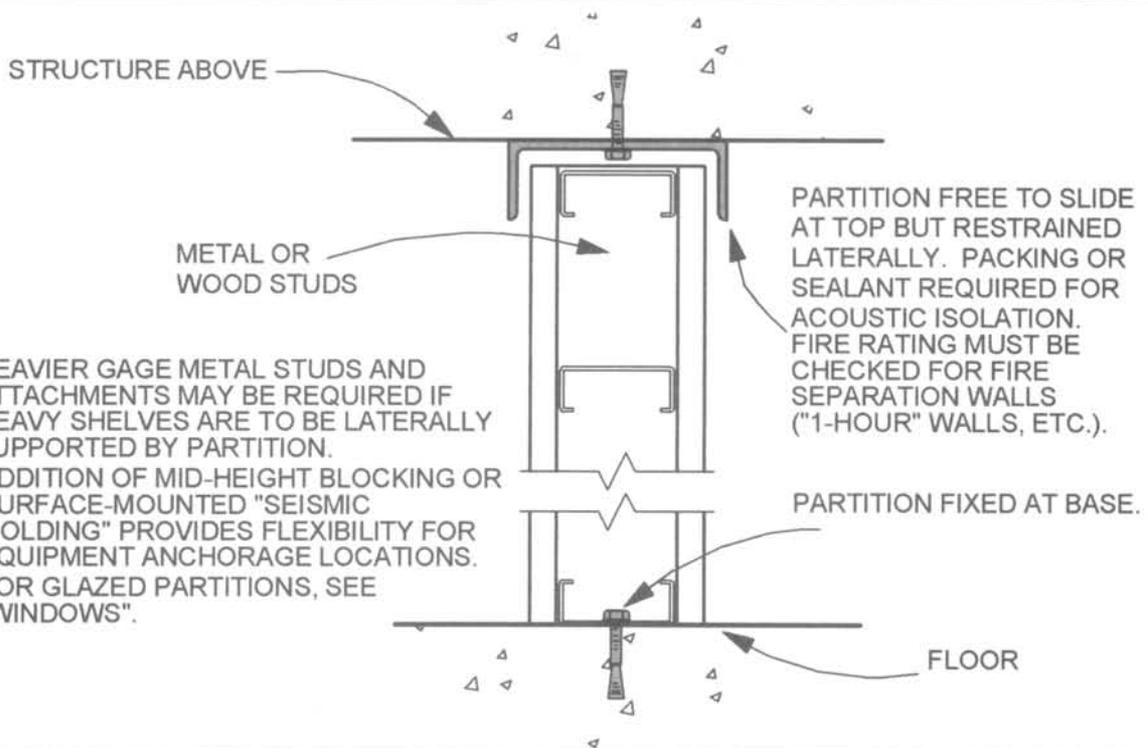
A2a

BUILT-IN FULL-HEIGHT PARTITIONS

ENGINEERING REQUIRED



Earthquake Damage: 1994, Northridge, California
Photo Credit: Wiss, Janney, Elstner Associates, Inc.



Schematic Upgrade Detail A2b

Approximate Cost: Varies, depending on design

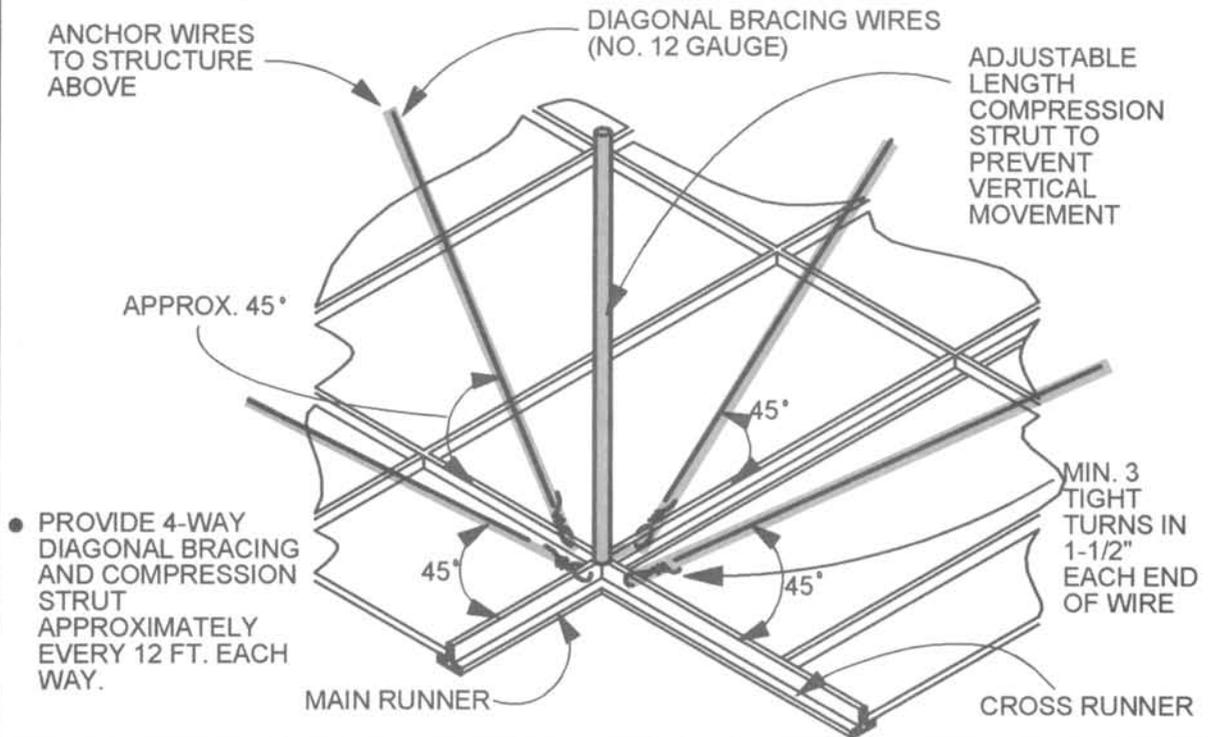
A2b

SUSPENDED T-BAR CEILINGS

ENGINEERING REQUIRED



Earthquake Damage: 1994, Northridge, California
Photo Credit: Wiss, Janney, Elstner Associates, Inc.

