- **Fecha de publicación:** 09/08/1994
- **Tipo de publicación:** Regla final
- **Número de registro de la Fed:** 59: 40672-40753
- **Número estándar:** 1910 ; 1926
- **Título:** Normas de seguridad para la protección contra caídas en la industria de la construcción

DEPARTAMENTO DE TRABAJO

Administración de Seguridad y Salud Ocupacional

29 CFR Partes 1910 y 1926

RIN 1218-AA66

[Expediente No. S-206]

Normas de seguridad para la protección contra caídas en la industria de la construcción

AGENCIA: Administración de Salud y Seguridad Ocupacional, Departamento de Trabajo de EE. UU.

ACCIÓN: Regla final

RESUMEN: La Administración de Salud y Seguridad Ocupacional (OSHA) por la presente revisa las normas de seguridad de la industria de la construcción que regulan los sistemas y procedimientos de protección contra caídas. Estos sistemas y procedimientos están destinados a evitar que los empleados se caigan, suban o atraviesen los niveles de trabajo y protegen a los empleados de la caída de objetos.

La regla final corrige los problemas que han surgido durante la aplicación de las normas existentes. En esta regla final, OSHA mantiene o aumenta los requisitos para protección contra esos peligros, pero lo hace usando más criterios orientados al desempeño cuando sea posible, en lugar de lenguaje orientado a especificaciones. La regla final también consolida y simplifica muchas de las disposiciones existentes. Esta reglamentación es otro paso en el plan de OSHA para revisar sus normas de seguridad y revisarlas según sea necesario para proporcionar condiciones de trabajo más seguras sin imponer cargas innecesarias.

Además, la regla final hace un cambio a una disposición en las Normas de Seguridad y Salud Ocupacional para la Industria General. En particular, la Sec. 1910.269 - Generación, transmisión y distribución de energía eléctrica; Equipo de protección eléctrica que contiene un requisito en el párrafo (f) (2) de que el equipo personal de detención de caídas cumpla con los requisitos de la subparte E de la Parte 1926. Esa disposición ha sido revisada para requerir que el equipo cumpla con los requisitos de la subparte M revisada de la Parte 1926. .

FECHA DE VIGENCIA: Esta regla final entra en vigencia el 6 de febrero de 1995.

DIRECCIONES: De conformidad con 28 USC 2112 (a), la Agencia designa para la recepción de peticiones de revisión de la norma, el Abogado Asociado de Seguridad y Salud Ocupacional, Oficina del Abogado, Sala S-4004, Departamento de Trabajo de EE. UU., 200 Constitution Avenue NW., Washington, DC 20210.

PARA MÁS INFORMACIÓN PÓNGASE EN CONTACTO CON: Sr. James Foster, Departamento de Trabajo de EE. UU., Administración de Salud y Seguridad Ocupacional, Oficina de Información y Asuntos del Consumidor, Sala N3647, 200 Constitution Avenue, NW., Washington, DC 20210, Teléfono (202) 219-8148 .

INFORMACIÓN SUPLEMENTARIA: Los autores principales de esta regla final son Barbara J. Bielaski, oficial de proyectos, Oficina de Normas de Seguridad de la Construcción e Ingeniería Civil; Jens Svenson, Oficina de Análisis Regulatorio; Stephen Jones, Oficina del Procurador.

I. Antecedentes

El Congreso enmendó la Ley de Estándares de Horas de Trabajo por Contrato (40 USC 327 et seq.) En 1969 al agregar una nueva sección 107 (40 USC 333) para proporcionar a los empleados en la industria de la construcción un ambiente de trabajo más seguro y para reducir la frecuencia y severidad de la construcción. accidentes y lesiones. La enmienda, comúnmente conocida como Ley de Seguridad en la Construcción (CSA) [PL 91-54; 9 de agosto de 1969], reforzó significativamente la protección de los empleados al exigir la promulgación de normas de seguridad y salud ocupacional para los empleados de la industria de la construcción y la construcción que trabajan en proyectos de construcción financiados o asistidos por el gobierno federal. En consecuencia, el Secretario de Trabajo emitió Regulaciones de Seguridad y Salud para la Construcción en 29 CFR Parte 1518 (36 FR 7340, 17 de abril de

The Occupational Safety and Health Act (OSH Act) (84 Stat. 1590; 29 U.S.C. 651 et seq.), was enacted by Congress in 1970 and authorized the Secretary of Labor to adopt established Federal standards issued under other statutes, including the Construction Safety Act, as occupational safety and health standards. Accordingly, the Secretary of Labor adopted those Construction Standards, which had been issued under the Construction Safety Act in 29 CFR Part 1518, as OSHA standards in accordance with section 6(a) of the OSH Act (36 FR 10466, May 29, 1971). The Safety and Health Regulations for Construction were redesignated as Part 1926 later in 1971 (36 FR 25232, December 30, 1971).

OSHA adopted several regulations related to fall protection under section 6(a) of the OSH Act. In particular, the Agency adopted the standards which currently appear in subpart E, Personal Protective Equipment, (including Sec. 1926.104 -- Safety Belts, Lifelines, and Lanyards and Sec. 1926.105 -- Safety Nets) and in subpart M, Floor and Wall Openings and Stairways. Subpart M has been amended several times under section 6(b) of the OSH Act.

As part of OSHA's continuing standards evaluation program, and in response to public comments, a complete review of subpart M was begun in 1977. Since then, the Advisory Committee on Construction Safety and Health (ACCSH) has reviewed draft revisions of subpart M a number of times and has made many suggestions regarding the draft regulatory language. The transcripts of the ACCSH meetings where draft revisions to subpart M were discussed are part of the public record (Exhibit 1). The ACCSH recommendations, and those of other interested parties, have been carefully analyzed in connection with the present rulemaking. Many of the changes in the revised standard reflect the suggestions of the ACCSH and other interested persons. Specific ACCSH recommendations are discussed in the appropriate sections of the Summary and Explanation, below. Committee discussions that either were inconclusive or did not produce a specific recommendation have also been considered, but are not discussed in this preamble.

On November 25, 1986, OSHA proposed to revise virtually all of the fall protection provisions of the construction industry standards and to consolidate those requirements, except where specifically provided otherwise, in subpart M [51 FR 42718]. The proposal set a period, ending February 23, 1987, during which interested parties could submit written comments and request a hearing. The Agency twice granted commenters' requests for more time to submit comments and hearing requests. OSHA first extended the comment and hearing request period to June 1, 1987 [52 FR 5790, February 26, 1987] and then extended that period to August 14, 1987 [52 FR 20616, June 2, 1987]. The Agency received 162 comments on the proposal and several requests for a hearing.

On January 26, 1988, OSHA announced that it would convene an informal public hearing beginning on March 22, 1988, to elicit additional information on specific issues related to fall protection, scaffolds and stairways and ladders [53 FR 2048]. The hearing notice also reopened the comment period regarding proposed subpart M until March 8, 1988, for the limited purpose of obtaining additional information on appropriate fall protection coverage for employees engaged in steel erection activities. The Agency noted that the information obtained would be used in development of a separate proposed rule covering steel erection. OSHA received 22 comments in response to the limited reopening of the comment period.

The informal public hearings were conducted on March 22-23, 1988, with Administrative Law Judge Joel Williams presiding. At the close of the hearings, Judge Williams set a period, ending May 9, 1988, for hearing participants to submit additional comments and information. OSHA received 15 submissions, including testimony and documentary evidence, at the hearing. On August 11, 1989, Judge Williams certified the rulemaking record, including the hearing transcript and all written submissions to the docket, there by closing the record for this proceeding.

On August 5, 1992, OSHA reopened the rulemaking record (57 FR 34656) to consider new information submitted by the Precast/Prestressed Concrete Institute (PCI) regarding the fall protection needs of employees engaged in precast concrete construction. The PCI submissions (Exs. 25-4 and 25-6) described some characteristic precast concrete construction situations and alternative measures PCI believed employers could take to provide fall protection for their employees in those situations. The Agency solicited input on whether OSHA should allow precast concrete construction employers to protect employees from fall hazards by means other than guardrail systems, personal fall arrest systems or safety net systems. The Agency also sought comments regarding what criteria OSHA should set to determine the appropriateness of using alternative measures and to determine if the alternative measures are effectively minimizing fall hazards. The comment period, which ended November 3, 1992, elicited 14 comments.

On March 29, 1993, the Agency again reopened the rulemaking record (58 FR 16515) to provide additional time for the precast concrete construction industry to comment on the issues raised in the August 5, 1992, notice. The March 29 notice also discussed the fall protection needs of employees involved in residential construction, focusing on the feasibility of protecting employees erecting roof trusses and exterior wall panels with guardrails, personal fall arrest systems or safety net systems. OSHA requested information regarding alternative measures, or safe work practices, residential construction employers can use to minimize fall hazards. The limited comment period, which ended on May 28, 1993, elicited 28 comments.

A wide range of employees, businesses, trade associations, state governments, and other interested parties contributed to the development of this record. The Agency appreciates these efforts to help OSHA develop a rulemaking record that provides a sound basis for the promulgation of this final rule.

The Agency believes that, while the means of providing fall protection are continually improving, there may be circumstances where employers can demonstrate that compliance with certain fall protection requirements would be infeasible; i.e., it would be impossible to accomplish the work using conventional fall protection systems or it is technologically impossible to use conventional fall protection systems, or that those systems would create a greater hazard to employees. OSHA has determined that revised subpart M is needed to address those circumstances, encourage greater compliance by employers and employees, and maximize employee protection from fall hazards. OSHA believes that the clarified and revised language of the final rule will help employers to understand and implement the requirements of subpart M, resulting in improved employee protection. In addition, much of the final rule has been written in more performance-oriented language. This will make it easier for employers to provide the necessary protection for their employees, since they will be able to select fall protection measures which are compatible with the type of work being performed.

This project has been coordinated with other ongoing projects for the revision of related general industry standards in 29 CFR Part 1910, subpart D -- Walking/Working Surfaces, [proposed rule published at 55 FR 13360, April 10, 1990] and 29 CFR Part 1910 subpart I -- Personal Protective Equipment (Fall Protection Systems), [proposed rule published at 55 FR 13423, April 10, 1990] and with the proposed rulemaking for the Shipyard Industry in 29 CFR 1915 subpart M -- Fall Protection [proposed rule published at 53 FR 48168, November 29, 1988]. Where appropriate, the 1910, 1915, and 1926 requirements will use the same language to address similar hazards so employers will have clear and consistent direction as to what is necessary to protect employees from fall hazards.

In developing this final rule, OSHA has focused on requiring employers to provide construction employees with a positive method of protection against fall hazards wherever possible. At the same time, the Agency has taken steps to allow alternatives to traditional, conventional fall protection methods in situations where conventional methods can be shown to be inappropriate or unreasonable. Some of the alternative methods prescribed in revised subpart M represent innovations which are necessary to deal with unique workplace conditions. The record of this rulemaking indicates that these methods have not been used long enough or widely enough to enable the Agency to determine just how effective they will be throughout the construction industry.

In this regard, OSHA intends to monitor the effectiveness of these provisions carefully for the next several years, to make sure that they are providing the necessary protection for construction workers. The Agency will carefully review and examine its enforcement data, together with any investigative reports and other information on accidents which involve fall hazards. In addition, OSHA intends to work closely with NIOSH in performing such data collection and analysis. Should the available data indicate that the alternative methods are not providing adequate fall protection to employees, the Agency will reevaluate the standards and determine what changes, if any, are warranted.

II. Hazards Involved

Fall accidents resulting in injuries and fatalities continue to occur at construction sites despite the promulgation of the OSHA Construction Standards in 1971. OSHA's initial review of accident data indicated that compliance with existing OSHA standards would have, in general, prevented the mishaps. After a more complete review of information derived from enforcement experience and public comments, OSHA decided that certain existing provisions needed to be updated and clarified, in order to improve employee protection. In addition, OSHA decided to reorganize the existing fall protection requirements so that employers could more readily determine what requirements they must follow.

Precise fall hazard accident data for the entire construction industry are not available. Falls are generally recorded by OSHA according to the nature of the injury and the surface involved, but the two categories have not been uniformly cross-referenced. However, based upon the data which have been compiled, OSHA estimates that there are at least 68,000 injuries due to falls from elevations covered under subpart M occur every year, and 95 fatalities (Regulatory Impact and Regulatory Flexibility Analysis, Section III).

The U.S. Department of Labor, based on data from the Bureau of Labor Statistics, has listed falls as one of the leading causes of traumatic occupational death, accounting for 8% of all occupational fatalities in 1986. Data from NIOSH showed that from 1980-1985, falls represented about 10% of all traumatic occupational deaths for which a cause was identified, and that falls were shown to be one of the major causes of injuries to construction workers. A NIOSH analysis of death certificates from work related injuries over a 10-year period has made it clear that falls are the leading cause of work related injury death among construction workers (E. Lynn Jenkins, S.M. Kisner, D.E. Fosbroke, et al. Fatal Injuries to Workers in the United States, 1980-89; A Decade of Surveillance -- National Profile, DHHS, NIOSH, 93-108, August 1993).

An OSHA study involving 99 fall-related fatalities (Ex. 3-3) suggests that virtually all of those deaths could have been prevented by the use of guardrails, body belts, body harnesses, safety nets, covers, or other means which would reduce employee exposure to the fall hazard.

OSHA recognizes that such accidents are, generally, complex events, involving a combination of factors. Accordingly, the Agency notes that a number of human and equipment-related issues must be addressed to protect employees from fall hazards. Among those issues are the following:

The need to know where protection is required;

The selection of fall protection systems which are appropriate for given situations;

The proper construction and installation of safety systems;

The proper supervision of employees;

The implementation of safe work procedures; and

The proper training in the selection, use, and maintenance of fall protection systems.

Each of these topics is covered in revised subpart M. The final rule requires employers to identify and evaluate fall hazards, and it includes specific training requirements that clarify the existing general training provisions of Sec. 1926.21 as they apply to fall protection. The final rule also makes it clear what an employer must do to provide fall protection for employees. Finally, the final rule relocates fall protection requirements from other subparts in the construction regulations, and places them in subpart M. For example, fall protection for workers on steep roofs was addressed by provisions in existing subpart L, but now will be addressed in revised subpart M.

Based on its review of the incident data, OSHA has concluded that fall hazards pose a significant risk of death or serious injury for construction employees and that compliance with the requirements of revised subpart M is reasonably necessary to protect employees from those hazards. For a further discussion of accident rates and the significance of fall hazards in construction employment, see Section IV. Summary of the Regulatory Impact Analysis and Section V. Statutory Considerations.

Certain proposed provisions have been reorganized in the final rule. The reorganized provisions are as follows:

Reorganization Table	
New Sec. no. and/or paragraph	Proposed Sec. no. and/or paragraph
Sec. 1926.501	
(b)(11)	(c)
(b)(12)	
(b)(13)	
(b)(14)	(d)
(b)(15)	
(c)	(e)
Sec. 1926.502	
(b)(10)	(b)(11)
(b)(11)	(b)(12)
(b)(12)	(b)(13)
(b)(13)	(b)(14)
(b)(14)	(b)(15)
(b)(15)	
(d)(1)	(d)(9)
(d)(2)	(d)(10)
(d)(3)	(d)(16)
(d)(4)	

(d)(5)	
(d)(6)	(d)(17), (18) and (19)
(d)(7)	
(d)(8)	(d)(14)
(d)(9)	(d)(13) and (15)
(d)(10)	(d)(11)
(d)(11)	(d)(3)
(d)(12)	(d)(13) partial
(d)(13)	(d)(13) partial
(d)(14)	
(d)(15)	(d)(12)
(d)(16)	(d)(4), (5), and (6)
(d)(17)	(d)(7)
(d)(18)	(d)(1)
(d)(19)	(d)(2)
(d)(20)	
(d)(21)	(d)(20)
(d)(22)	(d)(8)
(d)(23)	(d)(21)
(d)(24)	(d)(22)
(e)(2)	(e)(3)
(e)(3)	
(e)(4)	(e)(2)
(e)(5)	(e)(4)
(e)(6)	
(e)(7)	
(e)(8)	
(e)(9)	(e)(5)
(e)(10)	
(g)(1)	(g)(1) and (g)(5)
(g)(2)	(g)(2) and (g)(5)
(h)(4)	
(i)(4)	
(j)(8)	
(k)(1)-(10)	
Sec. 1926.503	
(b)	
(c)	(a)(2)
Appendix D	
Appendix E	

III. Summary and Explanation of the Final Rule

The following discussion explains how the final rule corresponds to or differs from the proposed and the existing standards, and how the comments and testimony presented on each provision influenced the drafting of the final rule. Except where otherwise indicated, proposed provisions which did not elicit comment have been promulgated as proposed, for the reasons stated in the preamble to the proposed rule.

Subpart M -- Fall Protection

OSHA has changed the title of subpart M from "Floor and Wall Openings, and Stairways" to "Fall Protection." The revised title reflects both the relocation of the provisions for stairways to subpart X, which was published as a final rule on November 14, 1990 (55 FR 47660), and the Agency's decision to consolidate most requirements for fall protection in construction in revised subpart M. OSHA has made subpart M the comprehensive reference for construction fall protection standards by revising and relocating the general requirements in existing Sec. 1926.104 -- Safety belts, lifelines, and lanyards; existing Sec. 1926.105 -- Safety nets; and the pertinent definitions in existing Sec. 1926.107 to subpart M.

OSHA is also deleting Sec. 1926.651(l)(2), which requires fall protection at "remotely located excavations," and Sec. 1926.701(f)(2), which requires fall protection for employees installing reinforcing steel more than 6 feet (1.8 m) above adjacent working surfaces, because the pertinent hazards are covered by Sec. Sec. 1926.501(b)(7)and (b)(5), respectively. Another excavation provision, Sec. 1926.651(l)(1), is being revised to be consistent with Sec. 1926.501(b)(6) of the final rule. All three of the provisions noted above pertain to fall protection. In addition, the provision of existing Sec. 1926.105(a), has been relocated to Sec. 1926.753 of subpart R (steel erection) to maintain existing coverage pending rulemaking to revise the fall protection requirements for steel erection work. A more complete discussion of the revised and relocated provisions is provided later in this document.

1926.500 Scope, Application, and definitions Applicable to This Subpart

Paragraph (a) of Sec. 1926.500 states the scope and application of subpart M. Paragraph (a)(1) states that the fall protection requirements of subpart M apply to all construction workplaces, except where another subpart of part 1926 specifies what fall protection systems must be used and sets the criteria for those fall protection systems. OSHA notes there are some activities that will be classified as either general industry or construction depending on other activities occurring at the same time or same site. For example, when surface preparation work and sandblasting work are being performed in connection with painting activities or other construction activities, then these two activities are considered construction work and employers engaged in these activities must follow the requirements of subpart M as it pertains to fall hazards associated with surface preparation and sandblasting. On the other hand, when these activities are conducted as part of general maintenance work, the fall protection requirements of the general industry standards (part 1910) would apply.

Paragraph (a)(1), which is essentially the same as proposed Sec. 1926.500(a)(1), also states that the provisions of subpart M do not apply when the employer establishes that employees are only inspecting, investigating, or assessing workplace conditions prior to the actual start of the work or after work has been completed. OSHA has set this exception because employees engaged in inspecting, investigating and assessing workplace conditions before the actual work begins or after work has been completed are exposed to fall hazards for very short durations, if at all, since they most likely would be able to accomplish their work without going near the danger zone. Also, the Agency's experience is that such individuals who are not continually or routinely exposed to fall hazards tend to be very focused on their footing, ever alert and aware of the hazards associated with falling. These practical considerations would make it unreasonable, the Agency believes, to require the installation of fall protection systems either prior to the start of construction work or after such work has been completed. Such requirements would impose an unreasonable burden on employers without demonstrable benefits.

OSHA notes that the operations covered by paragraph (a)(1) are normally conducted in good weather, that the nature of such work normally exposes the employee to the fall hazard only for a short time, if at all, and that requiring the installation of fall protection systems under such circumstances would expose the employee who installs those systems to falling hazards for a longer time than the person performing an inspection or similar work. In addition, OSHA anticipates that employees who inspect, investigate or assess workplace conditions will be more aware of their proximity to an unprotected edge than, for example, a roofer who is moving backwards while operating a felt laying machine, or a plumber whose attention is on overhead pipe and not on the floor edge.

Some commenters (Exs. 2-15, 2-31, and 2-56) expressed concern regarding the proposed exception. In particular, one commenter (Ex. 2-31) said "the exception . . . will create havoc for enforcement agencies." The commenter further stated that "superintendents, foremen, and other company officials will never have to be protected during the entire job, because they will say that they are only inspecting." Another commenter (Ex. 2-15) suggested that OSHA grant only a conditional exception. It would then allow the exception only where exposures to falling are minimal at most or nonexistent. In addition, only experienced, responsible persons trained in the hazards associated with inspections, investigations, etc., would be allowed to work without fall protection. One commenter (Ex. 2-56) disagreed with the proposed exclusion, saying:

These employees are exposed to unique hazards since their functions are to determine if protection systems are adequate, deteriorated, etc. To allow such employees to work unprotected will promote the not wearing or using such protection by others.

Based on the comments received, OSHA recognizes that proposed Sec. 1926.500(a)(1) requires clarification. Therefore, OSHA has decided to reword the provision to make it clear that the exclusion only applies when the employer establishes that employees are inspecting, investigating, or assessing workplace conditions prior to the actual start of work or after the work has been completed. It was OSHA's intent when it proposed this provision that the exclusion would only apply at the two times stated above, not during the period when construction work is being performed. As explained in the preamble to the proposed rule, the exception would apply where an employee goes onto a roof in need of repair to inspect the roof and to estimate what work is needed. During such an inspection, guardrails, body belts, body harnesses, safety nets, or other safety systems would not be required. However, if inspections are made while construction operations are under way, all employees who are exposed to fall hazards while performing these inspections must be protected as required by subpart M. The intent of the provision is also to recognize that after all work has been completed, and workers have left the area, there may be a need for building inspectors, owners, etc. to inspect the work. OSHA recognizes that in these situations, all fall protection equipment, such as perimeter guardrail systems, may have been removed. OSHA is not requiring the installation of the systems for a second time for inspectors, because the Agency recognizes it would be unreasonably burdensome to require the reinstallation of fall protection equipment after all the work has been completed.

Paragraph (a)(2), like the proposal, notes that some subparts within part 1926 aside from subpart M contain fall protection requirements. Those other provisions, however, are not comprehensive. Therefore, when an employee is exposed to a falling hazard, such as that of falling more than 6 feet to a lower level, which is not specifically addressed in another subpart, OSHA intends that the general provisions of subpart M apply. For example, while subpart N contains requirements for fall protection when certain cranes are used, it does not address other equipment or workplace conditions otherwise covered by subpart N which may also expose employees to a fall hazard. Also, paragraph (a)(3) provides that if another subpart requires the use of specified fall protection systems but does not set criteria which those systems must meet, the criteria set in subpart M apply. For example, subpart L -- Scaffolds, requires that employers provide guardrails and safety belts (body belts) when employees are working on scaffolds. Subpart L sets criteria for the use of guardrail systems on scaffolds, but does not set criteria for the use of body belts. Under those circumstances, body belts used by employees working on scaffolds must satisfy the criteria in subpart M, while guardrails would be required to meet the criteria in subpart L.

Aside from subpart L, the subparts in part 1926 that address the subject of fall protection are subparts N, R, S, V and X.

A brief summary of the fall protection topics covered for each of the above-mentioned subparts is listed below.

* Subpart N -- Cranes and Derricks. Requirements to have fall protection for employees working on certain cranes and derricks are contained in subpart N.

* Subpart R -- Steel Erection. Requirements to have fall protection for employees engaged in the construction of skeleton steel buildings are contained in subpart R.

* Subpart S -- Underground Construction, Caissons, Cofferdams, and Compressed Air. Requirements to have fall protection on specified pieces of equipment used in under-ground construction operations are contained in subpart S.

* Subpart V -- Power Transmission and Distribution. Requirements to have fall protection for employees engaged in the construction of electric transmission and distribution lines and equipment are contained in subpart V.

* Subpart X -- Stairways and Ladders. Requirements to have fall protection for employees working on stairways and fixed ladders are contained in subpart X. Subpart X already references the current fall protection criteria set out in subpart M, and that reference will now incorporate the revised criteria in Sec. 1926.502 of this final rule.

OSHA notes that the proposed rule also identified subpart O as containing requirements for fall protection for employees on pile driving equipment. OSHA has not included this exclusion in the final rule because subpart O does not actually contain a requirement to have fall protection equipment; rather, it only contains a requirement that attachment points be provided to facilitate attachment of personal fall arrest equipment.

OSHA received several comments related to proposed paragraph (a)(2). Two commenters (Exs. 2-19 and 2-56) indicated some confusion regarding the extent to which employees engaged in steel erection activities would be covered by the requirements of proposed subpart M. Based on the apparent confusion and the Agency's recognition that a complete revision of subpart R -- Steel Erection, was needed, OSHA decided to defer consideration of changing current fall protection requirements as they apply to steel erection of buildings to the subpart R rulemaking. However, as noted in the hearing notice (53 FR 2048) information gathered through the subpart M rulemaking on fall protection for steel erection will be used to help the Agency develop proposed revisions to subpart R. Therefore, pending completion of the subpart R rulemaking, OSHA will continue to apply the existing fall protection requirements of part 1926 to steel erection operations. To this end, as noted above, OSHA is relocating existing Sec. 1926.105(a) to subpart R as Sec. 1926.753. This provision will remain in subpart R until a final rule for revised subpart R becomes effective. In this way, OSHA ensures that employers engaged in steel erection activities currently covered by the existing, unrevised fall protection requirements remain covered until the rulemaking on subpart R is completed.

Section 1926.500(b) lists and defines all major terms used in the final rule. Many of the proposed terms and definitions have been promulgated unchanged or with only editorial revisions. These terms include "dangerous equipment," "equivalent," "failure," "guardrail system," "hole," "low-slope roofs," "mechanical equipment," "opening," "overhand brick laying and related work," "positioning device system," "roof," "safety monitoring system," "steep roof," "work area." The proposed terms and definitions which did not elicit comment and which are being promulgated without change or with only editorial changes are not discussed below. However, all other terms and definitions, including any revisions, additions, and deletions, are discussed below.

Also, OSHA notes that several commenters indicated that they had already provided comments on terms used in relation to personal fall arrest systems and positioning device systems covered by OSHA's proposed rule for powered platforms (Docket S-700A), and requested that OSHA consider their comments in regard to the proposed terms and fall protection requirements of subpart M. Those commenters included the Industrial Safety Equipment Association (ISEA), Research and Trading Corporation (RTC), and the ANSI Z359 Committee Chairman (testifying on behalf of the U.S. Technical Advisory Group, an advisory group representing Government and private interests on personal equipment for protection against falling, ISO/TC94/SC4 (USTAG) in the powered platform rulemaking) (Exs. 2-23, 2-36, 2-50, and 3-13).

OSHA has considered those comments and has reviewed the powered platforms rulemaking record (final rule, Sec. 1910.66, published July 28, 1989; 54 FR 31408), in general, for information relating to fall protection. Based on that review, OSHA has decided that those terms defined in the powered platforms rule which relate to personal

fall arrest systems will also be defined in subpart M, where such terms are used in the final rule. Consequently, definitions for the following terms have been added to subpart M: "anchorage," "buckle," "connector," "free fall," "rope grab," "self-retracting lifeline/lanyard," and "snap-hook." These terms were used in the proposed rule and had the same meaning as provided in the definitions used in this final rule. OSHA believes this action will promote consistency throughout OSHA standards with regard to fall protection and OSHA intends to use the same terminology and definitions in its rules covering the same type of equipment. The newly defined terms and proposed terms that elicited comment are discussed below.

"Anchorage." This term is defined to be a secure point of attachment for lifelines, lanyards, or deceleration devices.

"Body belt/harness system." The term "body belt/harness system" has been changed to "personal fall arrest system" for the sake of uniformity with the general industry standard for powered platforms. The term "personal fall arrest system" is discussed in detail below.

"Body harness." Although there were no comments on the proposed definition of this term, OSHA has reworded the definition so that it is identical to the definition of "body harness" in the final rule on powered platforms.

Again, the purpose of this rewording is to promote consistency in the OSHA regulations. The rewording does not alter the meaning of the term as proposed.

"Buckle." This term is defined to mean any device for holding the body belt or body harness closed around the employee's body. The ISEA (Ex. 2-23) suggested that a definition for the term buckle was needed. OSHA agrees and has defined the term in this final rule, using the language from the final rule on powered platforms. In the final rule on powered platforms, OSHA stated the following, which OSHA believes is also applicable to this rulemaking (See 54 FR 31446):

One comment was received on the definition of "buckle" [citation omitted] which suggested that the term was superfluous and should be addressed in a separate national consensus standard for body support systems. OSHA disagrees since the term is used in the OSHA standard and there is not yet a national consensus standard for body support systems which includes this term.

"Built-up roofing." OSHA proposed to define the term "built-up roofing" to mean a weather proofing cover, applied over roof decks, consisting of a liquid-applied system, a single-ply system, or a multiple-ply system. Liquid-applied systems generally consist of silicone rubber, plastics, or similar material applied by spray or roller equipment. Single-ply systems generally consist of a single layer of synthetic rubber, plastic or similar materials, and often, but not always, a layer of adhesive. Multiple-ply systems generally consist of layers of felt and bitumen. Any of the systems may be covered with a layer of mineral aggregate.

OSHA has removed this term from the definition paragraph because the Agency has determined, as discussed below in relation to Sec. 1926.501(b)(10), that there is no need to provide for different fall protection requirements for low-slope roofs based on the type of work (e.g., built-up roofing) being performed.

"Connector." This term is used in the final rule in place of the term "hardware" which was used in the proposed rule. It is defined to mean a device which is used to couple (connect) parts of the personal fall arrest system or positioning device system together. It may be an independent component of the system, such as a carabiner, or it may be an integral component of part of the system (such as a buckle or dee-ring sewn into a body belt or body harness, or a snap-hook spliced or sewn to a lanyard or self-retracting lanyard). The term and definition in the final rule are the same as those in the powered platforms final rule [54 FR 31470], in which OSHA stated the following, which OSHA believes is applicable to this rulemaking (See 54 FR 31446):

OSHA is replacing the proposed term "hardware" with the term "connector." Two commenters stated that "hardware" was too broad and one suggested that the term "connector" be used instead [citations omitted]. OSHA agrees with these suggestions, notes that "connector" connotes the specific function at issue, has deleted the term

"hardware," replaced it with the term "connector" and has expanded the definition.