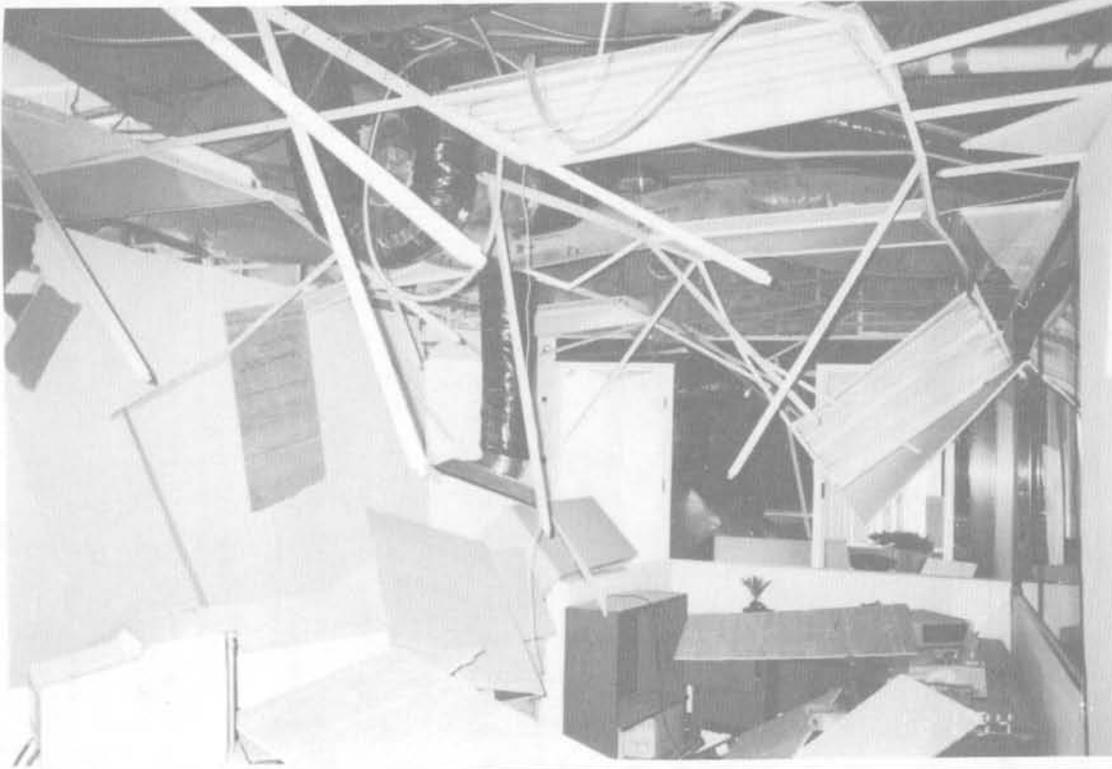


Schematic Upgrade Detail A3
Approximate Cost: \$50 per brace

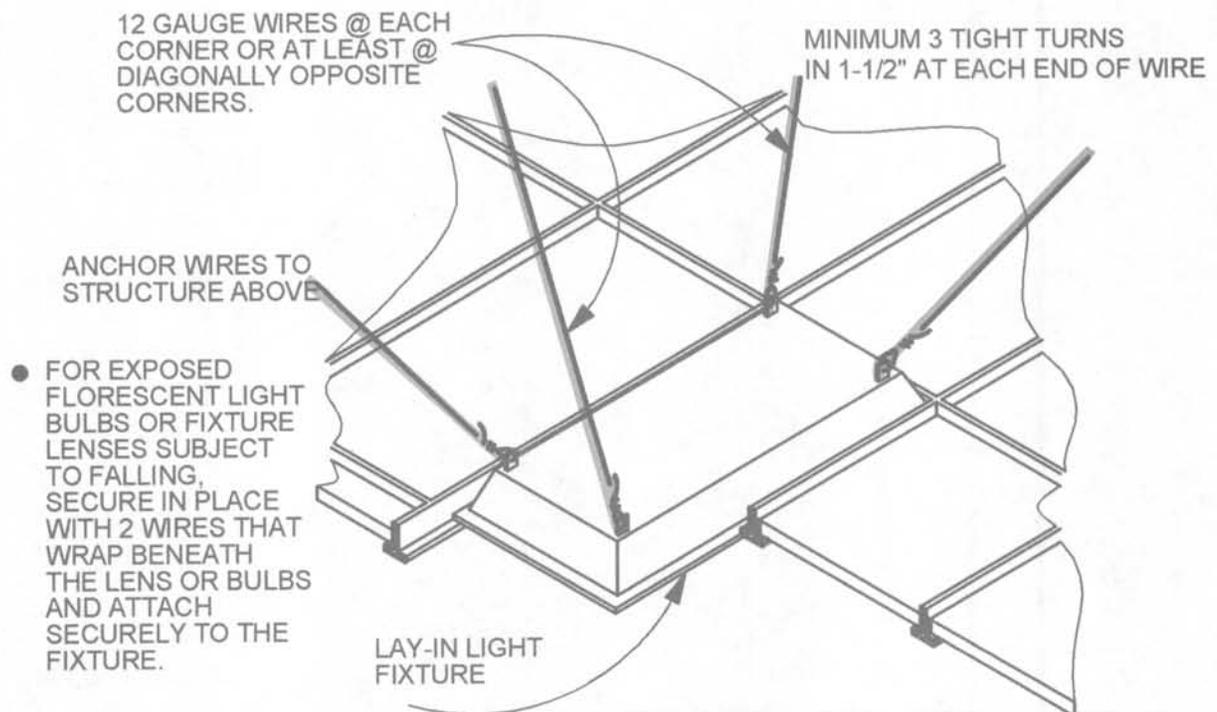
A3

SUSPENDED LIGHT FIXTURES

DO-IT-YOURSELF



Earthquake Damage: 1994, Northridge, California
Photo Credit: Wiss, Janney, Elstner Associates, Inc.



Upgrade Detail U5a

Approximate Cost: \$50 per fixture

A5a

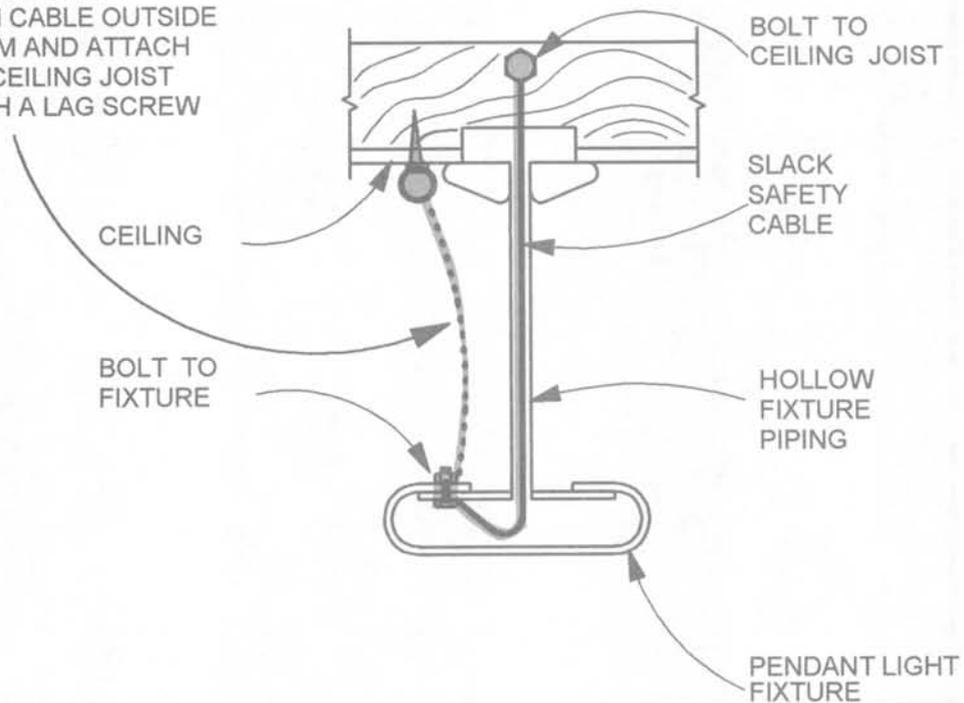
PENDANT LIGHT FIXTURES

DO-IT-YOURSELF



Failure of light fixtures at Northridge Junior High School
Earthquake Damage: 1994, Northridge, California
Photo Credit: Earthquake Engineering Research Institute, Gary L. McGavin

ALTERNATE:
RUN CABLE OUTSIDE
STEM AND ATTACH
TO CEILING JOIST
WITH A LAG SCREW



Upgrade Detail A5b
Approximate Cost: \$80

A5b

STAIRWAYS

ENGINEERING REQUIRED



Earthquake Damage: 1994, Northridge, California
Photo Credit: Wiss, Janney, Elstner Associates, Inc.

- TO PREVENT DAMAGE TO STAIRS THEY SHOULD BE MODIFIED TO ALLOW THEM TO SLIDE AT LANDINGS WITH "GANG PLANK" DETAILS; THIS IS DESIRABLE FOR FLEXIBLE FRAME BUILDINGS.
- IF STAIR ENCLOSURES ARE CONSTRUCTED USING BRITTLE MATERIALS, SUCH AS, HOLLOW CLAY TILE, GLASS BLOCK PARTITIONS, OR SKYLIGHTS, IT IS RECOMMENDED THAT THEY BE ENCAPSULATED OR REPLACED TO PREVENT FALLING HAZARDS AND DEBRIS IN THE STAIRWELL.
- PROVIDE ANCHORAGE FOR PIPES, LIGHTING OR DUCTS IN STAIRWELLS TO PREVENT FALLING HAZARDS AND DEBRIS.

Schematic Upgrade Detail A9

Approximate Cost: Depends on design

A9

WINDOWS

ENGINEERING REQUIRED



Earthquake Damage: 1994, Northridge, California
Photo Credit: Wiss, Janney, Elstner Associates, Inc.

- USE OF TEMPERED GLASS WILL GREATLY REDUCE THE SEISMIC HAZARD. TEMPERED GLASS MAY STILL BREAK, BUT WILL BREAK INTO SMALL DULL FRAGMENTS INSTEAD OF LARGE DANGEROUS SHARDS.
- POLYESTER SHATTER RESISTANT FILMS ARE AVAILABLE THAT HELP HOLD TOGETHER FRAGMENTS OF ANY PANES THAT CRACK IN AN EARTHQUAKE. (TYPICAL SOLAR FILM MAY NOT BE ADEQUATE FOR THIS PURPOSE).
- USE OF LAMINATED GLASS FOR STOREFRONTS REDUCES SEISMIC RISK AND ALSO INCREASES PROTECTION FROM BURGLARY OR VANDALISM.
- SMALLER, OPERABLE, AND WOODEN FRAMED WINDOWS TOLERATE MORE LATERAL DRIFT.
- FOR NEW CONSTRUCTION, STIFFER BUILDINGS AND GLAZING WITH MORE THAN THE STANDARD EDGE CLEARANCES MAY BE DESIRABLE. CHECK WHETHER OR NOT THE BUILDING'S CALCULATED SEISMIC DRIFT HAS BEEN CONSIDERED IN THE DESIGN OF THE GLAZING.