"Controlled access zone" (CAZ). This term is used to describe a work area designated and clearly marked in which certain types of work (such as over hand brick laying work) may take place without the use of conventional fall protection systems -- guardrail systems, personal fall arrest systems, or safety net systems -- to protect the employees working in the zone. Access to the zone must be controlled to limit the number of workers exposed to fall hazards. OSHA observes that safety monitoring systems may be required where a CAZ is used as part of a fall protection plan (see Sec. 1926.502(k)). The proposed term "control zone" was essentially identical.

One commenter (Ex. 2-157) stated "the definition of control zone in [proposed] Sec. 1926.502(g) does not appear to be applicable to scaffolds. OSHA acknowledges that a controlled access zone would not be used on a scaffold, although scaffolds might be used within a controlled access zone. Requirements to have fall protection on scaffolds both within and outside of controlled access zones are found in subpart L -- Scaffolds.

Another commenter, the Mason Contractors Association of America (Ex. 2-95), suggested that the term "control zone system" used in the proposal should be changed to "controlled access zone" (CAZ) to more effectively and correctly describe the function of a control zone. OSHA agrees with the commenter and has changed the term. There were no other substantive comments on the definition.

OSHA notes that the use of a controlled access zone is permitted only in Overhand brick laying and related work, (Sec. 1926.501(b)(9)) and as part of a Fall Protection Plan (see Sec. 1926.502(k) for Leading edge work (Sec. 1926.502(b)(2)(i)); Precast concrete work (Sec. 1926.501(b)(12)); or residential construction work (Sec. 1926.501(b)(13)).

"Deceleration device." This term describes a piece of equipment used to bring a falling employee to a stop without injury. The proposed definition of "deceleration device" has been revised to be consistent with the definition used in OSHA's final rule on powered platforms [54 FR 31470]. There were several comments received on the proposed definition and in response to Issue #21. In this issue, OSHA discussed the use of the term "deceleration device" in the proposals for both the construction fall protection requirements of subpart M and the fall protection requirements for the general industry standard on powered platforms, subpart F. Bristol Steel and the NEA (Exs. 2-12 and 2-43) commented that the term is sufficiently descriptive. The ISEA, the Mine Safety Appliance Company (MSA), and the SSFI (Exs. 2-23, 2-35, and 2-89) suggested rewording the definition because they viewed it as misleading and confusing. Other commenters, including the National Constructors Association and the BCMALU (Exs. 2-45 and 2-46), suggested replacing the term with "shock absorber" or "fall arrester," respectively. RTC (Ex. 2-36) and the ANSI Z359 Committee/USTAG representative (Ex. 2-50) referred OSHA to their comments on the proposal for powered platforms. The following discussion from the final rule on powered platforms [54 FR 31446] covers those comments:

Comments were received on the definition of "deceleration device" [citations omitted]. It was suggested that this term be eliminated and replaced with three terms, "fall arrester," "energy absorber," and "self-retracting lifeline/lanyard" because the examples listed by OSHA in its proposed definition of deceleration device serve varying combinations of the function of these three suggested components. In particular, it was pointed out that a rope grab may or may not serve to dissipate a substantial amount of energy in and of itself. The distinction that the commenter was making was that some components of the system were "fall arresters" (purpose to stop a fall), others were "energy absorbers" (purpose to brake a fall more comfortably), and others were "self-retracting lifeline/lanyards" (purpose to take slack out of the lifeline or lanyard to minimize free fall). OSHA notes, however, that it is difficult to clearly separate all components into these three suggested categories since fall arrest (stopping) and energy absorption (braking) are closely related. In addition, many self-retracting lifeline/lanyards serve all three functions very well (a condition which the commenter labels as a "subsystem" or "hybrid component"). OSHA believes that the only practical way to accomplish what is suggested would be to have test methods and criteria for each of the three component functions. However, at this time, there are no national consensus standards or other accepted criteria for any of the three which OSHA could propose to adopt.

In addition, OSHA's approach in the final standard is to address personal fall arrest equipment on a system basis. Therefore, OSHA does not have separate requirements for "fall arrestors," "energy absorbers" and "self-retracting lifeline/lanyards" because it is the performance of the complete system, as assembled, which is regulated by the OSHA standard. OSHA's final standard does not preclude the voluntary standards writing bodies from developing design standards for all of the various components and is supportive of this undertaking * * *.

OSHA has, however, used the commenters' suggestions to clarify the definition of "deceleration device," as well as further clarify the test methods applicable to the various assembled systems * * *.

After a careful review of the comments received and for the reasons above, OSHA has determined that the term "deceleration device" is appropriate, but the definition has been revised to clarify that deceleration devices serve to dissipate a substantial amount of the energy imposed on an employee during fall arrest or otherwise limit the energy imposed on an employee during fall arrest. The definition mentions several examples of mechanisms which accomplish this function.

"Deceleration distance." This term is used to describe the distance a falling employee travels (excluding lifeline elongation and free fall distance). Aside from some editorial revision, the definition in the final rule is identical to the proposed definition. The ISEA and the MSA (Exs. 2-23 and 2-35) commented that the proposed definition, just as the proposed definition in powered platforms, could cause confusion, such as the mistaken belief that deceleration distance was the total fall distance. OSHA agrees with the commenters and has reworded the definition of deceleration distance to remove the point of confusion. In particular, OSHA has eliminated the words "excluding lifeline elongation between those two points" that appeared in the subpart M proposed rule. The definition in the final rule is consistent with the definition in Sec. 1910.66, powered platforms. OSHA has also considered the comments which were provided to the powered platform rulemaking record (Ex. 3-13). OSHA's discussion of those comments in the final rule on powered platforms [54 FR 31447] is applicable here and appears below:

Several comments were received on the proposed definition for "deceleration distance" [citations omitted]. Concern was expressed by all commenters that it was only possible to evaluate the stopping distance for the device itself once it was activated. OSHA agrees with these comments and has revised the definition of deceleration distance to exclude lifeline elongation and any free fall distance which occurs before the device is activated. In addition, suggestions for clarification of the definition were accepted.

"Failure." This term describes load refusal, breakage, or separation of component parts where the ultimate strength has been exceeded. Four commenters (Exs. 2-16, 2-23, 2-45, and 2-56) expressed concern regarding the definition of the term "failure." Two of these commenters, (Exs. 2-16 and 2-23), noted that the term "failed" as used in proposed paragraph (c) of the proposed non-mandatory Appendix C, was inconsistent with the proposed definition of "failure." OSHA agrees, and has both deleted the term from the Appendix and reworded the Appendix to remove the potential for confusion. Additionally, a commenter (Ex. 2-56) asked, "what is load Refusal?" which is a phrase used as part of the definition of the term "failure." OSHA uses the phrase in a situation where whatever is supposed to support the load is refusing to do so -- it is not performing its intended purpose. Hence, it has failed its purpose and is not supporting the load.

OSHA has determined that as clarified above, the proposed definition of "failure" is appropriate for the final rule.

"Force factor." The term force factor was defined in the proposed rule. The term has been deleted in the final rule because, as explained in the final rule on powered platforms [54 FR 31447], the comments and testimony suggested that the term "force factor" was confusing, even to systems experts. The Agency also noted that the term would not be needed if the factor was incorporated into the test methods. OSHA agreed with those commenters and deleted the term "force factor" from the final rule on powered platforms, while incorporating the concept in the test methods section. OSHA has taken the same action in this final rule.

"Free fall" means the act of falling before the personal fall arrest system begins to apply force to arrest the fall. OSHA did not propose a definition for this term. The term and definition in the final rule are identical to the ones used in the final rule on powered platforms [54 FR 31470]. OSHA has determined that the inclusion of this definition is appropriate for purposes of clarity and to provide guidance consistent with that set in the powered platforms standard. OSHA believes that the following language which appeared in the final rule on powered platforms (54 FR 31447) is applicable to this rulemaking:

One comment was received on the proposed definition of free fall [citation omitted] suggesting that the phrase "personal fall arrest system" should be used as well as the definition being further clarified to define when the free fall period ends. OSHA agrees with this suggestion and has revised the definition of free fall accordingly.

"Free fall distance." This term is used to describe the vertical distance an employee moves during a fall before a deceleration device is activated. Although there were no comments on the proposed definition, OSHA has reworded the definition to be consistent with the definition used in the final rule for powered platforms [54 FR 31447 and 31470]. There wording does not substantively alter the meaning of the term, as proposed.

"Hole." This term is used to describe a void or gap 2 inches (5.1 cm) or more in its least dimension in a floor, roof, or other walking/ working surface. The definition of this term is consistent with the proposed definition, with only minor editorial revision (the words void or gap are used instead of the words hole or opening). The existing standard defines holes and openings as separate topics; however, the treatment of each is essentially the same. The existing rule defines a floor hole as an opening less than 12 inches but more than 1 inch or more in its least dimension through which materials may fall; and defines a floor opening as a hole 12 inches or more in its least dimension through which persons may fall. To eliminate confusion, OSHA proposed to use the word "hole" to describe all voids and gaps (holes and openings) in floors, roofs, and other walking/working surfaces. The word "opening" is used later to describe voids and gaps in vertical surfaces such as walls and partitions.

There were several comments on the proposed definition of "holes." One commenter (Ex. 2-140) thought the proposed definition of the term "hole" was too restrictive, assuming that the "purpose is to prevent workers from falling through to lower areas." Other commenters (Exs. 2-16, 2-47, and 2-92) requested that OSHA clarify the definition of holes because it was unclear whether OSHA's intent was to regulate holes through which material or persons could fall. OSHA observes that its intent is to address all hazards associated with holes, including employees falling through and stepping into holes, as well the hazards of objects falling through holes onto employees. As noted in the proposal, OSHA chose the 2-inch least dimension for a "hole," instead of the 1-inch least dimension set in the definition of the existing term "floor hole," because the Agency believes that focusing on holes which are at least 2-inches wide addresses the problems caused by small holes more reasonably.

"Infeasible" is a new term and as used in this subpart, it means that it is impossible to perform the construction work while using a conventional fall protection system, or that it is technologically impossible to use a conventional system. The conventional systems are guardrail systems, safety net systems, and personal fall arrest systems. This term is being added to provide guidance to employers who believe it is infeasible to use conventional fall protection systems and wish to raise a defense of infeasibility as the reason for not using conventional fall protection systems. The definition has evolved from litigation involving contested citations where employers have asserted that compliance with an OSHA requirement was "infeasible" or "impossible." The discussion of the criteria for implementation of a fall protection plan (Sec. 1926.501(b)(2) of the final rule), below, provides further information about how OSHA is applying the new term.

"Lanyard" means a flexible line of rope, wire rope, or strap which generally has a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline, or anchorage. This definition reflects editorial revision of the proposed language. Two commenters, the AGC of Florida and the ISEA (Exs. 2-16 and 2-23), pointed out that the inclusion of "strap webbing" in the proposed definition was redundant because it is a type

of flexible line already in the definition. OSHA has revised the definition, removing the redundancy. The revised language of the definition is consistent with the definition used in the final rule on powered platforms [54 FR 31470].

"Lifeline." The term "lifeline" has been revised in the final rule so that it is consistent with the definition used in the final rule for powered platforms [54 FR 31470]. The terms "drop lines" and "trolley lines" have been deleted. The revised definition more clearly expresses the function of a lifeline and its use for connecting other components of a personal fall arrest system. OSHA received two comments (Exs. 2-12 and 2-35) on the proposed definition. Both commenters pointed out that the proposed definition was in conflict with the definition of a lanyard. OSHA agrees with the commenters and has revised the definition to eliminate the conflict.

"Low-slope roof." OSHA is using the term "low-slope roof" in the final rule instead of the proposed term "low-pitched roof." This change in terminology is merely an editorial correction that uses the proper expression to make it clear that we are describing the slope of the roof, not the pitch.

"Personal fall arrest system." This term replaces the term "body belt/harness systems" and means a system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, a body belt or body harness, and may include a lanyard, deceleration device, lifeline, or suitable combination of these. OSHA has decided to replace the term "body belt/harness system" in an effort to keep all terms and definitions related to fall protection consistent throughout the standards. The final rule on powered platforms also contained a definition for personal fall arrest systems [54 FR 31470] which is identical to the definition in this final rule. The meaning is essentially the same as that proposed for body belt/harness systems, and the phrase "personal fall arrest systems" appears in the final rule wherever the phrase "body belt/harness systems" was used in the proposed rule. There were two comments related to the proposed definition "body belt/harness systems." The commenters, ISEA and MSA (Exs. 2-23 and 2-35), both suggested rewording the definition to indicate that lifelines and deceleration devices are not always included as a part of a body belt/harness system as the proposed definition implied. OSHA agrees and has revised the proposed definition accordingly.

"Positioning device system." This term means a body belt or body harness system rigged to allow an employee to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning backwards. The proposed definition was identical. Two commenters (Exs. 2-15 and 2-23) suggested changing the definition of the term "positioning device system" to permit such devices to be used on surfaces such as small horizontal ledges and steep roofs. OSHA observes that changing the definition would have no effect on the requirements to have fall protection at unprotected sides and edges of walking/working surfaces (e.g., ledges) or of steep roofs. The use of positioning device systems was not proposed for use in either of these situations. OSHA has no evidence that would lead it to believe that positioning device systems offer appropriate protection to workers on ledges and steep roofs, nor has the commenter provided any substantive information to that effect. After consideration of the record, OSHA has determined that the term "positioning device systems" is appropriately defined and that no further revision is necessary.

"Roofing work." This is a new term in the final rule. The term is defined to mean the hoisting, storage, application and removal of roofing materials and equipment, including related insulation, sheet metal, and vapor barrier work, but not including the construction of the roof deck. OSHA proposed to use this definition to define the term "built-up" roofing work. However, many commenters pointed out that OSHA's definition in the proposal was incorrect as it applied to the term "built-up." The commenters said the definition described all kinds of roofing work, and it was not just a definition of "built-up" roofing work. Many of the commenters represented roofing contractors (Exs. 2-54, 2-57, 2-68, 2-74, 2-83, 2-85, 2-88, 2-94, 2-109, 2-124, 2-126, 2-128, 2-130, as well as others) and they wrote to support the position of the National Roofing Contractors Association (NRCA) (Ex. 2-162) who pointed out the incorrect terminology.

Other commenters (Exs. 2-91, 2-110, and 2-124) stated that the term "built-up roofing" should be replaced with the term "low-slope roofing," because "this change will reflect a truer meaning to the definition to which the standard will apply." They also stated that the term defined in the proposal describes all types of roofing, not just built-up roofing. The commenters suggested that OSHA define "low-slope roofing" to mean "the application, installation, and/or removal of any roofing material or system over a roof deck or existing roof." OSHA believes that this term should apply to roof work performed on any roof, regardless of the slope. Accordingly, OSHA has not made the suggested change.

OSHA agrees with the commenters who suggest the term "built-up roofing"

needs to be deleted from the proposed rule. OSHA also agrees with the commenters that the proposed definition accurately defines roofing work in general and is defining the term roofing work as suggested.

"Rope grab" means a deceleration device that travels on a lifeline and automatically engages the lifelines and locks by friction so as to arrest the fall of an employee. A rope grab usually employs the principle of inertial locking, cam/level locking, or both. This term was not defined in the proposed rule. It has been added to this final rule as in the powered platforms final rule [54 FR 31470], to state clearly what the Agency means when it uses "rope grab" as an example of a "deceleration device."

"Self-retracting lifeline/lanyard" means a deceleration device containing a drum-wound line that may be slowly extracted from or retracted onto the drum under slight tension during normal employee movement, and that, after onset of a fall, automatically locks the drum and arrests the fall. This term, like rope grab, was not defined in proposed Part 1926, subpart M. OSHA, however, has determined that it is appropriate to define self-retracting lifeline/lanyard so that the term which is used in the definition of "deceleration device" is clearly understood. OSHA made the same determination in the final rule on powered platforms [54 FR 31470].

"Snaphook" means a connector comprised of a hook-shaped member with a keeper, which is normally closed or similar arrangement. The "keeper" opens to permit insertion of other hardware or of a like object and then, when released, automatically closes to retain the object. Snaphooks are generally, either locking or non-locking. Both types are covered in the definition of snaphook. That term was defined in the proposed rule for powered platforms but not in the proposal for subpart M.

Note: Effective January 1, 1998, the use of non-locking snaphooks is prohibited for use as part of personal fall arrest systems and positioning device systems.

OSHA received one comment (Ex. 2-23) on the subpart M proposal suggesting that the term "snaphook" should be defined. OSHA agrees with that comment because the Agency believes that the standard should clearly express what OSHA means when its sets requirements for personal fall arrest system components. In addition, OSHA notes that some of the comments (Ex. 3-13) and testimony addressed in the final rule on powered platforms suggested that the proposed definition of "snaphook" should distinguish between locking and non-locking snaphooks [54 FR 31447]. OSHA agreed with that suggestion in the powered platform final rule [54 FR 31470] and revised the proposed definition of "snaphook" accordingly. That definition is identical to the definition used in this final rule.

"Work area." The definition is identical to the one proposed. OSHA notes that this definition applies to all areas where employees are present.

1926.501 -- Duty To Have Fall Protection

This section specifies the areas and operations where fall protection systems are required. The criteria to be met by fall protection systems, and the training necessary to use the systems properly, are covered in succeeding Sec. Sec. 1926.502 and 1926.503, respectively.

Paragraph (a)(1). This paragraph states that section 1926.501 sets forth the type of fall protection systems employers must use in various areas and operations. In addition, it mandates that all fall protection systems required to be used by Sec. 1926.501 conform to the criteria and work practices set forth in Sec. 1926.502. OSHA notes that most of the provisions provide several choices for providing fall protection, but some provisions limit the choices. For example, only guardrail systems are permitted to be used to protect employees on ramps and runways and other walkways. In these situations, OSHA believes guardrail systems offer the appropriate level of fall protection and the record supports this conclusion.

There were no comments specific to this paragraph. OSHA has made a minor editorial change for the sake of clarity. However, OSHA provides the following discussion to clarify further its intent under this general provision.

OSHA has consistently maintained that all construction employers are responsible for obtaining information about the workplace hazards to which their employees may be exposed and for taking appropriate action to protect affected employees from any such hazards. "The [Occupational Safety and Health Review] Commission has held that an employer must make a reasonable effort to anticipate the particular hazards to which its employees may be exposed in the course of their scheduled work. Specifically, an employer must inspect the area to determine what hazards exist or may arise during the work before permitting employees to work in that area, and the employer must then give specific and appropriate instructions to prevent exposure to unsafe conditions." Automatic Sprinkler Corp. of America, 8 BNA OSHC 1384, 1387, 1980 CCH OSHD 24,495 (No. 76-5089, 1980), cited with approval in several cases, including Conagra Flour Milling Co., 15 BNA OSHC 1817, 1823, 1992 CCH OSHD 29,808 (No. 88-2572, 1992).

In addition, it is well established that general contractors must "apprise themselves of which safety efforts their specialty subcontractors have chosen to make in completing their assignments." Blount Intern. Ltd., 15 BNA 1897, 1900 n. 3, 1992 CCH OSHD 29,854 (No. 89-1394, 1992).

OSHA considers subcontractors to have a reciprocal responsibility to determine what protective measures the general contractors have identified as necessary and have implemented. Furthermore, the same considerations arise at a multi-employer worksite, because each contractor needs to know about any hazards that other contractors may confront or create so that contractors can take the appropriate precautions for employee protection.

OSHA requires employers to protect employees performing construction work from fall hazards, and sets criteria for the proper implementation of fall protection through the requirements in subpart M and the specific standards referenced in Sec. 1926.500(a)(2) and (a)(3). However, there is much more to workplace safety than an employer arriving at a work site with a copy of the pertinent standards in hand. Employers have a duty to anticipate the need to work at heights and to plan their work activities accordingly. Careful planning and preparation (e.g., project design that incorporates fall protection and employee training) lay the necessary groundwork for an accident-free workplace.

OSHA is aware that many falls have occurred because employers have not taken fall protection into account when they plan and undertake construction even when it is known that the work involves employee exposure to fall hazards. In some cases, an employer has recognized the hazard and established appropriate fall protection procedures, but has failed to ensure that employees followed those procedures. In other cases, employers either misidentified the hazard, selected inappropriate measures or completely failed to address fall hazards. The foreseeable consequence is that, as discussed above in the Background section, falls from elevations account for a large percentage of construction-related injuries and is the leading cause of death on construction jobs.

Employers need information about the work they are to perform so that they can make fall protection an integral part of their projects. An employer's communication and coordination with customers, other contractors (particularly at multi-employer worksites) and suppliers are critical elements of that employer's ability to protect its employees and to avoid creating hazards for other employees. Initially, the employer needs to develop or obtain

information regarding the work to be performed, so that all anticipated fall hazards are identified. The employer would then determine how to protect its employees from those hazards. For example, many employers are minimizing exposure to fall hazards by having anchorage points for personal fall arrest systems fabricated or designed into structural members and by installing perimeter lines on structural members before those members are lifted into position.

OSHA anticipates that the trend towards providing "100 percent fall protection" will spur even more effective efforts, from the design stage through to project completion, to increase employee protection. To this end, employers will need to reexamine their "traditional methods" and, when possible, update them by incorporating available fall protection technology and design concepts. OSHA believes that while there may initially be some increased costs and disruption associated with these efforts, subsequent productivity gains and reductions in the cost of workers' compensation will clearly make it highly cost effective in the long run to provide effective fall protection. (See Regulatory Impact and Regulatory Flexibility Analysis, Section V).

An employer who controls its own construction projects will generally find it adequate to make its design and equipment decisions part of the project blueprints and workplan. Where employers are bidding a contract to perform specified construction work, making fall protection a bid item gives potential customers a clear idea of how prospective contractors plan to comply with subpart M. This is a point at which effective communication between a contractor and a customer is critical. Prospective contractors must obtain sufficient information from the customer to enable them to develop responsive bids, incorporating fall protection that complies with subpart M. By doing so, the bidding contractor reassures the customer that it has taken into account the full cost of performing the work in question. Both parties need to recognize that employee protection is an integral part of every construction project. Employers will not be permitted to gain a competitive advantage by exposing their workers to fall hazards.

Paragraph (a)(2) is a new requirement added as a result of comments on Issue #6. In Issue #6, OSHA requested comment on whether it should promulgate rules requiring the inspection of work surfaces to determine their structural integrity prior to employees being required to work on such surfaces. OSHA explained that there are currently no specific requirements that address this concern. OSHA notes, however, there are general requirements in existing Sec. 1926.20(b)(2) which address inspections of job sites, materials and equipment by a designated competent person. Issue #6 asked whether or not a specific requirement should be added to the fall protection section that would require employers to take some specific action, in addition to complying with Sec. 1926.20(b)(2), to determine whether or not the work surfaces would support the weight of workers, equipment and materials, thereby preventing a collapse that would result in employees falling.

Issue #6 also explained that the inspections would insure that work surfaces have the requisite strength to prevent collapse under the weight of employees, tools, and materials. The issue further stated that OSHA has obtained information (Ex. 3-3) which indicated that it was appropriate to require such inspection. That study showed that of 8 fatalities of employees falling through ceilings, 4 of the accidents occurred because the work surface was not capable of supporting the employee's weight.The study also showed that of 55 fatalities resulting from falls from roof levels, 8 occurred because the employees were working on surfaces with insufficient structural strength to support their weight. OSHA asked for comments on the necessary criteria for inspection of surfaces, the inspection methods to be used, and the qualifications of the inspectors.

In response, ACCSH recommended that a competent person certify the structural integrity of a working surface before employees are allowed to work on it. (Tr. 6/10/87; p. 109).

The Tennessee Valley Authority (TVA) (Ex. 2-20) stated, "Work surfaces should be inspected for their structural integrity prior to allowing employees on that surface," and that a qualified civil or structural engineer should conduct the inspection.

The Scaffolding, Shoring, § Forming Institute, Inc. (SSFI) (Ex. 2-89) also commented in support of an inspection provision and recommended that the inspection by made by a "qualified" individual.

Four other commenters agreed that inspection for structural integrity should be required by OSHA (Exs. 2-6, 2-9, 2-36, 2-50 and 2-99). The Egan Companies (Ex. 2-9) also recommended that periodic inspections be conducted in addition to initial inspection.

Other commenters were opposed to OSHA requiring an inspection to determine structural integrity. For example, the Great Lakes Fabricators § Erectors Association (GLFEA) (Ex. 2-19) said that such a requirement was more properly the responsibility of building codes and building inspectors rather than OSHA. Bristol Steel and the National Erectors Association (NEA) (Exs. 2-12 and 2-43) commented that the requirement would be ineffective at reducing the kinds of accidents regulated by subpart M and that costs would far outweigh the benefits. The commenters further stated, "The problem is that persons do not recognize hazards and respond sensibly to the situation at hand," adding that education and training would help. Miller and Long (Ex. 2-41) stated "* * * the working surfaces are designed by an engineer and erected to his specifications." The National Constructors Association (NCA) (Ex. 2-45) commented that inspections should be a part of the employer's quality assurance/quality control program.

The Boston Cement Masons and Asphalt Layers Union, (BCMALU) Local No. 545 (Ex. 2-46) noted that work surfaces such as metal decking should be heavy enough to withstand the workers and equipment. They also commented that most metal decking jobs around Boston have to be shored up when concrete is placed.

OSHA observes that the existing regulations in subpart Q (Concrete and Masonry Construction) and subpart R (Steel Erection) contain provisions requiring employers to take specific action to eliminate the hazards identified by the BCMALU. Section 1926.701(a) of subpart Q prohibits imposing loads on structures until it has been determined that the structure can support the load, and subpart R requires decking to be of sufficient strength to carry the working load (Sec. 1926.752(f)). Those existing provisions directly address the situations identified by the BCMALU.

After considering all of the comments received on this issue, OSHA has determined that the record supports adding a new inspection requirement, more specific than that in Sec. 1926.20(b)(2). As discussed above, existing Sec. 1926.20(b)(2) requires, in part, that employers "* * * provide for frequent and regular inspections of job sites, materials, and equipment to be made by competent persons designated by the employer." Revised paragraph (a)(2) will require employers to ensure the structural integrity of walking/working surfaces before employees are permitted to be on those surfaces.

Paragraph 1926.501(b). Paragraph (b) contains 15 requirements that set forth the options from which employers may choose to protect employees exposed to fall hazards when on "walking/working surfaces," as defined in Sec. 1926.500(b). Under paragraph (b), employers are required to choose and use a fall protection system (or combination of systems) as provided by paragraphs (b)(1) through (b)(15) which address the fall protection needs of particular walking and working surfaces.

OSHA has used the term "walking and working surfaces" instead of the existing term "floor" to indicate clearly that subpart M addresses all surfaces where employees perform construction work. The Agency has always maintained that the OSHA construction fall protection standards cover all walking and working surfaces. The revised rule reaffirms the existing Agency interpretation and practice and clarifies the language of the standards in that regard. Also, OSHA has consistently held that subpart M addresses the hazards of falling from a walking/working surface to any kind of lower level (e.g., solid, liquid or colloid). In addition, the Agency has determined that compliance with revised subpart M will not conflict with Sec. 1926.106, Working over or near water.

OSHA received three comments on the introductory language of proposed paragraph (b), including two which were in response to Issue #2. In Issue #2, OSHA asked if it had been overly restrictive in its fall protection provisions by limiting options for certain areas or operations. The Milwaukee Construction Industry Safety Council (MCISC) (Ex. 2-140) expressed the opinion that warning lines provide appropriate protection for workers who are

not required to go near unprotected edges. OSHA agrees and observes that the use of warning lines is permitted as an appropriate method of protecting workers on low-slope roofs and where no workers are required to go near the unprotected edges. In particular, OSHA recognizes that there may be circumstances where the use of a warning line system is appropriate, in conjunction with a Fall Protection Plan, to protect workers who are not required to go near unprotected edges.

The Eastern Contractors Association, Inc. (ECA) (Ex. 2-3) commented that "The fall protection requirements 6 feet on open sided floors and 10 feet on scaffolds should remain as is," and explained that the situations were different and each presented unique problems. In the proposed revision to subpart L, Scaffolds, the Agency proposed (Sec. 1926.451(e)) that employees working on scaffolds more than 10 feet above lower levels be protected from fall hazards (51 FR 42707, November 25, 1986). The appropriate height threshold for fall protection on scaffolds will be set in the final rule for subpart L. The ECA also stated the height at which fall protection is required should be the same for all trades. OSHA agrees and this final rule reflects that concern.

On the other hand, the SSFI (Ex. 2-89) recommended that the proposed and existing height thresholds for fall protection at unprotected sides and edges, low-pitched floors, roof, etc. be changed from 6 feet (1.8 m) to 10 feet (3.05 m). Based on the BLS injury and fatality data, discussed above (Ex. 3-6), OSHA believes that employees performing construction work on walking and working surfaces 6 feet (1.8 m) or more above lower levels are exposed to a significant risk of injury and death. Accordingly, more workers would be injured or killed if the height threshold for fall protection were raised to 10 feet (3.05 m). Therefore, OSHA is not making the suggested change.

Paragraph (b)(1) sets forth the requirements for fall protection from unprotected sides and edges of walking and working surfaces. It provides that employees must be protected when they are exposed to falls from unprotected sides and edges of walking/working surfaces which are 6 feet (1.8 m) or more above lower levels. The options from which an employer can choose to provide this protection are guardrail systems, safety net systems, and personal fall arrest systems. OSHA considers these three types of systems to be "conventional fall protection systems."