Schematic Upgrade Detail A12

Approximate Cost: Depends on design

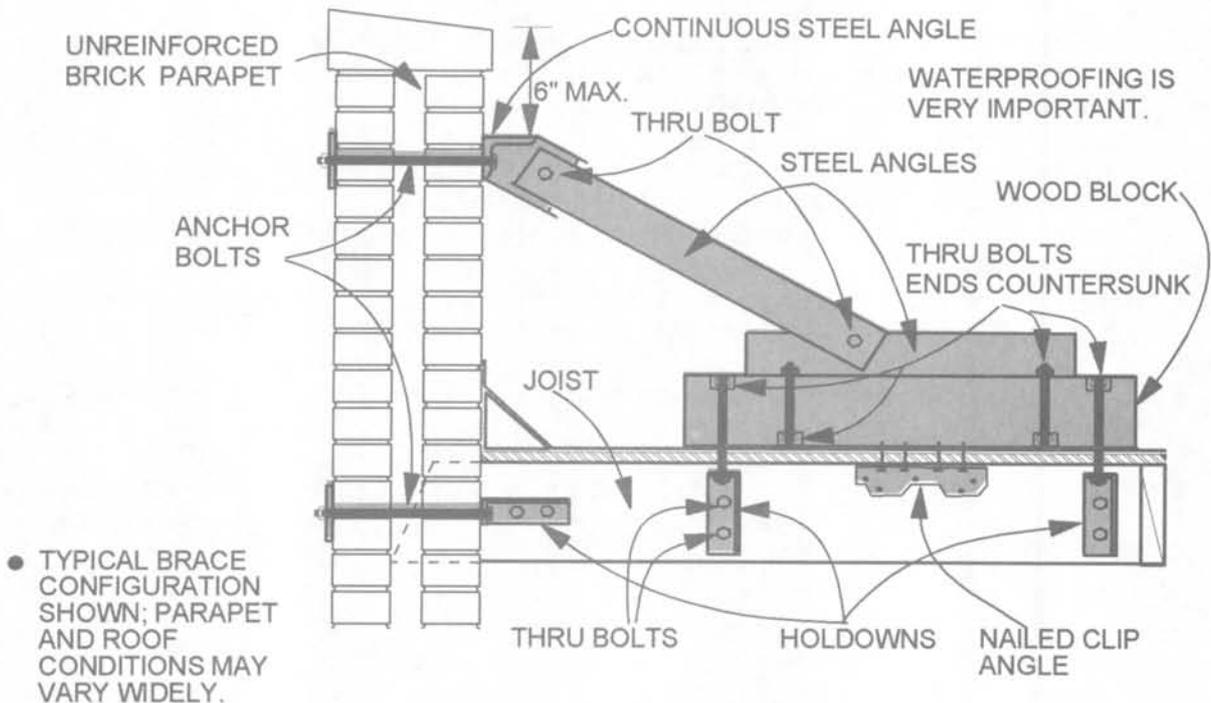
A12

UNREINFORCED BRICK PARAPETS

ENGINEERING REQUIRED



Earthquake Damage: 1989, Loma Prieta, California
Photo Credit: Wiss, Janney, Elstner Associates, Inc.



Schematic Upgrade Detail A15a
Approximate Cost: \$50 per foot

A15a

VENEER

ENGINEERING REQUIRED



Earthquake Damage: 1994, Northridge, California
Photo Credit: Robert Reitherman

- SEE APPLICABLE BUILDING CODE REQUIREMENTS FOR LIMITATIONS REGARDING THE HEIGHT, AREA, UNIT SIZE, AND UNIT WEIGHT OF EITHER ADHERED OR ANCHORED VENEER SYSTEMS. REFER TO THE CODE SECTIONS FOR SPECIFIC REQUIREMENTS FOR BACKING, TIES, AND REINFORCEMENT. (FOR EXAMPLE, SECTION 1403 OF THE 1994 UBC).
- VENEER SYSTEMS MUST ALSO AT LEAST MEET THE MINIMUM LATERAL FORCE REQUIREMENTS FOR NONSTRUCTURAL COMPONENTS. (FOR EXAMPLE, THE REQUIREMENTS FOR EXTERIOR AND INTERIOR ORNAMENTATION AND APPENDAGES IN CHAPTER 16 OF THE 1994 UBC).
- REMOVAL OF VENEER MOUNTED OVER ENTRANCES OR OTHER POTENTIALLY CROWDED LOCATIONS IS THE MOST RELIABLE UPGRADE SOLUTION.

Schematic Upgrade Detail A15b
Approximate Cost: Varies

A15b

FREESTANDING WALLS OR FENCES

ENGINEERING REQUIRED



Earthquake Damage: 1994, Northridge, California
Photo Credit: Robert Reitherman

- MANY MILES OF POORLY CONSTRUCTED CONCRETE MASONRY UNIT (CMU) FENCES WERE DAMAGED DURING THE 1994 NORTHRIDGE EARTHQUAKE. COLLAPSE OF WALLS WITH INADEQUATE OR ABSENT REINFORCING AND/OR FOUNDATIONS WAS COMMON IN NORTHRIDGE AND SYLMAR. IN MANY CASES, MOST OF THE SIDEWALK WAS COVERED WITH DEBRIS, AS SHOWN ABOVE.
- FREESTANDING WALLS OR FENCES BUILT OF CMU, BRICK, OR STONE NEED TO BE ENGINEERED AND CONSTRUCTED WITH APPROPRIATE FOUNDATIONS, ADEQUATE REINFORCEMENT, AND GOOD QUALITY MORTAR.
- STANDARD DETAILS FOR LOW FENCES OR SHORT RETAINING WALLS MAY BE AVAILABLE FROM THE LOCAL BUILDING DEPARTMENT.

Schematic Upgrade Detail A16

Approximate Cost: Depends on the design

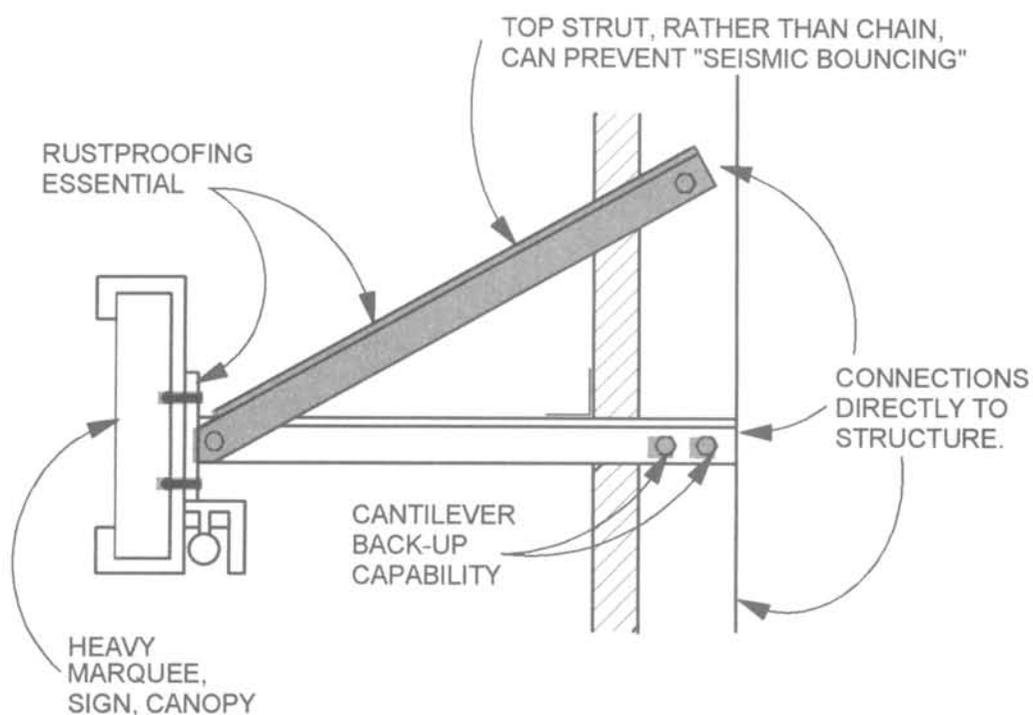
A16

EXTERIOR SIGNS

ENGINEERING REQUIRED



Earthquake Damage: 1979, Imperial Valley, California
Photo Credit: Robert Reitherman/BSD, Inc.