Paragraph (b)(1), as promulgated, differs from proposed paragraph (b)(1) in several respects. In proposed paragraph (b)(1), OSHA distinguished between unprotected sides and edges that were at least 18 inches (.5 m) in width, and those that were less than 18 inches (.5 m) in width. In particular, the proposed rule required employers to protect employees by the use of guardrails when the floor, roof or other walking and working surface was at least 18 inches (.5 m) in width. Where the unprotected sides and edges were less than 18 inches (.5 m) wide, OSHA proposed to provide more flexibility as to the method of fall protection by allowing employers to use personal fall arrest systems (body belt/harness systems) or safety net systems instead of guardrail systems. OSHA proposed these options because it recognized the feasibility problems associated with erecting guardrails on a surface that was less than 18 inches (.5 m) wide and, therefore, proposed alternative methods of protecting workers from falls. The proposed 18-inch (.5 m) threshold was consistent with existing Sec. 1926.500(d)(3) which addresses ramps and runways. In addition, the Agency notes that the proposed requirement that walking and working surfaces over 18 inches (.5 m) wide be protected at the edge with guardrail systems was also consistent with existing Sec. 1926.500(d)(1) which requires a guardrail system to be erected at every open-sided floor or platform, which would include the floor perimeter. Thus, the proposed rule and the existing rule contained essentially the same requirement.

Three commenters (Exs. 2-1, 2-15, and 2-140) contended that proposed paragraph (b)(1) was either inappropriate or too restrictive. Two of the commenters cited situations where, they believed, guardrail systems would not be the most appropriate form of protection, and stated that using a personal fall arrest system is sometimes more appropriate. For example, the Alaska Department of Labor (Ex. 2-1) commented, "In many cases workers are exposed to hazards erecting a guardrail system that could be avoided if they were allowed to use a safety line

system." Also, as mentioned above, ISEA (Ex. 2-23) requested that OSHA permit the use of positioning device systems on surfaces such as small horizontal ledges and steep roofs. OSHA has determined that positioning device systems do not provide adequate fall protection in these situations.

OSHA agrees with the commenters that there are work operations and areas with walking and working surfaces that are 18 inches (.5 m) or more wide (e.g., ledges and balconies) where personal fall protection systems or safety net systems are at least as protective as guardrails. Accordingly, OSHA has revised proposed paragraph (b)(1) to allow any of the conventional fall protection systems.

In Issue #4, OSHA asked whether there was a distance from the unprotected side or edge where a worker would be safe from fall hazards and not need any fall protection. As an example, OSHA inquired if fall protection would be necessary at the perimeter of a floor if employees were only required to work in the center of a floor and that center would be as far as 10, 20, or 30 feet from an unprotected side or edge.

The GLFEA (Ex. 2-19) recommended that employers provide fall protection to employees who are within 8 feet of the edge. Another commenter, the MCISC (Ex. 2-140), suggested that employees who work 6 to 10 (1.8 to 3.05 m) feet from the edge would not need fall protection. The SSFI (Ex. 2-89) agreed with the proposed OSHA approach, requiring fall protection regardless of employee distance from exposed edge, because "it is nearly impossible to develop a policy for most every situation that may or may not require guarding."

Miller § Long Co., Inc. (Ex. 2-41) commented, "I feel that all open sided floors should have adequate fall protection because once it is there, the potential hazard for employees to `wander' into an unsafe area is negated." In addition, the BCMALU (Ex. 2-46) commented, "Who knows when the wind will change while you are carrying something that could make you like a kite or when you will or others will have to work near the edge."

The ACCSH, in its meeting on June 10, 1987, (Tr. 6/10/87; pp. 67-88) had considerable discussion on the areas of concern addressed in Issue #4. The discussion began with the following statement from a member:

I believe that this entire question is based on a false assumption. The assumption that seems to be included in it is that if a worker is working near the middle of a floor, he's never going to approach the edge of the floor. And if we know of any way to convince employees that that's the way they will work, I'd like to know what it is. Workers on any construction site are very mobile, and there's no effective system to keep employees from venturing into an unprotected danger zone * * *.

I can't think of any job that I have ever seen where there's a floor or roof that will not require some work near the edge of it at some time during the process. The guardrail must be, the protection must be placed at that time and certainly there's no added cost to leaving that in place until the work is completed on that floor and some permanent protection is in existence.

The Committee voted to recommend that guardrail systems or other means of fall protection be provided on any elevated work surface where employees were present, subject only to the exemptions that OSHA has now included in the final rule on subpart M.

The Precast/Prestressed Concrete Institute (PCI) (Ex. 2-44) also addressed the issue of perimeter protection, stating that "Perimeter protection is not really the responsibility of the * * * subcontractor; it is the responsibility of the general contractor to coordinate safety and make the workplace safe for all trades * * *."

OSHA has carefully evaluated the concerns expressed and has determined that employers should have the option to use personal fall arrest systems or safety net systems where those systems would be feasible and would protect employees from fall hazards. Whatever conventional system is adopted, OSHA expects the employer to implement it early in the construction process and to maintain that system in place until all work has been completed or until the permanent elements of the structure which will eliminate the exposure to falling hazards are in place. It is not OSHA's intent that individual contractors or subcontractors each separately provide and remove fall protection systems on the same floor. The general contractor in charge of the overall project can, and should,

evaluate those situations where fall protection may be needed. OSHA believes, based on its knowledge of good industry practices, that the general contractor will contract for fall protection for all employees until employees are no longer exposed to the fall hazard. In the event that the fall protection system has been dismantled and workers are then required to work on the floor in an area away from the fall hazard, OSHA compliance staff will consider the extent to which individual contractors acted to prevent workers from leaving the work area and traveling to the unprotected edge. For example, a contractor could erect a guardrail system around the perimeter of the work area, thus providing protection from the unprotected sides and edges. OSHA would consider this an acceptable form of protection under the circumstances, provided workers remain in the protected area at all times.

In conclusion, after careful and complete consideration of the entire record, OSHA has determined that there is no "safe" distance from an unprotected side or edge that would render fall protection unnecessary.

Paragraph (b)(2) sets requirements for the protection of employees who are exposed to fall hazards while constructing leading edges and employees who are working on the same level as a leading edge, but are not actually engaged in constructing the leading edge. As defined in the final rule, a leading edge is the edge of a floor, roof, or formwork that changes location as additional floor, roof, or formwork sections are placed, formed, or constructed. Leading edges not actively and continuously under construction are considered to be "unprotected sides and edges," and are covered by paragraph (b)(1).

Paragraph (b)(2)(i) of the final rule requires that employers protect employees actively engaged in constructing leading edges from fall hazards through the use of guardrail systems, safety net systems, or personal fall arrest systems. In addition, paragraph (b)(2)(i) provides that if the employer can demonstrate that it is infeasible or would create a greater hazard to use any of these systems, the employers must develop and implement a fall protection plan which meets the requirements of paragraph (k) of Sec. 1926.502. The fall protection plan, in turn, requires, among other criteria and conditions for use, that the employer designate all areas where conventional fall protection systems cannot be used as controlled access zones. Employers must also implement a safety monitoring system in those zones if no other alternative measure has been implemented. Criteria for controlled zone systems and safety monitoring systems are found in Sec. 1926.502 (g) and (h), respectively.

Paragraph (b)(2)(ii) requires that employees on walking/working surfaces where leading edges are under construction, but who are not constructing the leading edge, shall be protected from fall hazards by guardrail systems, safety net systems or personal fall arrest system.

The leading edge provisions of the final rule differ from the proposed rule. In the proposal, OSHA explained its belief that a requirement to erect safety net systems would not always be feasible because of insufficient room to rig a safety net and because the net would have to be constantly moved, exposing workers repeatedly to fall hazards while erecting the net.

OSHA also noted that because the time lapse between placement of successive floor, roof, or floor formwork sections would often be only a few minutes, guardrail systems erected along a leading edge would have to be removed almost as soon as they were erected to allow placement of the next section. In addition, OSHA noted, the continued erection and removal of guardrail systems could pose a "greater hazard" to the employees than having the employees work without the guardrails. Because of this, OSHA was concerned that guardrail systems, as required in the existing rule, often would not allow the accomplishment of work along leading edges.

Finally, OSHA expressed its view that personal fall arrest systems (body belt and harness systems) might limit an employee's freedom of movement, hindering job performance as well as impairing an employee's ability to avoid hazardous situations (such as a misdirected incoming piece of concrete or other structural member used on the leading edge). Also, during the erection of some structural members, employees are required to walk along a leading edge during placement of the member. A personal fall arrest system (body belt or harness system) might impede this effort if the employee's movement was restricted by the length of the lanyard, causing constant reattachment of the systems to different anchor points.

In recognition of these potentially infeasible (impossible to perform the work) or greater hazard situations, OSHA proposed to allow the use of a fourth option -- safety monitoring systems on leading edges and the use of control zone systems to limit the number of employees exposed to the hazard at leading edges.

There were several varied comments on the proposed leading edge provision. NIOSH (Ex. 2-33 and 27-6) questioned the adequacy of the safety monitoring system, noting that it relied on visual inspection only, and recommended that it be deleted as a fall protection option. NIOSH also stated that using a monitor would require active involvement of both the monitor and the worker to ensure safety.

Miller § Long (Ex. 2-41) noted that, "The only employees at the leading edge are the ones who are working on the leading edge. Therefore, the warning lines and monitor systems are not needed."

The Daniel Marr § Son Co. (Ex. 2-40), specifically addressing the concerns of ironworkers installing decking, also commented on the safety monitoring system for leading edge work, noting that, "By requiring a worker to act as a monitor, the Department of Labor will be forcing steel erection companies to duplicate safety efforts and, at the same time, be placing a large financial burden on the construction industry." OSHA notes that at this time, the final rule for subpart M does not apply to steel erection activities in buildings. The Agency has begun work with the Steel Erection Negotiated Rulemaking Advisory Committee to develop a proposed revision for subpart R which will address fall protection for employees performing steel erection activities in buildings [see meeting notice at 59 FR 25848 and 59 FR 26153].

Finally, WMACSA (Ex. 2-56) wanted to know how the leading edge provision applied to workers setting precast stone walls on the leading edge. In response, OSHA observes that the leading edge provision would not be applicable in the situation described. That is, if a wall is being set at the edge, the leading edge of the floor or roof or formwork is no longer under construction. Therefore, the work location (the edge) would be considered an unprotected side and edge and covered by paragraph (b)(1), above.

The final rule differs from the proposed rule in that it requires the use of one of the three conventional fall protection systems, but does not permit an employer to use a safety monitoring system instead of one of the conventional systems as was proposed. However, as noted above, when the employer demonstrates that all conventional fall protection systems are infeasible (i.e., it is impossible to perform the construction work or technologically impossible to use) or create a greater hazard, the final rule requires the employer to develop and implement a fall protection plan. A fall protection plan, in turn, requires the employer to establish a controlled access zone and to implement a safety monitoring system if no other alternative measure has been implemented in the zone where conventional fall protection is not being used.

A controlled access zone, discussed in detail in Sec. 1926.502(g) below, is defined with control lines to form a visual and physical barrier which, in this case, prevents an employee from inadvertently entering the area immediately adjacent to the leading edge. OSHA notes, again, that any unprotected side or edge of the floor or roof which is not part of the controlled access zone must be guarded as required by the pertinent provisions of Sec. 1926.502(b) or other protection provided to employees who may be exposed to falls from those other unprotected sides or edges. Criteria for safety monitoring systems can be found in Sec. 1926.502(h).

A safety monitoring system does not provide a physical means of preventing falls or arresting a fall, and therefore, will not provide protection equivalent to that provided through the use of the other fall protection measures proposed.

Accordingly, OSHA has removed these systems as a direct alternative to conventional fall protection systems under the general rule for leading edge work. However, as discussed above, the final rule requires the use of a fall protection plan that complies with Sec. 1926.502(k) where the employer can demonstrate that the use of conventional fall protection would be infeasible or would create a greater hazard. The following information is provided to assist employers in determining if the use of conventional fall protection would be infeasible or pose a greater hazard at a particular work area or for a particular operation.

OSHA considers a fall protection measure to be infeasible when the employer establishes that application of that measure is either functionally unworkable or would prevent the performance of required work. The Agency recognizes that there are situations where one or another measure cannot be implemented, because of the configuration of the worksite (for example, where structures are built so close together that nets cannot be installed) or due to circumstances during a particular phase of the construction process (for example, where work at the leading edge precludes the use of guardrails).

OSHA has consistently maintained, however, that, in general, at least one of the three conventional fall protection measures mandated by subpart M can be used to protect employees at a particular worksite from fall hazards. In particular, the Agency has frequently found that the use of personal fall arrest systems is feasible even where a guardrail system or safety net system is infeasible. Further, equipment is generally available to provide safe anchorage points for personal fall arrest systems. It is in this area that preplanning of the construction project is most critical. Focusing on fall protection at the design and planning stages of a construction project will enable an employer to develop measures that protect affected employees from fall hazards.

OSHA recognizes that the applicability of alternative measures will depend on the circumstances of particular employers and work sites and that those circumstances vary widely. Therefore, paragraph (b)(2), like the provisions at Sec. Sec. 1926.501 (b)(12) and (b)(13), sets general, rather than specific, criteria for an employer who seeks to determine if it is appropriate to implement a fall protection plan that complies with 29 CFR 1926.502(k).

OSHA has consistently maintained that employers must consider the safety of workers as well as the technical aspects of their construction projects. In a case involving existing Sec. 1926.105(a), the 5th Circuit of the U.S. Court of Appeals has stated "[t]he regulation in question . . . specifically dictates the employer's duty to supply fall protection. The duty to consider alternative methods of construction which permits compliance with the regulation is merely a corollary of the duty to comply. The petitioner has attempted to characterize this duty as a burden requiring changes in methods of construction; however, that characterization ignores the employer's initial responsibility to comply with OSHA regulations. If an employer were permitted to choose any method of construction, and subsequently argue that compliance with OSHA regulations was impossible because of the method of construction chosen, then the regulations could be undermined in many instances." Cleveland Consol. v. OSHRC, 649 F.2d 1160, 1166 (5th Cir. 1981). In addition, regarding an employer's duty to anticipate and determine the need for fall protection, the Occupational Safety and Health Review Commission has held that the employer "could have easily foreseen the lack of open steel, given the problem some foresight, and installed a static line in advance." A.C. Dellovade, Inc., 13 BNA OSHC 1017, 1020 (No. 83-1189, 1987).

OSHA has long acknowledged that there may be circumstances at a particular workplace which would make it unreasonable for the Agency to pursue a citation. In the enforcement context, OSHA has consistently placed the burden on the employer in question to establish any such circumstances as "affirmative defenses" to OSHA citations. The Agency has had considerable experience in evaluating employers' efforts to establish affirmative defenses (e.g., "impossibility" (sometimes also known as "infeasibility") and "greater hazard" defenses) to citations. Based on that experience, OSHA developed Section V.E of the Field Operations Manual (FOM) to guide OSHA personnel in assessing those defenses.

Under Section V.E.3.b of the FOM, an employer has established "impossibility" when "Compliance with the requirements of a standard is: (1) Functionally impossible or would prevent performance of required work; and (2) There are no alternative means of employee protection." Under Section V.E.3.c, an employer has established "greater hazard" when "Compliance with a standard would result in greater hazards to employees than non-compliance and: (1) There are no alternative means of employee protection; and (2) An application [for] a variance would be inappropriate. Under Section V.E.3.d, an OSHA compliance officer who becomes aware that an

employer is raising an affirmative defense is directed to gather pertinent information and to bring any possible defenses to the attention of his or her supervisor. That section further provides that a citation is not issued when OSHA determines that each and every element of an affirmative defense is present.

Paragraph (b)(2), as well as Sec. Sec. 1926.501 (b)(12) and (b)(13), discussed below, reflect the Agency's long standing position, as presented in the FOM, regarding the criteria for an employer to successfully establish the pertinent affirmative defenses.

OSHA considers compliance with a measure to be "infeasible" when it is technologically impossible to do what a standard requires or when following the standard would prevent performance of the work in question. A contractor attempting to establish infeasibility will be required to establish the worksite-specific circumstances that preclude reliance on conventional fall protection to protect employees from fall hazards. For example, the employer will be required to establish that the available personal fall arrest systems cannot be used in a particular work area due to design or equipment constraints. The employer will need to indicate the particular problem (such as inability to provide safe anchorage; danger of lifeline entanglement; likelihood that lifelines, especially self-retracting lifelines, will be mired in grout; likelihood that completion of work would be prevented by fall protection; and inability of personal fall arrest systems to function due to the configuration of the work area for OSHA to determine that the employer has made the necessary showing for use of a fall protection plan. It will not be sufficient for the employer to merely assert that it is impossible to use fall protection equipment. Non-mandatory Appendix E provides guidance regarding the kind of considerations employers would take into account in attempting to comply with Sec. 1926.501(b)(2), (b)(12) or (b)(13).

The Agency does not consider "economic infeasibility" to be a basis for failing to provide conventional fall protection for employees constructing leading edges, erecting precast concrete members, or performing residential construction work. The Agency has consistently maintained, and the record for this rulemaking shows, that the industry can either absorb the costs of compliance with revised subpart M or pass those costs along to its customers. It is well established that all employers must comply with OSHA's standards whether or not they are inspected or cited by the Agency. A.E. Burgess Leather Co., 5 O.S.H. Cas. (BNA) 1096, 1097 n. 2 (Review Commission 1977), aff'd 576 F.2d 948 (1st Cir. 1978).

OSHA has also consistently maintained that "impracticality" does not excuse a contractor from compliance with the requirements for fall protection. However, based on OSHA's statutory mandate to protect employee safety and health and to address the significant risks posed by fall hazards, it is reasonably necessary and appropriate to require the protective measures set forth in this standard. As the RIA clearly shows, the requirements of revised subpart M are both technologically and economically feasible for the construction industry and they allow for those limited situations in which feasibility may be an issue.

As noted above, OSHA has acknowledged that there are situations where the implementation of a particular fall arrest system would create a "greater hazard" for employees than they would otherwise encounter. Under current Agency practice, an employer establishes the "greater hazard" defense to a citation by demonstrating that the hazards created by compliance with a standard are greater than those created by non-compliance. The Agency is aware that there are workplace situations where the installation of guardrails or safety nets could involve more risk, due to the nature or duration of the exposure, than the work for which protection is required. On the other hand, OSHA has found that, as with the "infeasibility" defense, the "greater hazard" defense does not generally excuse an employer from protecting its affected employees with personal fall arrest systems. In particular, the Agency has found that careful planning of a construction project enables the employer to erect buildings/structures into which the necessary anchorage points for personal fall arrest systems have already been engineered. For example, in the case of precast concrete erection, preplanning may allow for lifting inserts to be designed so that they function as both anchorage points for personal fall arrest systems and as lifting inserts.

OSHA further acknowledges that, regardless of an employer's ability to preplan for fall protection, there may be cases where the installation or use of personal fall arrest systems poses a greater hazard than that to which employees performing the construction work would otherwise be exposed. The Agency will expect an employer who seeks to make that case to indicate specifically how compliance with the requirement for personal fall arrest systems would pose a greater hazard. OSHA will assess each such case on its particular merits.

Paragraph (b)(3) sets fall protection requirements for employees in hoist areas of walking and working surfaces that are 6 feet (1.8 m) or more above lower levels. Employees shall be protected through the use of guardrail systems or personal fall arrest systems. If guardrails (or chains or gates if they are being used in lieu of guardrails at the hoist area) are removed to facilitate hoisting operations, then employees who lean through the access opening or out over the edge of the access opening to perform their duties shall be protected by the use of personal fall arrest systems.

This provision, essentially identical to the proposed provision, is based on existing Sec. 1926.500(g)(5), which addresses the same hazard but applies only to material hoisting operations on low-pitched roofs during built-up roofing operations. The proposal extended the existing requirement to all situations where equipment and material hoisting operations are being carried out on floors and other walking/working surfaces. The wording of the proposed provision has been revised for the sake of clarity.

There were two comments on this provision. The WMACSA (Ex. 2-56) commented that the term "hoist areas" needed to be defined for the sake of clarity. In addition, the SSFI (Ex. 2-89) requested that OSHA interpret the "exception" in proposed paragraph (b)(3), because "the paragraph seems ambiguous." OSHA believes that it has responded to the concerns of both commenters by rewording the provision to state more clearly which type of fall protection may be used at hoist areas. The revised provision clearly differentiates between working in the area where hoisting activities will take place (e.g., the area where materials are to be landed) and taking part in the actual hoisting operation (e.g., receiving materials hoisted by a crane). The exception language used in the proposal has been incorporated into the text of final rule paragraph (b)(3) so it is clear that during hoisting operations employees must be protected by personal fall arrest systems if they lean through the access opening or out over the edge to receive or guide materials. Otherwise, the employer would use either guardrail systems or personal fall arrest systems to protect workers at hoist areas.

Paragraph (b)(4) of the final rule requires that employees be protected from hazards associated with holes. In particular, employees may be injured or killed if they step into holes, trip over holes, fall through holes or are hit by objects falling through holes. Some workplaces may present all of these hazards while others may have only one of them. The proposed rule has been revised to indicate clearly which protective measures are applicable to a particular hole situation. OSHA notes that covers which comply with the criteria of Sec. 1926.502(i) will protect employees from all of the above-described hazards.

Paragraph (b)(4)(i) requires that employees be protected from falling into or through holes (including skylight openings) 6 feet (1.8 m) or more above lower levels by covers over the hole, erecting a guardrail system around the hole, or by the use of a personal fall arrest system. The Agency has revised the proposed rule to include personal fall arrest systems as an acceptable fall protection option because OSHA believes that a properly rigged system can protect an employee from falling though a hole. Paragraph (b)(4)(ii) requires that employees be protected from tripping in or stepping into holes by covers; and paragraph (b)(4)(iii) requires that employees be protected from objects falling through holes by covers.

The final rule differs from the proposed rule, which was based on requirements in the existing standards in Sec. 1926.500(b). The existing standard contains separate specific rules for guarding floor openings and floor holes in various walking/working surfaces. In the proposed rule, OSHA treated most holes as presenting the same type of hazard and did not address each individual type of hole separately. The proposed rule also set very specific requirements for the use of covers.

In addition, the proposed rule was apparently unclear with regard to requirements for protecting workers from stepping and tripping into holes and for protecting workers from objects falling through holes. While it appeared the regulatory language of the proposed rule limited protection from holes to just those situations where employees could fall to 6 feet or more to lower levels, the explanatory discussion of the provision in the preamble to the proposed rule indicated it was the Agency's intent "that all holes . . . be guarded. .. ." (51 FR 42722). The inconsistency was brought to OSHA's attention by a comment from AGC representatives (Exs. 2-16, 2-47, and 2-92), who pointed out that there was a need to clarify the definition or the requirement. Their concern was whether the Agency intended to cover holes into which employees could fall or holes through which materials could fall.

The California Department of Industrial Relations (CAL/OSHA) (Ex. 2-15) suggested that OSHA allow a standby employee safety monitoring system in lieu of guardrails when covers were being removed for short duration work. The commenter stated that it was unrealistic to require a guardrail where a cover is removed for passage of equipment and material for a short duration, where a standby employee could guard the hole. As discussed above at "leading edges," the use of safety monitoring systems is thought to be the least protective of all the systems permitted by the final rule. For this reason, OSHA has limited the situations where the use of safety monitoring systems is acceptable to roofing operations on low-sloped roofs and to situations where the employer can demonstrate that it is infeasible or creates a greater hazard to use conventional fall protection systems and that employer has developed a fall protection plan. OSHA does not recognize a safety monitoring system as an acceptable means of protecting workers exposed to falling into or through holes. There are other, more protective measures that can be taken to address falls at holes, including covers, guardrail systems and personal fall arrest systems, therefore, OSHA is not permitting the use of the less protective safety monitoring system at holes. Additionally, the final rule reflects the current industry practice with regard to protecting workers exposed to holes and OSHA does not have any basis for reducing the level of protection.

For clarification, OSHA does not intend that a guardrail be erected around holes while employees are working at the hole, passing materials, etc. Therefore, if the cover is removed while work is in progress, guardrails are not required because they would interfere with the performance of work. When the work has been completed, the employer will be required to either replace the cover or erect guardrails around the hole.

Other comments (Exs. 2-31 and 2-56) concerned securing holes and these are discussed later in this preamble along with other comments on the criteria for covers which is addressed in paragraph Sec. 1926.502(i). These comments prompt OSHA to remind employers and employees that this paragraph (like other paragraphs in Sec. 1926.501) only specifies the "duty" requirement to have fall protection. Once an employer has chosen from among the options provided to meet this duty, he or she must then meet the requirements in Sec.1926.502, which sets the criteria and conditions for use for each of the various fall protection systems required to be used in Sec. 1926.501.

Many commenters responded to Issues #2 and #7, which raised questions and concerns related to guarding holes and the criteria for covers used to guard holes. For example, the Associated Builders and Contractors, Inc. (ABC) (Ex. 2-51) commented that they found the provision limiting protection to covers or guardrails was unnecessarily restrictive because a guardrail system around a 3-inch hole would require a 3-foot diagonal guardrail. OSHA observes that the proposed provision was framed in performance-oriented language so that employers would have had the flexibility to choose between guardrails and covers, based on the circumstances at the workplace. OSHA believes that compliance with paragraph (b)(4) of the final rule, whichever method is chosen, will protect employees appropriately. OSHA anticipates that employers will use guardrails only in those cases where the size and configuration of the hole indicate that the use of a guardrail would be appropriate. The ABC also suggested that the final rule allow the same protection for holes as OSHA proposed for leading edges. As discussed above, OSHA has revised the proposed rule to allow the use of personal fall arrest systems where an employee may fall through a hole, but OSHA has not allowed the use of safety monitoring systems to protect employees from falling through holes.

Bristol Steel § the NEA (Exs. 2-12 and 2-43) stated that "Covers can be more hazardous than no protection at all because workers can see an uncovered hole but they can unintentionally remove a cover and step into a hidden hole." In addition, they stated that ". . . guardrails provide a false sense of security" because "Maintenance of guardrails is a serious problem when various workers are constantly altering, damaging, or temporarily removing them." OSHA observes that it has revised proposed Sec. 1926.502(i) to require that covers be "secured" when installed to prevent their being easily removed or accidentally displaced. This change should eliminate the commenters' concerns with regard to unintentional removal of covers.

Both commenters suggested control zones to keep workers at a safe distance from holes, advocating (like the ABC, (Ex. 2-51)) that paragraph (b)(4) address holes the same as the proposed paragraph (b)(2) treated leading edges, allowing the use of guardrail systems and safety monitoring systems, among other options. Finally, both Bristol Steel and the NEA stated that the use of "attending persons" at unguarded holes was "impractical and dangerous . . . because it is so difficult to enforce and so easy to let lapse during a critical moment" that "Safety monitors for workers performing the work and control zone systems for other workers in the area should be considered minimum safety precautions." As noted above, the Agency shares the commenters' concerns about the adequacy of the protection provided by safety monitoring systems.

Based on review of the comments, OSHA has concluded that the feasibility concerns that led the Agency to allow use of controlled access zones and safety monitoring systems are not present with regard to holes. Further, OSHA does not believe that the use of controlled access zones and safety monitoring systems would adequately protect employees working in proximity to holes.

Paragraph (b)(5) requires employees working on formwork and reinforcing steel 6 feet or more above lower levels to be protected by a personal fall arrest system, safety net system or positioning device system. This provision is identical to proposed Sec. 1926.501(b)(5). In addition, OSHA notes that with one exception (discussed below), paragraph (b)(5) presents the same requirement currently found in Sec. 1926.701(f)(2) of the concrete and masonry standard. The requirement in Sec. 1926.701(f)(2) is being relocated to subpart M because, as explained earlier, OSHA is consolidating virtually all construction fall protection requirements in subpart M, Fall Protection.

As OSHA explained in the proposal, positioning devices are essentially body belts or body harnesses that are attached by short lanyards to the work surface, allowing a worker to perform a job with both hands free. While existing Sec. 1926.701(f)(2) does not provide for the use of positioning devices, OSHA has determined that such devices, used in compliance with Sec. 1926.502(e) of the final rule, will provide appropriate protection for affected employees. As stated in the proposal, because of the short length of the lanyard (approximately 9 to 18 inches, depending on how it is rigged), the use of positioning devices does not pose a significant fall hazard. The criteria for positioning devices systems as provided by Sec. 1926.502(e) are discussed below.

Paragraph (b)(6) requires ramps, runways, and other walkways to be equipped with guardrails. As discussed below, the final rule is essentially the same as the proposed rule and is very similar to existing Sec. Sec. 1926.500(d)(2) and 1926.651(l)(1), which address fall protection for runways and excavations, respectively.

OSHA proposed to revise existing Sec. 1926.500(d)(2) by changing the 4-foot threshold for fall protection to a 6-foot threshold, so that this provision limit conforms with the other fall protection provisions. In addition to ramps and runways, the proposal was expanded to include all walkways and bridges where a fall hazard exists, not just those over excavations addressed in the existing rules. OSHA notes that existing Sec. 1926.651(l)(1) of the excavation standards is also being revised to make it clear that guardrails on walkways built over excavations must meet the requirements of revised subpart M.

OSHA has revised proposed paragraph (b)(6) by removing the word "bridges" from the list of surfaces covered by the provision. The removal of the word "bridges" was prompted by a comment from the Wisconsin Road Builders Association (WRBA) (Ex. 2-154) which pointed out that they had been engaged in bridge building for over 40 years and that their company uses body belts 90 percent of the time and harnesses 10 percent of the time when working

on bridges over water. OSHA was unsure whether this commenter was objecting to the requirement of the proposal which specifically required "guardrails" on bridges used as walkways, or if the commenter was suggesting that body belts be allowed to protect workers crossing over bridges. In any event, the comment alerted OSHA that the term "bridges" as used here could be understood to mean bridges other than those used as walkways. The Agency notes that paragraph (b)(6) does not apply to the use of personal fall arrest systems or safety net systems to protect workers from falling while bridges are being constructed. Rather, Sec. 1926.501(b)(1) covers bridges under construction, and it requires employers to protect employees from falls off unprotected sides and edges of bridges with guardrail systems, safety net systems, or personal fall arrest systems. OSHA believes that only guardrails can provide appropriate fall protection for workers as they cross over ramps, runways and other walkways.