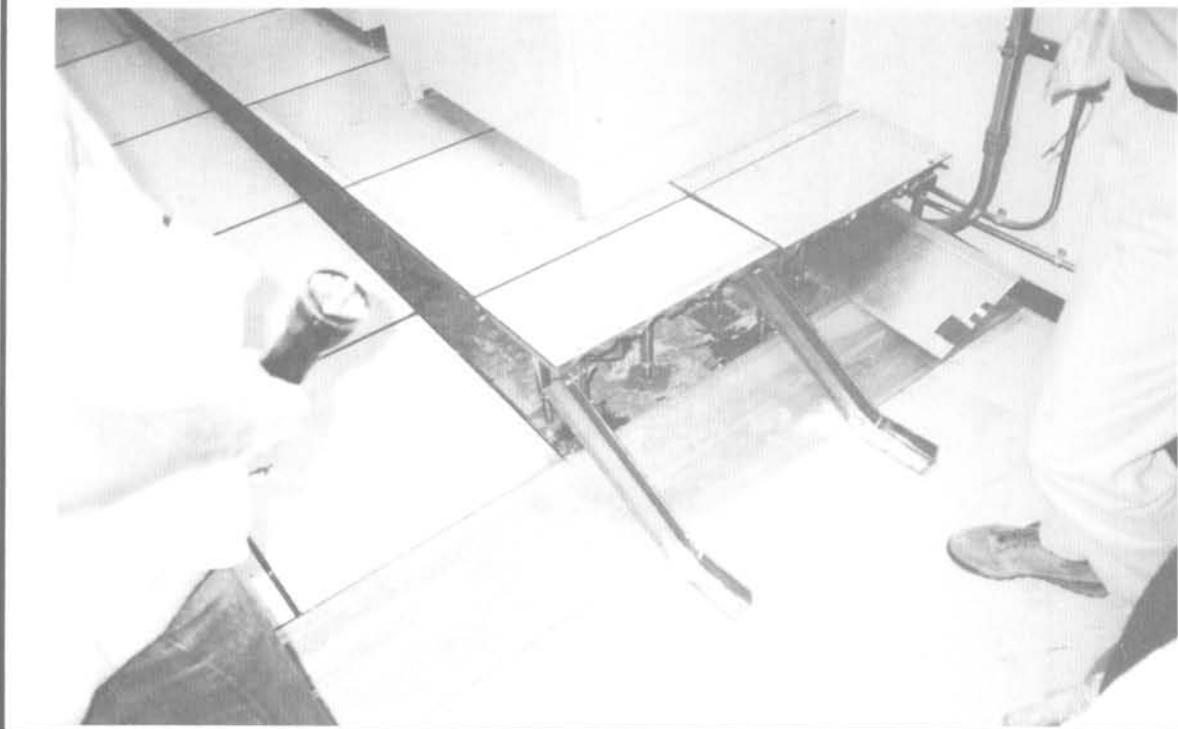


Schematic Upgrade Detail A21
Approximate Cost: \$500 - \$800

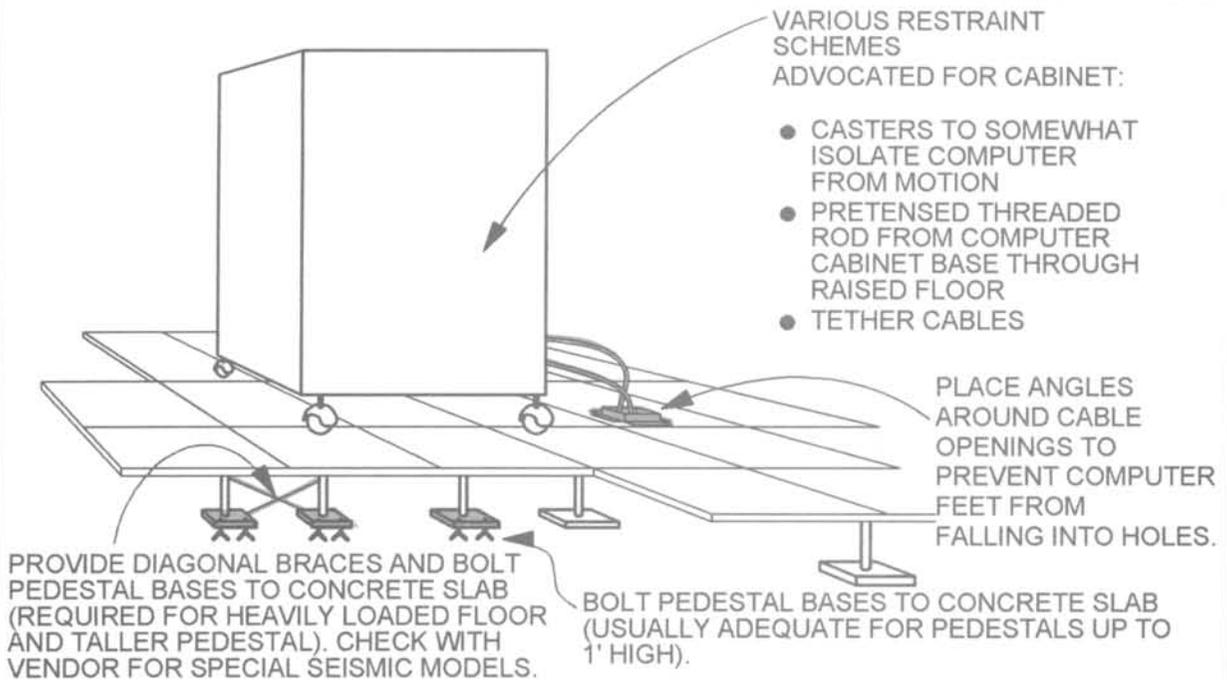
A21

LARGE COMPUTERS AND ACCESS FLOORS

ENGINEERING REQUIRED



Temporary bracing for collapsed access floor
Earthquake Damage: 1994, Northridge, California
Photo Credit: Wiss, Janney, Elstner Associates, Inc.



Schematic Upgrade Detail C8

Approximate Cost: Access floor alone -- \$3 - \$7 per square foot
Cabinet restraint -- \$300 - \$500 per cabinet

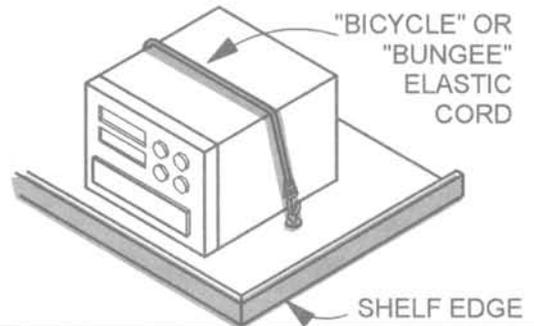
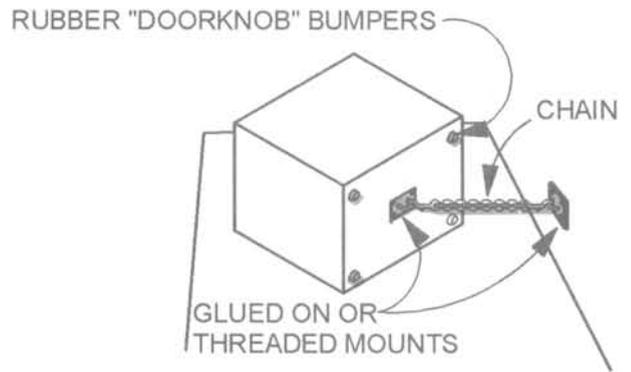
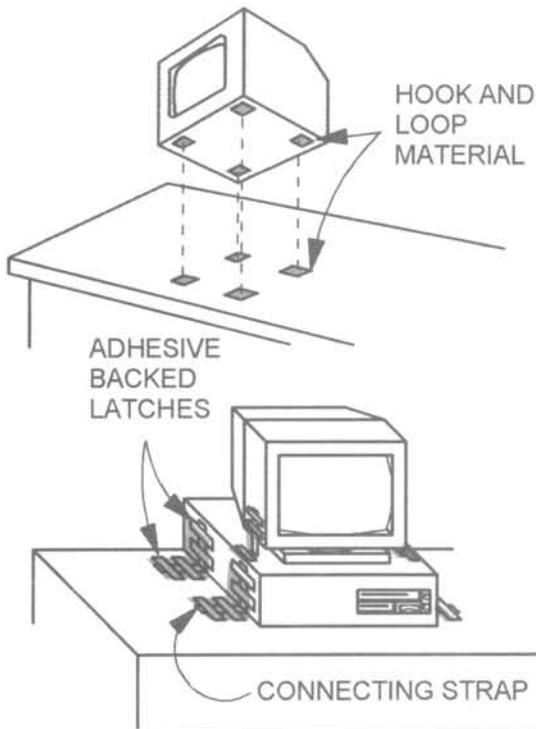
C8

DESKTOP COMPUTERS AND OFFICE EQUIPMENT

DO-IT-YOURSELF



Unsecured computers may fall and suffer damage
Photo Credit: Wiss, Janney, Elstner Associates, Inc.

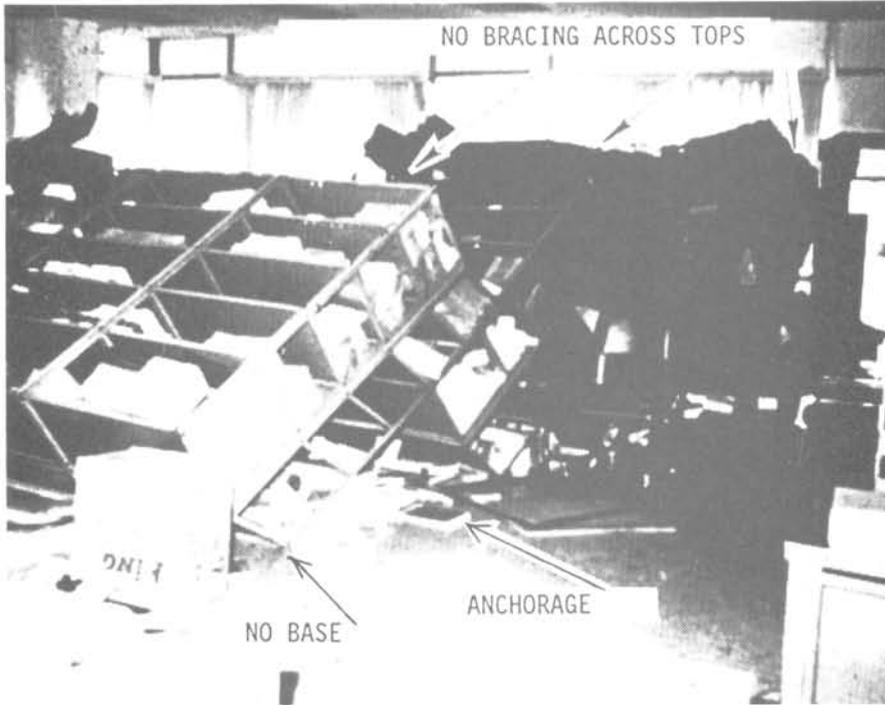


Upgrade Detail C10
Approximate Cost: \$50 per computer

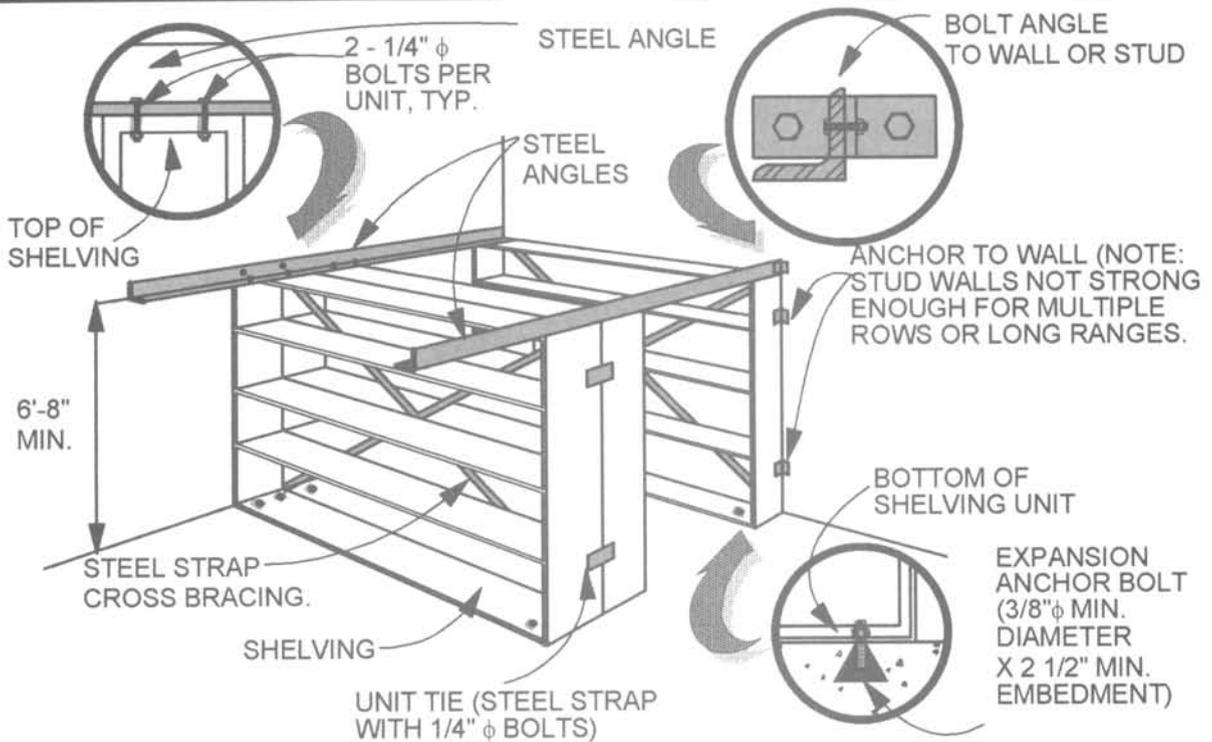
C10

TALL SHELVING: FREESTANDING

ENGINEERING REQUIRED



Earthquake Damage: 1972, Managua, Nicaragua
Photo Credit: John F. Meehan



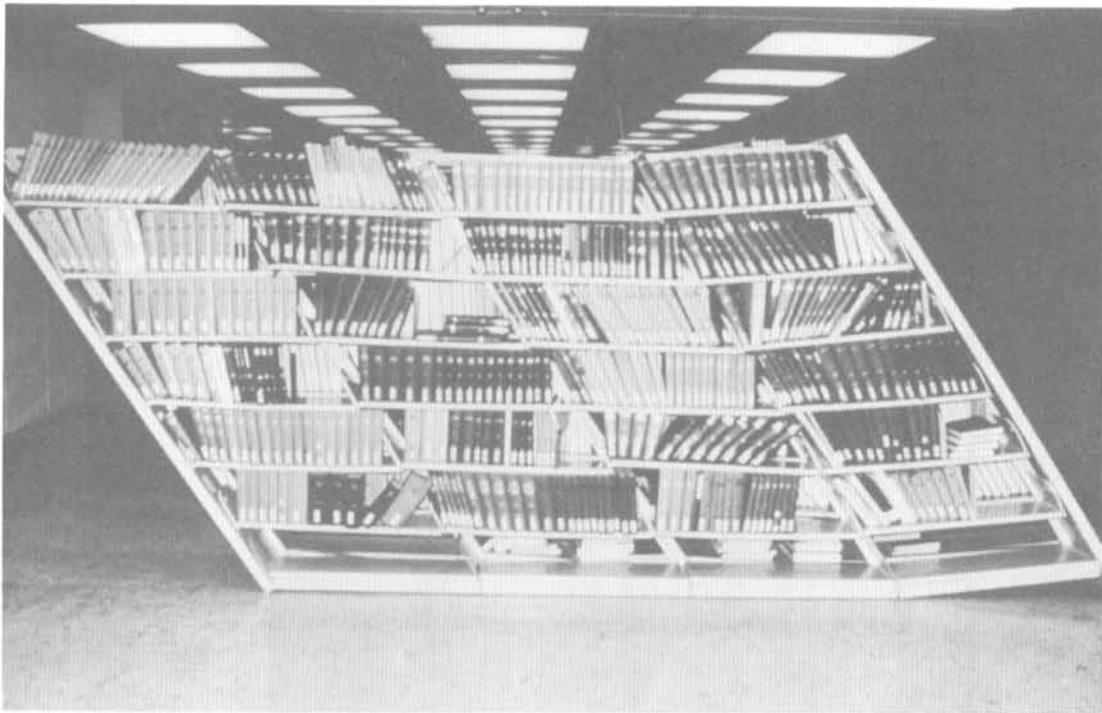
Schematic Upgrade Detail C12a

Approximate Cost: \$20 per lineal foot of shelving

C12a

LIBRARY STACKS

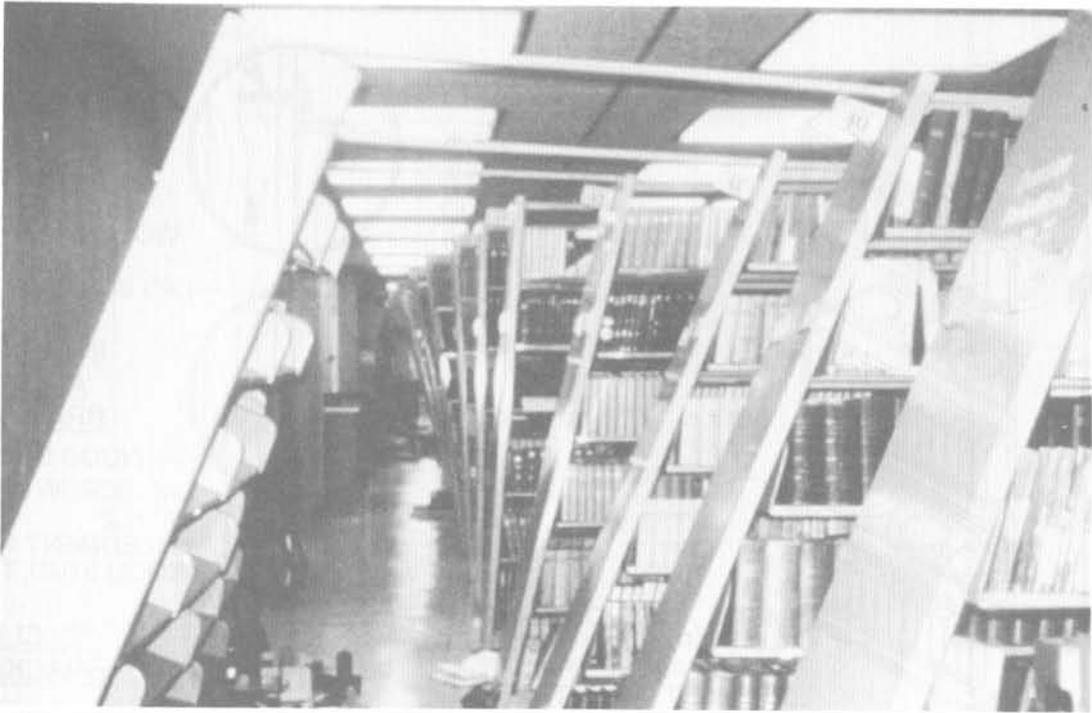
ENGINEERING REQUIRED



Failure of library shelving

Earthquake Damage: 1987, Whittier Narrows, California

Photo Credit: Earthquake Engineering Research Institute, Larry Parsons



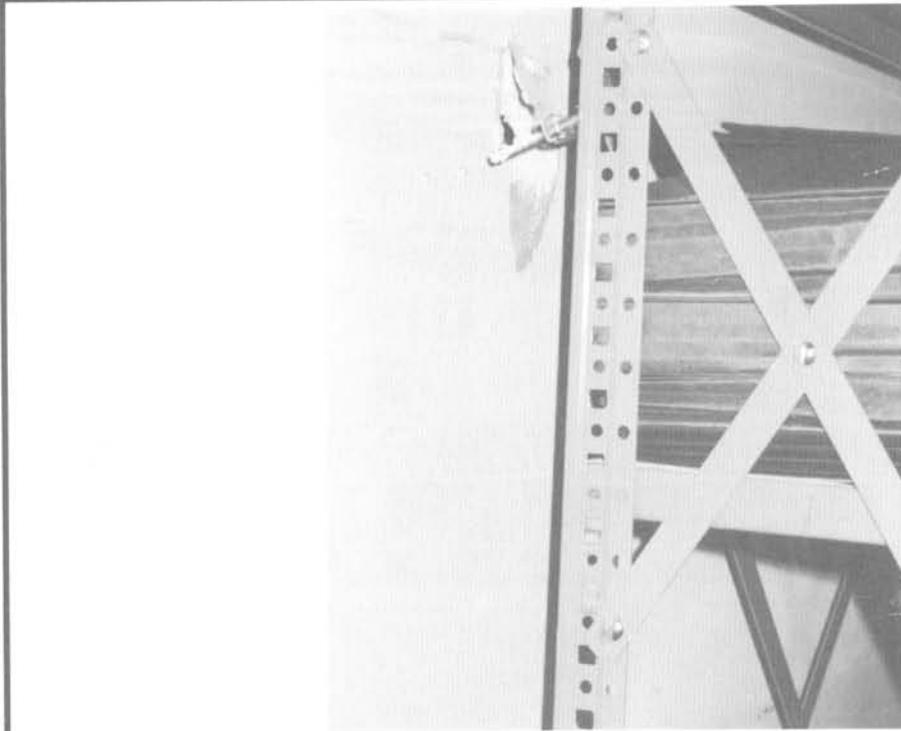