Another commenter (Ex. 2-56) suggested that OSHA define "ramps, walkways and bridges," pointing out that "walkways" is defined as a part of a scaffold in the proposed scaffold standard. As the commenter pointed out, a definition for "walkways" has been provided in the scaffold regulations because the term has a unique meaning as it applies to scaffolds. The Agency notes that a definition in subpart L does not apply to terms used in subpart M. OSHA has determined that there is no need to define the terms based on the Agency's belief that the use of the terms -- ramps, runways, and walkways -- in this subpart is consistent with the definitions provided by any standard dictionary.

Paragraph (b)(7) requires that the edges of excavations which are not readily seen (i. e., concealed from view by plant growth, etc.) be protected with guardrail systems, fences, or barricades to prevent employees from falling into them if the excavation depth is 6 feet or more. In addition, walls, pits, shafts, and similar excavations with depths of 6 feet or more shall be guarded to prevent employees from falling into them. The only difference between the proposed requirements and the final rule is that the option to use signs as an alternative means of protection has been removed. The final rule is also essentially the same as the existing requirement in Sec. 1926.651(l)(2), which is being removed from subpart P and incorporated into subpart M because it addresses fall protection. As OSHA explained in the proposal, although employers are not generally required to provide guardrail systems at excavations, the Agency believes that barricades are necessary for excavations that are obscured from view, because of plant growth or other barriers, when the fall distance is at least 6 feet.

In response to the proposal and to Issue #12, regarding the use of signs as an alternative to barricades at obscured excavations, CAL/OSHA and the State of Maryland (MOSH) (Exs. 2-15 and 2-31) objected to the use of signs as a means of protecting employees from falling into excavations. MOSH (Ex. 2-31) contended that excavations and trenches should be guarded whether they can be seen or not.That view was echoed by commenters (Exs. 2-19, 2-46, and 2-99) who stated, in addition, that signs alone were not effective.

Another commenter, the Tennessee Valley Authority (TVA) (Ex. 2-20), commented that "Signs can be useful as an indicator of a hazard but should only be used in conjunction with other measures to provide employee protection." Yet another commenter, the National Constructors Association (NCA) (Ex.2-45), commented that "the use of physical barriers to prevent access to high exposure areas has been sufficient and [we] do not see any need for new requirements."

On the other hand, some commenters (Exs. 2-16, 2-47, and 2-92) supported the use of signs, noting they had "* * * been used successfully for this purpose in the past, depending upon the type exposure or particular situation." Some other commenters (Exs. 2-12 and 2-43) recommended that OSHA promulgate the standard as proposed. In addition, some commenters (Exs. 2-16, 2-47, 2-92, and 2-140) suggested that the requirement belonged in the excavation subpart. (OSHA's reasons for placing most fall protection provisions in subpart M have been discussed earlier in this preamble).

The SSFI (Ex. 2-89) supported the use of signs when no other fall prevention measures could be utilized. They also supported signs in conjunction with other measures. The ACCSH recommended that obscure excavations be protected not only by barricades and warning signs, but with lights if needed for nighttime operation. (Tr. 6/10/87;

pp. 134- 135).

Based on its review of the record, OSHA agrees with those commenters who have stated that signs, alone, would not adequately protect employees and has revised proposed paragraph (b)(7) accordingly.

Paragraph (b)(8) requires employers to protect employees from falling onto dangerous equipment. Paragraph (b)(8)(i) provides that where a floor, roof, or other walking or working surface is less than 6 feet above such hazards, employees shall be protected by guardrails or equipment guards that shield the hazard. Paragraph (b)(8)(ii) requires that employers protect employees on floors, roofs, and other walking or working surfaces 6 feet or more above dangerous equipment with guardrail systems, personal fall arrest systems, or safety net systems. "Dangerous equipment" is defined in Sec. 1926.500(b) as equipment such as pickling or galvanizing tanks, degreasing units, machinery, electrical equipment and other units which, as a result of form or function, may be hazardous to employees who fall onto or into such equipment. These requirements are identical to the proposed provisions, which were based on existing provisions in Sec. 1926.500(d) (4) and (5).

There was one comment on this provision. The SSFI (Ex. 2-89), directing its comment to paragraph (b)(8)(ii), stated "It is recommended that all employees above dangerous equipment be protected by a guardrail system or by body belt/harness system or safety net system. There should be no limitations regarding the height in which the employee should be protected."

The SSFI did not further elaborate on their comment. OSHA observes that the two requirements of this paragraph differ in the options from which employers must choose to protect employees based on the distance between the employee and the dangerous equipment with which the potential for contact exists. OSHA proposed only two options -- the use of guardrail systems or the use of equipment guards -- where the fall distance is less than 6 feet (1.8 m) because the use of safety net systems or personal fall arrest systems would not be appropriate. Specifically, the Agency believes that if a personal fall arrest system or a safety net system conforming to the criteria in Sec. 1926.502 were used where the fall distance is less than 6 feet, the employee's fall may not be arrested before contact was made with the equipment. On the other hand, where ample distance exists, i.e., more than 6 feet (1.8 m), the conventional fall protection systems would all be protective. By contrast, equipment guards would not be an appropriate option because they would not protect employees from such falls. For the reasons stated above, OSHA proposed options that it considered most appropriate to protect employees taking into consideration the fall distances and hazards involved. OSHA believes that paragraph (b)(8),as proposed, appropriately addresses the pertinent hazard. Therefore, OSHA promulgates paragraph (b)(8) unchanged.

Paragraph (b)(9) addresses the fall protection requirements for employees engaged in overhand brick laying operations and related work, except as set in Sec. 1926.451(g)(1)(vii). These employees are involved in the construction of masonry walls and must lean over the wall to complete the joint work. Related work, as used in this paragraph, means mason tending as well as electrical work that must be incorporated into the brick wall during the brick laying process.

Paragraph (b)(9)(i) requires that employees performing overhand brick laying and related work 6 feet (1.8 m) or more above lower levels to be protected by guardrail systems, safety net systems, personal fall arrest systems, or they must work in a controlled access zone. However, when these employees are reaching more than 10 inches (25 cm) below the level of the walking/working surfaces, only guardrail systems, safety net systems or personal fall arrest systems are permitted to be used under paragraph (b)(9)(ii), controlled access zones are not acceptable in this situation.

OSHA has repeatedly stressed that employees exposed to the risk of falling should, in general, be protected by one of the three conventional systems -- guardrail systems, safety net systems and personal fall arrest systems. However, OSHA also recognizes that the use of such systems sometimes is not feasible when overhand brick laying and related operations are taking place. In particular, guardrails may interfere with the performance of work; safety net systems often cannot be safely attached to or supported by the structure; and personal fall arrest

systems often become tangled or pose serious trip and fall hazards. After extensive consultation with the Mason Contractors of America, the International Union of Bricklayers and Allied Craftsmen, the Laborer's International Union of North America, and the ACCSH, OSHA proposed to allow the use of a control zone (now referred to as a controlled access zone), as an additional option that could be used in those situations where conventional fall protection systems were not feasible and the employees were not reaching more than 10 inches (25 cm) below the walking/working level.

The criteria for controlled access zones are set in Sec. 1926.502(g). In brief, a control zone line prevents non-overhand-brick laying employees from inadvertently entering the area immediately adjacent to the fall hazard and the controlled access zone designates the area where overhand brick laying may be performed without the use of guardrails, safety nets, or personal fall arrest systems as fall protection. However, paragraph (b)(9)(ii) provides that whenever an overhand bricklayer reaches more than 10 inches (25 cm) below the walking or working surface, the bricklayer must be protected by one of the "conventional" systems listed in paragraph (b)(9)(i) -- guardrail systems, safety net systems or personal fall arrest systems. When OSHA proposed this requirement, it explained it was doing so because it believed that the additional leaning presents a sufficient additional fall hazard to warrant such protection. OSHA anticipates that employers will comply with paragraph (b)(9)(ii) by having employees use personal fall arrest systems that will restrain employees from falling to lower levels.

It is important to note that controlled access zones are not permitted to be used as protection for employees performing overhand brick laying and related work who are exposed to fall hazards associated with hoist areas; holes; ramps, runways, and other walkways, and dangerous equipment. In these situations, fall protection must be provided by compliance with the paragraphs addressing the specific hazard, (i.e., paragraphs (b)(3), (4), (6), and (8)), as appropriate. For example, a worker performing overhand brick laying work near a floor hole would have to be protected as required by paragraph (b)(4) even when the hole is located within the area marked by a control zone line. Another example is a worker performing overhand brick laying work above dangerous equipment. The provisions of paragraph (b)(8) would apply; a controlled access zone would not be an acceptable method of fall protection. The final rule is identical to the proposed rule, except that, as explained below, OSHA has added a note referencing subpart L for regulation of brick laying work performed from scaffolds.

The Mason Contractors Association of America (MCAA), International Union of Bricklayers and Allied Craftsmen; and the Laborers International Union of North America, (Ex. 2-95) commented in support of the proposed provision. The MCAA referred to the proposed provision as "* * * the most reasonable, practical and economical and, above all, the safest method that can be devised for installing masonry products with the overhand method." OSHA concurs with the assessment of the MCAA with regard to this provision. In addition, the WMACSA (Ex. 2-56) stated that overhand brick laying should be prohibited as a practice, particularly when the work can be done from a scaffold. The MCISC (Ex. 2-140) commented that "Guardrail systems for scaffolds should be spelled out in scaffold standards." OSHA agrees that it is appropriate for brick laying performed from scaffolds to be regulated under subpart L, Scaffolds, rather than under subpart M and, accordingly, the Agency is adding a note to subpart L which so indicates. The MCISC also commented in support of the proposed provision, stating its belief that no fall protection was needed when brick laying operations were conducted from inside a building, except when reaching more than 10 inches below the working surface. In response, it should be pointed out that one of the options in paragraph (b)(9)(i) is to allow overhand brick laying workers reaching less than 10 inches below the walking/working surface, to work in a controlled access zone which essentially allows the work to be done without fall protection, just as the MCISC is recommending for work conducted inside a building. This option is not a fall protection system per se, but rather a method which limits the exposure to the fall hazard to those workers actually involved in the brick laying operation.

Paragraph (b)(10) applies to employees performing roofing operations on low-slope roofs with unprotected sides and edges 6 feet (1.8 m) or more above lower levels. It requires that employers protect employees from fall hazards by either a guardrail system, safety net system, or personal fall arrest system. Or, employers must use a combination of warning line systems and guardrail systems, warning line systems and safety net systems, warning

line systems and personal fall arrest system, or warning line systems and safety monitoring system. If, however, the roof is 50 feet (15.25 m) or less in width, the employer may protect employees by the use of a safety monitoring system alone.

As with paragraph (b)(9), discussed above, the provisions of paragraph (b) which cover hoisting areas, holes, ramps and runways, and dangerous equipment apply notwithstanding the provisions of paragraph (b)(10). The rationale for these exceptions is the same as that provided in the discussion of paragraph (b)(9), above.

The final provision differs substantially from the proposal. Under the proposed rule, employees performing "built-up roofing operations (meaning the application of hot tar or bitumen) on low-pitched roofs" were to be protected as required in existing Sec. 1926.500(g). Employees performing other roofing operations on low-slope roofs and exposed to falling 6 feet (1.8 m) or more to lower levels would have been covered by paragraph (b)(1) which applies, in general, to any walking/working surface with unprotected sides and edges 6 feet (1.8 m) above lower levels. The proposed paragraph was effectively identical with the provisions of existing Sec. 1926.500(g) for "built-up" roofing operations.

OSHA promulgated existing Sec. 1926.500(g) because it recognized that the use of guardrail systems, safety net systems, and personal fall arrest systems could pose feasibility problems or greater hazard. OSHA discussed the reasons for this belief when it published the final rule for the built-up roofing standard (45 FR 75619). In particular, in the preamble to that final rule, OSHA stated the following:

Guardrails are often used to provide fall protection and are required for open-sided floors and platforms by 1926.500(d)(1). However, although guardrails can be used during construction of a roof deck, they must be removed prior to the application of roof waterproofing membranes and related sheet metal work at the roof edge. According to a report by the engineering firm of Simpson, Gumpertz and Heger [Citation omitted], the reason guardrails must be removed is that, unless mounted on a parapet wall, guardrails are normally mounted on the roof deck and impede the application of the roof membrane. The use of freestanding guardrail systems as an alternative is limited since such guardrails must also be moved out of the way when the membrane is applied near roof edges and thus they are not a solution to the problem of providing fall protection. Other potential concerns include the increase in cost and time required to erect guardrails and the question of whether guardrails are needed when the work to be performed is not near the roof edge. These problems exist whether the work being done is a reroofing operation on an existing building or the application of a new roof on new construction. [45 FR 75619]

In the 1980 final rule, OSHA also acknowledged that this same report, prepared for the National Roofing Contractors Association (NRCA), concluded that guardrails make orderly built-up roofing work impossible and do not offer the desired protection, since they must be removed prior to the completion of roof side and edge finishing work. The report also discussed the reasons other conventional guarding systems were not appropriate. A full discussion is contained 1980 **Federal Register** notice. At that time, OSHA concluded as follows:

OSHA believes that the difficulties with conventional guarding systems (referred to in the standard as "motion-stopping-safety (MSS) systems") during the performance of built-up roofing work, will be avoided by allowing the use of a warning line and/or safety monitoring system. OSHA explained that a warning line "serves to warn and remind employees that they are approaching or working near a fall hazard by providing a direct physical contact with the employee. The contact attracts the employee's attention, enabling the employee to stop in time to avoid falling off the roof. The safety monitoring systems is a verbal warning system. OSHA describes the warning line systems with safety monitoring systems as an "alternative system of fall protection" which are "not intended to serve as positive fall restraints, but only as warning systems."

At the time of the proposed rule, OSHA relied on the information available from the 1980 rulemaking for built-up roofing work. Being unaware of any fall protection system that could be used in all cases and thus could eliminate the need for alternative systems such as the warning line system with safety monitoring system, OSHA proposed

to continue its existing requirements but to seek public comment on other methods of protecting workers from fall hazards at the edge of low-sloped roofs (flat roofs) during roofing work. In this regard, OSHA raised concerns about the height at which fall protection should be required for work on low-sloped roofs. Comments on this issue and other concerns regarding paragraph (b)(10) are discussed below.

In addition, the existing provisions used the terms "ground" and "eaves," respectively, as the points between which the height criteria is to be measured. OSHA proposed, instead, to use the terms "lower levels" and "unprotected sides and edges." OSHA believed the proposed language change would eliminate confusion, since some roofs do not have eaves, and other roofs are greater distances above the ground than above the nearest lower level (penthouse roofs, for example).

OSHA also proposed to permit built-up roofing work on low-pitched roofs with a fall distance less than 16 feet without the use of any of the fall protection systems required for other roofing work or required for higher work involving "built-up" roofing work. This, too, was consistent with the existing requirements in Sec. 1926.500(g), discussed above (see 45 FR 75618).

Issue #11 requested comment, including cost and injury data, on lowering the fall protection threshold for built-up roofing from 16 feet to 6 feet. OSHA stated that the 16-foot exemption for built-up roofing work was not appropriate and that a 6-foot threshold was both more appropriate and more consistent with the other provisions of subpart M. OSHA maintained that the contemplated change would not affect many built-up roofing employers because the option to use a safety monitoring system on low-pitched roofs with widths of less than 50 feet would encompass nearly all roofs less than 16 feet above lower levels.