Failure of inadequately upgraded library shelving

Earthquake Damage: 1987, Whittier Narrows, California

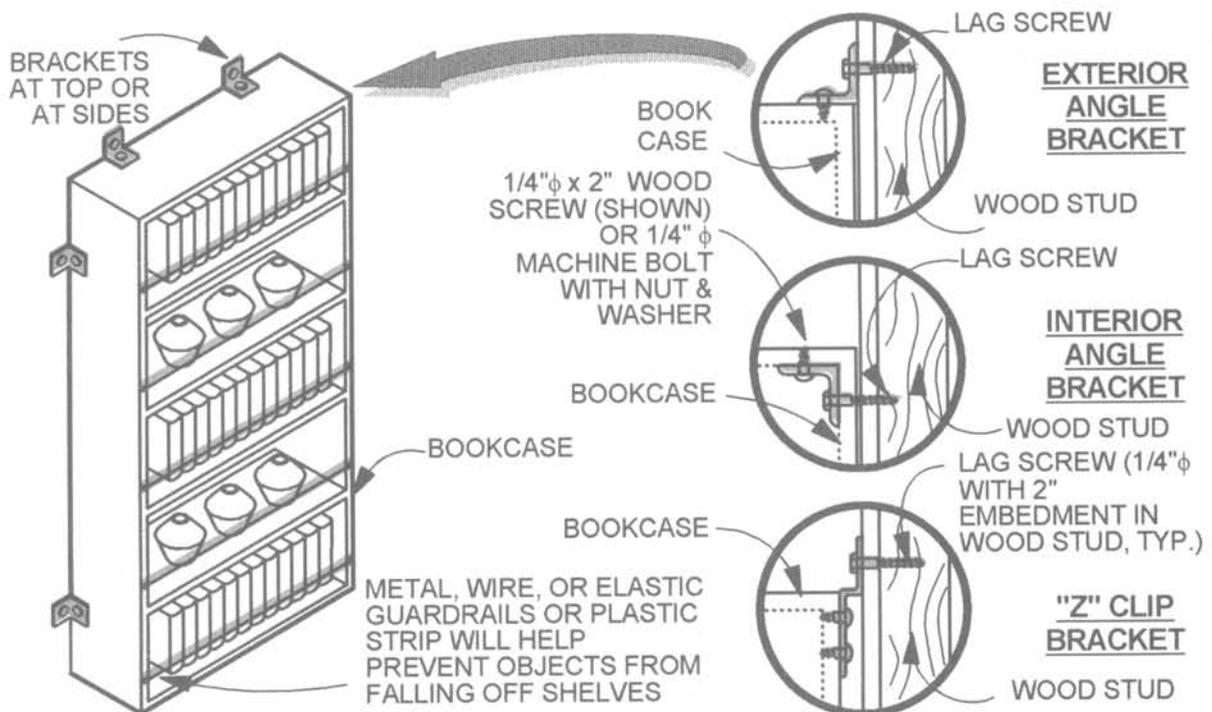
Photo Credit: Earthquake Engineering Research Institute, Marshall Lew & Greg Brandow **C12b**

TALL SHELVING: WALL UNIT

DO-IT-YOURSELF



Failure of inadequately upgraded shelving; toggle bolt pulled out of gypsum board.
Earthquake Damage: 1994, Northridge, California
Photo Credit: Wiss, Janney, Elstner Associates, Inc.



Upgrade Detail C12c

Approximate Cost: \$20 per lineal foot of shelving

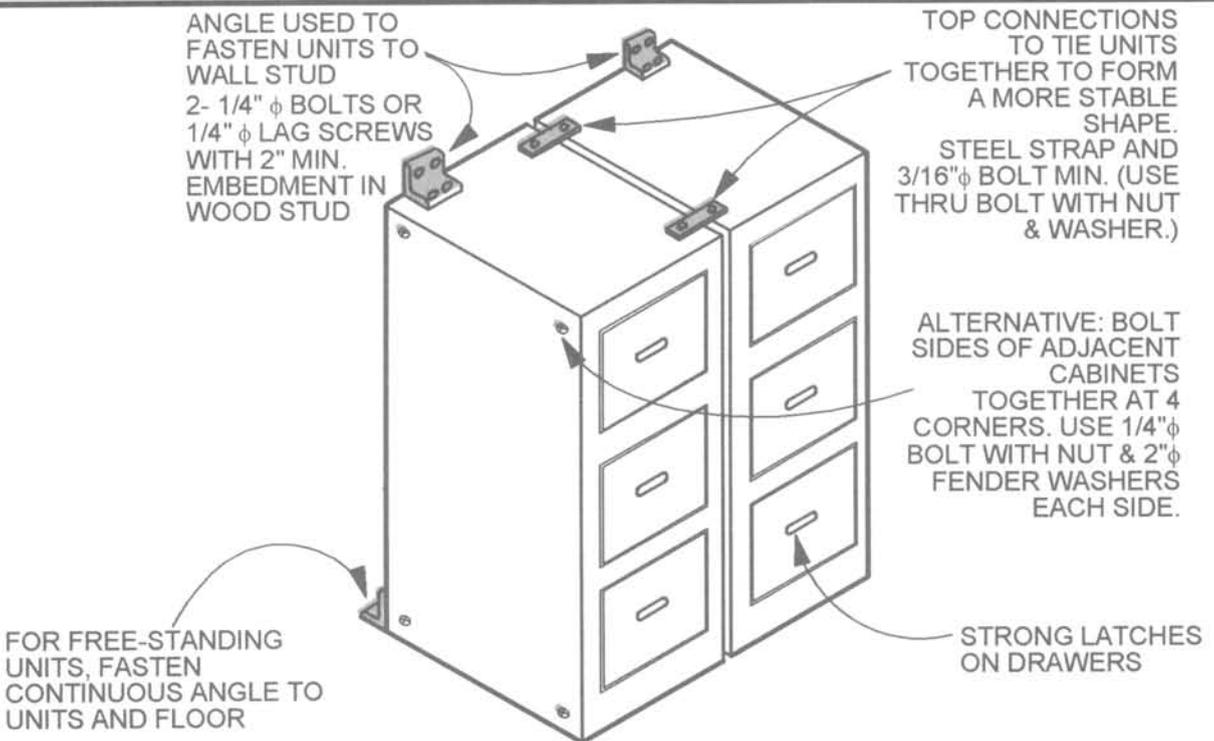
C12c

TALL FILE CABINETS

DO-IT-YOURSELF



Earthquake Damage: 1994, Northridge, California
Photo Credit: Wiss, Janney, Elstner Associates, Inc.

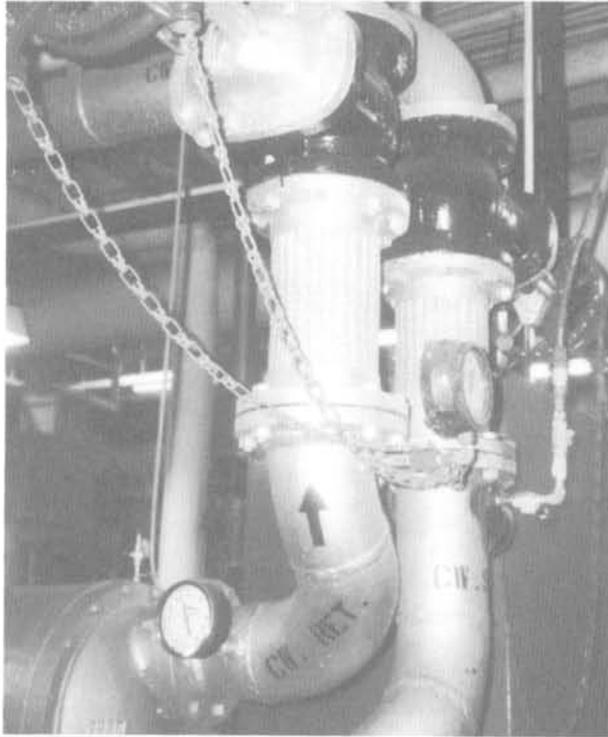


Upgrade Detail C13
Approximate Cost: \$20 per lineal foot

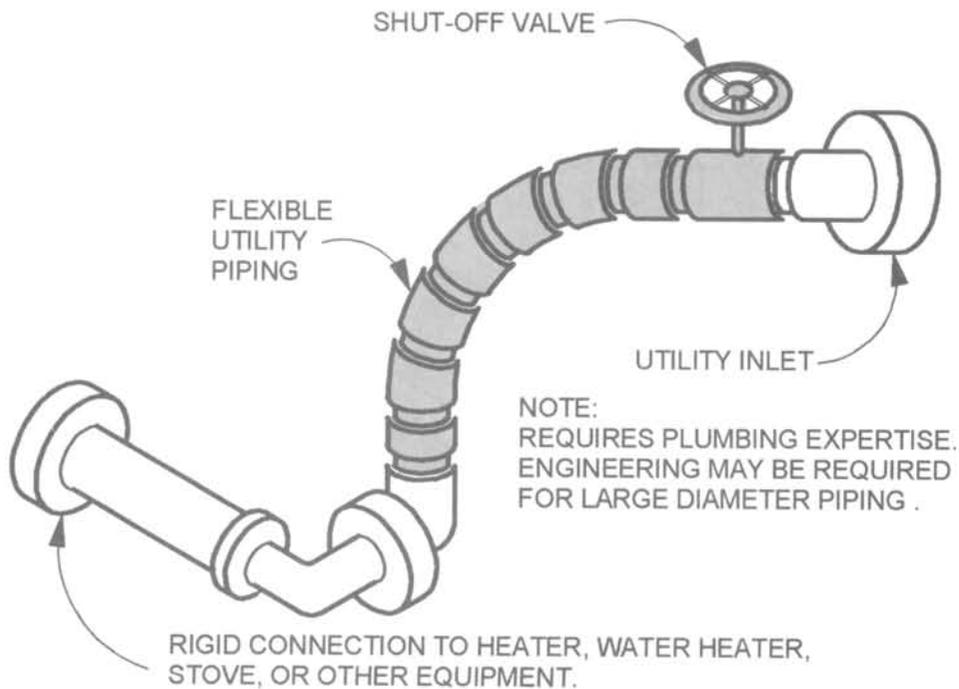
C13

FLEXIBLE CONNECTION FOR GAS OR FUEL LINES

DO-IT-YOURSELF



Flexible connection at pipe attachment to tank
Photo Credit: Wiss, Janney, Elstner Associates, Inc.



Upgrade Detail C18

Approximate Cost: \$100 for residential appliance; varies for larger items

C18

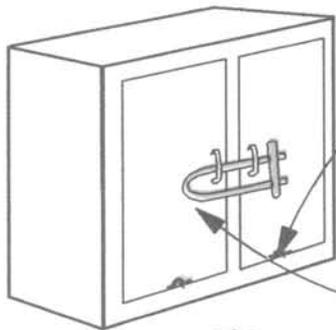
DRAWER AND CABINET LATCHES

DO-IT-YOURSELF



Unrestrained drawers and cabinets

Photo Credit: Wiss, Janney, Elstner Associates, Inc.



INSTALL STRONG MECHANICAL CABINET CATCHES (SAFETY HASP, SLIDE BOLT, TOUCH-DOOR CABINET CATCH, CLIP-ROLLER OR SNAP-ACTION CABINET CATCH, ETC.)

ALTERNATIVE: PROVIDE BABY-PROOF CLOSURE



INSTALL MECHANICAL DRAWER CLOSURE (BABY-PROOF LATCHES, DRAWER LOCKS, OR OTHER SPECIALTY LATCHES)

Upgrade Detail C19

Approximate Cost: \$50 per cabinet

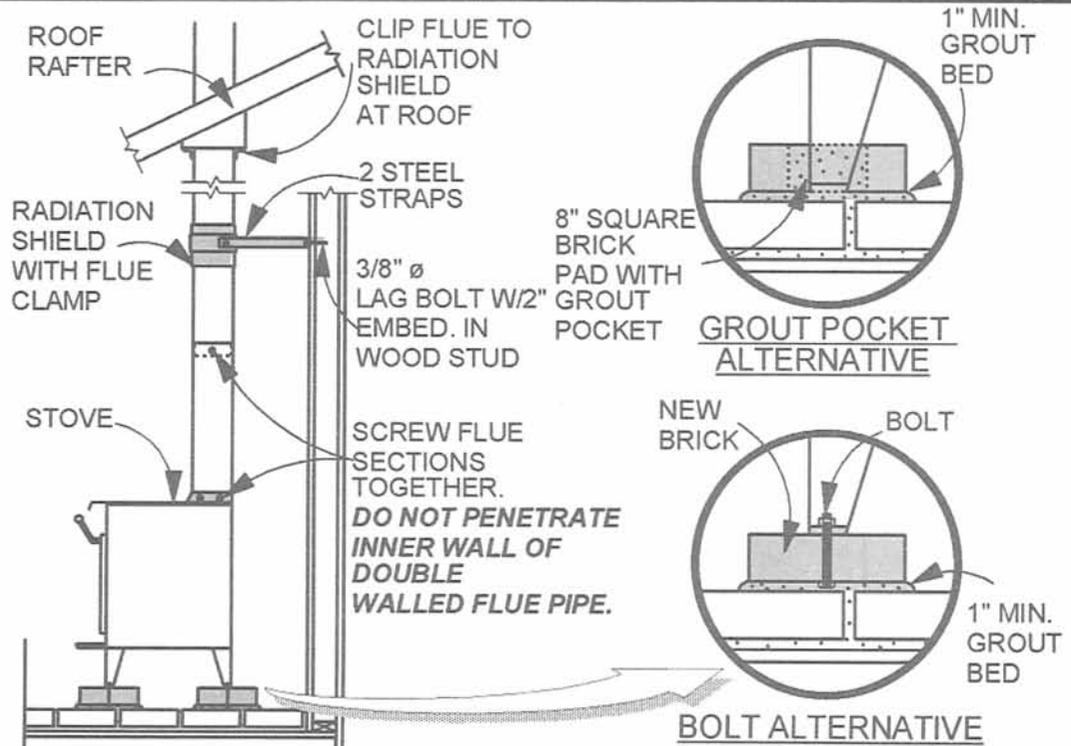
C19

FREESTANDING WOOD STOVE

DO-IT-YOURSELF



Unrestrained wood burning stove
Photo Credit: Wiss, Janney, Elstner Associates, Inc.



Upgrade Detail C20
Approximate Cost: \$500

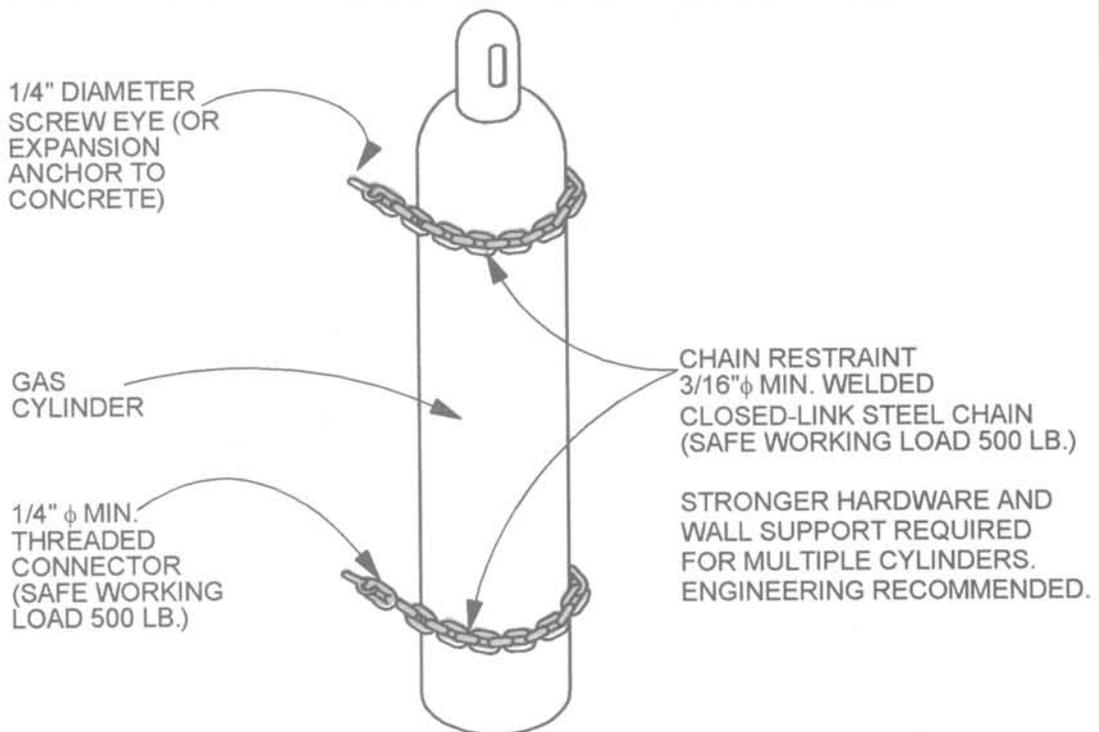
C20

COMPRESSED-GAS CYLINDERS

DO-IT-YOURSELF



Earthquake Damage: 1971, San Fernando, California
Photo Credit: Scientific Service, Inc.



Upgrade Detail C21

Approximate Cost: \$30 per lineal foot; \$50 for single units

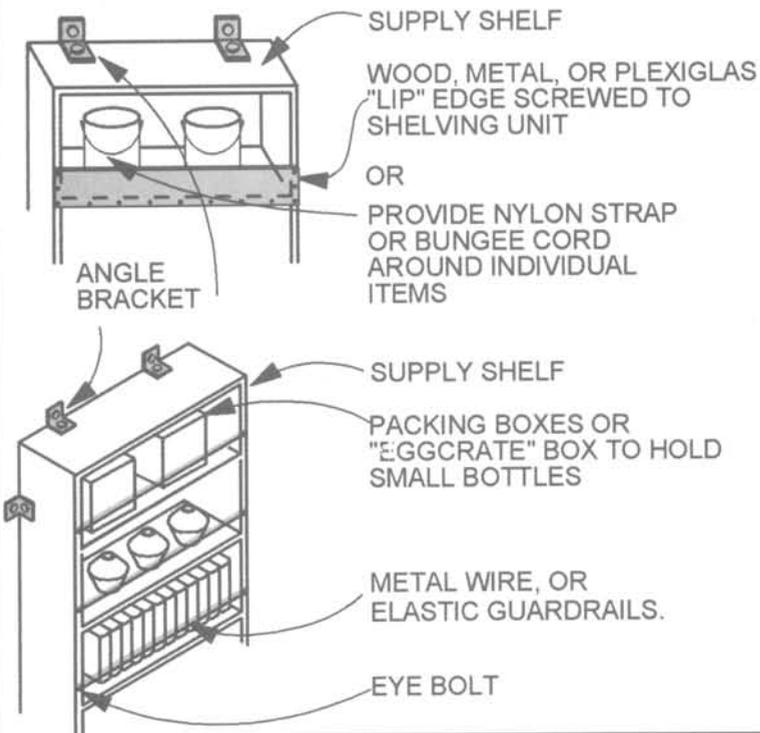
C21

CONTAINERS OF HAZARDOUS MATERIALS

ENGINEERING REQUIRED



Spilled pharmaceutical and medical supplies.
Earthquake Damage: 1994, Northridge, California
Photo Credit: Robert Reitherman



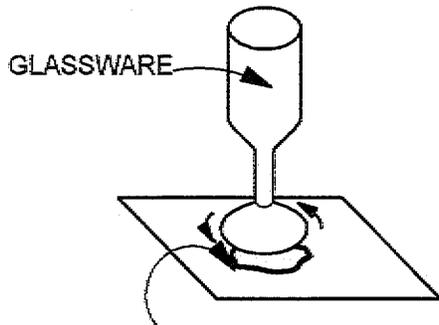
- ANCHOR STORAGE SHELVES
- PROVIDE SAFETY LIP OR SHELF EDGE
- PROVIDE MECHANICAL LATCHES FOR CABINETS AND DRAWERS
- STORE SMALL OR BREAKABLE ITEMS IN ORIGINAL PACKING OR EGGCRATE BOXES, NOT LOOSE ON SHELF OR IN DRAWER
- STORE INCOMPATIBLE MATERIALS AT A SAFE DISTANCE TO AVOID MIXING IF THE CONTAINERS FALL
- ORDER HAZARDOUS LAB CHEMICALS IN UNBREAKABLE PLASTIC BOTTLES OR IN GLASS BOTTLES WITH AN EXTERIOR PLASTIC SAFETY COATING

Schematic Upgrade Detail C22
Approximate Cost: Varies

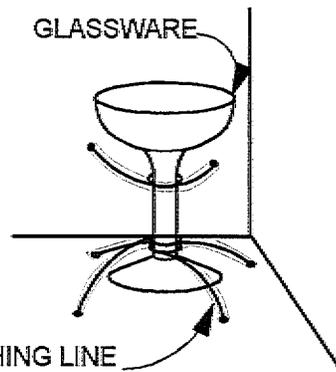
C22

FRAGILE ARTWORK

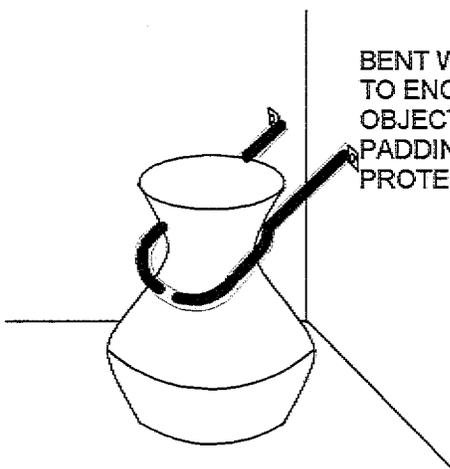
DO-IT-YOURSELF



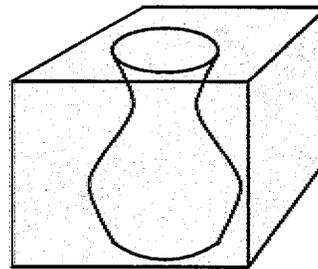
BEE'S WAX OR DENTAL WAX CAN RESTRAIN SMALL LIGHTWEIGHT OBJECTS. (REMOVE WITH CARE - WAX MAY LEAVE SMALL STAIN ON BASE OF OBJECT). ALTERNATIVE: USE PATCHES OF HOOK AND LOOP MATERIAL. [CAUTION - GLUE MAY AFFECT FINISH ON BASE OF OBJECT].



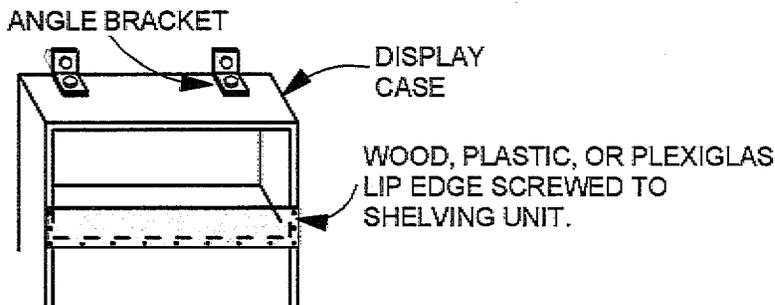
MONO-FILAMENT FISHING LINE USED FOR GUY WIRES



BENT WIRE ARMS TO ENCIRCLE THE OBJECT. PROVIDE PADDING TO PROTECT ARTWORK.



PLACE OBJECT IN CLOSE-FITTING GLASS OR PLEXIGLASS DISPLAY CASE. PEDESTAL MUST BE ANCHORED.



Upgrade Detail C26
Approximate Cost: Varies

C26