OSHA received over 70 written comments in response to this issue, mostly from roofing contractors supporting views expressed by the National Roofing Contractors Association (NRCA). Virtually all of the commenters stated that roofs with widths of 50 feet or less were not necessarily also less than 16 feet above lower levels. Thus, the commenters felt that their compliance burdens would be greatly increased if the threshold height for providing fall protection was reduced to 6 feet. The commenters supported the existing language (16-foot threshold) as the standard industry practice and as an appropriate response to fall hazards (Exs. 2-52, 2-58, 2-59, 2-61, 2-72, 2-90, 2-91, 2-93, 2-111, 2-119, 2-122, 2-141, 2-143, 2-144, and 2-161).

Also, the NRCA commenters favored continuation of the existing rules with regard to built-up roofing. These commenters stated that there was no need to protect workers from falling off unprotected sides and edges of low-slope roofs until the fall distance exceeded 16 feet. They also stated few injuries have resulted from such falls and that the cost of providing protection would exceed the benefits.

For example, the American Roofing and Sheet Metal Co. (Ex. 2-86) commented that "We have experienced no injuries from falls at roof perimeters and do not recognize this hazard to be significant compared to other hazards of roofing work."

One statistic frequently cited by NRCA commenters indicated that only one percent of losses were due to falls and most falls were experienced when workers fell through holes. However, the commenters did not explain what was meant by "one percent of losses."

The H.B. Fishman § Co. (Ex. 2-70) commented, "Again of the utmost importance is that holes in the deck, penetrations and other openings be properly protected. This is where the majority of injuries occur."

The Roofing Association of Long Island (Ex. 2-144) commented that "The experience gathered from other contractors as well as our own employees indicates that incidents of accidents as a result of falls from the perimeter of the roof are less frequent than the accidents resulting from falls through roof openings within the perimeter."

The Florida Service Roofing and Sheet Metal Company (Ex. 2-147) commented that "Our experience, spanning 65 years,reveals that falls from the perimeter of roofs have been so minimal that they can be considered to have been virtually non-existent." OSHA notes that from the period of 1985-1989, 297 fatalities involving falls from roofs were investigated by OSHA (Ex. 30). While OSHA cannot state specifically if all of those falls occurred from the perimeter of roofs, it is reasonable to assume that the number of fatalities from the roof perimeter is high.

Other commenters suggested that OSHA revise part of the proposed provision. Specifically, two commenters (Exs. 2-108 and 2-111) noted that the proposal implied that on roofs with widths of 50 feet or less, the use of a safety monitoring system was the only permitted system, rather than stating that it was an acceptable system. OSHA acknowledges that proposed paragraph (b)(10) could be misunderstood to allow only safety monitoring systems when a roof is 50 feet wide or less. The Agency has revised the proposed language to indicate clearly that on a roof 50 feet or less in width, the use of a safety monitoring system, without the warning line, is one of the measures allowed. OSHA allows the use of a safety monitoring system without the warning line on these narrow-width roofs because if warning lines were erected as prescribed in the standard, there would be little roof area remaining in which work could be performed.

The ACCSH (Tr. 6/10/87; pp. 133-134) recommended that OSHA change the 16-foot threshold to 6 feet and that safety monitors be allowed only where employees are working on built-up roofs. Three other commenters also supported the 6-foot rule (Exs. 2-33, 2-46, and 2-99). NIOSH (Ex. 2-33) commented that allowing the 16 foot exemption was "inadequate" and recommended that a maximum fall distance of 6 feet be set as appropriate for both low-slope roofs and steep roofs. They further suggested that the use of safety monitoring systems for flat and low-slope roofs might be an appropriate way of addressing the difference in hazards.

While the Roofers Union (Ex. 2-99) supported the 16-foot threshold in the 1980 rulemaking for existing Sec. 1926.500(g), they opposed the continuation of that provision in proposed subpart M. Instead, they urged OSHA to "promulgate a standard that will effectively protect roofers against the dangers from fall hazards which they face almost daily." They also questioned whether OSHA should continue to allow the use of warning line and safety monitoring systems to protect roofers working on low-slope roofs. The Roofers Union stated the following:

In 1979 we endorsed OSHA's proposed rule to provide for a warning line on low-pitched roofs primarily because there were no standards covering the guarding of low-pitched roofs and something had to be done immediately * * *. We also stated that we would press for total perimeter protection if the warning line approach did not prevent injuries or deaths from falls off the roof edge.

The standard (1926.500 g) has been in effect now for over 6 years yet the industry continues to be plagued by the same safety problems -- roof falls. Although there is no statistical evidence to demonstrate the effectiveness of the standard one way or the other, workmen's compensation rates for the roofing industry have risen significantly over the past 6 years. That indicates among other things that little is being done in the roofing industry to reduce the incidence of injuries and deaths.

The Roofers Union also cited BLS data from a study on falls which showed that of 110 falls from roofs, half of these involved workers falling distances of less than 15 feet. Of these workers, over half suffered fractures to one or more parts of their body, over 40 percent suffered muscle sprains, strains or torn ligaments and 9 percent suffered a concussion.

In conclusion, the Roofers Union stated, "The data demonstrate that a significant number of serious injuries occur from falls of less than 16 feet. So it makes no sense to exclude a significant percentage of hazardous work from the OSHA standard. And, OSHA has indicated that these requirements would not place a significant economic burden on the roofing industry." The final recommendation was that total perimeter protection should be required because the warning line system was not effective.

OSHA agrees with the Roofers Union that falls of less than 16 feet pose a significant hazard. OSHA also believes the injuries are related to the fall distance and the failure of contractors to take any fall protection measures, rather than the use of warning line systems. For this reason, OSHA will no longer permit workers exposed to falls between 6 feet and 16 feet to go unprotected from the fall hazard. OSHA believes the revised rule appropriately addresses the fall hazards on low-slope roofs and sets forth appropriate choices of fall protection, allowing roofing contractors some flexibility without sacrificing the safety of workers.

OSHA agrees with the commenters who suggested that all employees engaged in roofing operations who are exposed to the hazard of falling 6 feet (1.8 m) or more to lower levels should be protected in the same manner from fall hazards. OSHA also agrees with commenters who stated there is no need to distinguish between the application of hot and cold materials to determine the appropriate fall protection measures, hence the final provision will apply to all roofing operations on low-slope roofs and not just "built-up" roofing activities. OSHA notes that the criteria for warning line systems and safety monitoring systems are found in paragraphs (f) and (h) of Sec. 1926.502. Employers who use these systems must comply with all of the criteria and conditions for use that are specified.

Paragraph (b)(11) (proposed as paragraph (c)) requires employees on roofs with slopes greater than 4 in 12 (i.e., 4 inches vertical to 12 inches horizontal run) to be protected from falling when the roof has unprotected sides or edges more than 6 feet (1.8 m) above lower levels by the use of guardrail systems with toeboards, personal fall arrest systems, or safety net systems.

The final provision differs from the proposal. The proposed provision addressed both falls through holes and falls from unprotected sides and edges of steep roofs. In the final rule, all falls through and into holes are covered by paragraph (b)(4). Therefore, there is no need for a separate provision dealing with holes on steep roofs. OSHA notes that the protective measures required for holes in paragraph (b)(4) are essentially the same as proposed for holes under the steep roof provision. Another change in the final rule is that OSHA is requiring toeboards to be used when guardrail systems are used to provide fall protection on steep roofs.

The existing rules in subpart M do not specifically address fall protection requirements for steep roofs. Because of the lack of specific requirements, provisions outside subpart M have been utilized as the basis for citations for inadequate fall protection on steep roofs, including the following provisions: Sec. 1926.28(a) Personal protective equipment; Sec. 1926.104 Safety belts, lifelines, and lanyards; Sec. 1926.105 Safety nets; Sec. 1926.451(u)(3) Catch platforms; as well as the "General Duty Clause" (section 5(a)(1)) of the OSH Act). The final rule explicitly sets out the required fall protection systems for steep roofs.

NIOSH (Ex. 2-33) supported the requirement to have fall protection on steep roofs when the fall distance to lower levels exceeds 6 feet (1.8 m). CAL/OSHA (Ex. 2-15) stated, "The obvious hazard of the steepness of the roof, regardless of the eave height, should be addressed." They also suggested that "On steep roofs of 8 in 12 or steeper slopes, where the fall down the roof slope itself exceeds 6 feet (1.8 m)," the use of roof jacks and body belt systems, safety net systems or positioning device systems would be appropriate. Paragraph (b)(11) of the final rule will permit employees to work on roof jacks provided the employee is protected from fall hazards by the use of guardrail systems with toeboards, safety net systems, or personal fall arrest systems. While roof jacks provide a foothold, which may reduce the possibility of falling, they cannot be used as a substitute for fall protection. The final rule will not permit employers to protect employees on roof jacks from fall hazards through the use of positioning devices systems because such systems will not protect affected employees from fall hazards.

On the other hand OSHA observes, that because falls on steep roofs can result in workers and materials sliding down the slope, it would be appropriate to require the use of a toeboard as a standard practice when guardrail systems were chosen to provide fall protection. OSHA believes that omitting the toeboard would contribute to worker injuries since workers will not have any protective device to stop their sliding descent on the steep roof. OSHA notes that they could, then, slide right under the midrail and top rail of a conventional guardrail system.

Paragraph (b)(12) is a new paragraph. OSHA is promulgating paragraph (b)(12), which was not part of the proposed rule, to set requirements for employers whose employees are exposed to fall hazards while erecting precast concrete members and related operations. Under paragraph (b)(12), employees erecting precast concrete members 6 feet (1.8 m) or more above a lower level must be protected from falling by guardrail systems, safety net systems, or personal fall arrest systems, unless the employer can demonstrate that such systems would be infeasible or would create a greater hazard at the site where the affected employees are working. In such a situation, an employer would be required to develop and implement a fall protection plan which conforms to Sec. 1926.502(k), discussed below.

An exception is also allowed if another provision in paragraph (b) allows an alternative fall protection measure, such as covers over holes. Those alternative measures are also acceptable and do not need to be documented in a fall protection plan in order to be used.

In the NPRM discussion of proposed paragraph (b)(2), Leading edges, (51 FR at 42721), OSHA indicated its recognition that it may be infeasible to protect workers performing precast concrete erection at the leading edge with guardrail systems, safety net systems, or personal fall arrest systems. Paragraph (b)(2) of the final rule provides that employers engaged in leading edge work (which can include precast concrete erection work) who demonstrate that it would be infeasible or would create a greater hazard to use conventional fall protection must develop and implement a fall protection plan which documents why they believe they cannot provide conventional fall protection and sets out the alternative fall protection measures that will be taken. In particular, the employer must establish a controlled access zone (29 CFR 1926.502(g)) and, at a minimum, implement a safety monitoring system (29 CFR 1926.502(h)) if no other alternative fall protection measure has been taken to protect leading edge workers. The provisions of paragraph (b)(12) are essentially the same as those of paragraph (b)(2), but extend beyond leading edge work and allow employers engaged in any work involving the erection of precast concrete to develop and implement a fall protection plan where they can demonstrate infeasibility or greater hazard with conventional fall protection systems. A full discussion of the meaning of "infeasibility" and "greater hazard" was provided above along with the discussion of paragraph (b)(2) and applies here also.

Paragraph (b)(12) has been added in response to comments regarding fall protection for precast concrete construction. Issue #2 of proposed subpart M asked:

Are there areas or operations in addition to those already identified in proposed Sec. 1926.501, which have unique fall protection requirements not addressed by the proposed standards? Examples of such areas and operations might include carpenters erecting roof trusses during house construction; steel erectors working on other than tiered buildings . . . or connectors erecting wood, precast concrete, and structural members made of other materials. 51 FR at 42729.

The Agency received several comments from the Precast/Prestressed Concrete Institute (PCI) (Exs. 2-44, 2-106 and 2-107) regarding the need for separate fall protection standards for workers engaged in precast concrete erection.

Based on those comments, OSHA raised Issue M-2 in the January 26, 1988, Notice of Hearing on subparts L, M, and X [53 FR 2048] to solicit testimony and other information on the concerns raised by PCI. Specifically, OSHA stated (53 FR 2054):

The [Precast/]Prestressed Concrete Institute (PCI) (Ex. 2-44) has commented that fall protection for employees erecting precast concrete components is "not appropriately covered by the proposed regulations" in Subpart M, because, according to the PCI, concrete erectors, like steel erectors, need more freedom of movement than proposed Subpart M would permit. Therefore, the PCI suggested that OSHA revise proposed Subpart M so that precast concrete erection would be regulated under Subpart R, Steel Erection. At the August 4, 1987, ACCSH meeting, a PCI representative reiterated the view that connectors of precast concrete members should be provided the same considerations as connectors of steel members saying [Tr. 212]: "We feel that the erection

procedures and exemptions for steel are basically the same as those for precast concrete * * * Basically, the fall protection of the steel connector, again, would be the same as that for the precast connector." The PCI subsequently submitted comments (Ex. 2-106 and 2-107) which requested that OSHA exempt concrete erectors from proposed leading edge protection requirements in Subpart M and that OSHA exempt hollow core slab erectors from perimeter protection provisions, except for those in proposed Sec. 1926.502(h), Safety monitoring systems.

In response, PCI testified at the public hearing (Exs. 6 A-9 and 9, and Tr. 53-82, March 22, 1988) and submitted post-hearing comments (Exs. 17 and 19), which reiterated the points made in its comments. OSHA subsequently received additional correspondence from PCI (Exs. 25-1 and 25-2). In that correspondence, PCI (Ex. 25-1) stated that OSHA's "* * * lack of understanding of our unique erection problems will result in the promulgation of rules that will result in endless litigation and not serve the safety needs of the workers." In October 1989, OSHA informed PCI (Ex. 25-3) that the rulemaking record had closed and that, in any event, the late comments simply repeated submissions that had already been included in the record.

On February 12, 1990, PCI again wrote to OSHA (Ex. 25-4) reasserting that compliance with proposed subpart M was not appropriate to protect employees engaged in precast concrete erection. PCI again suggested that OSHA either regulate precast concrete under its own industry specific standard or under subpart R -- Steel Erection, because either alternative would be more applicable than the generic subpart M standard. That submission also contained a more detailed discussion of precast concrete erection procedures, including fall protection procedures. OSHA responded (Ex. 25-5) that it would review the information presented in the letter and would reopen the record if significant issues were raised that had not previously been included in the record.

On May 30, 1990, PCI again wrote to OSHA (Ex. 25-6) and expressed concern "* * * relative to OSHA's work to revise the construction industry safety standards addressing fall protection in both 29 CFR 1926 subparts M and R (Steel Erection)."

On June 15, 1990, OSHA informed PCI that the information presented in their letters was under review and a decision on further action would be made at the completion of that review. OSHA determined that the supplemental submissions from PCI did provide new information which was relevant to a full consideration of the issues raised by subpart M. Accordingly, the Agency reopened the rulemaking record (57 FR 34656, August 5, 1992) for the limited purpose of entering the new information and to receive comments on it. The comment period ended on November 3, 1992. The Agency reopened the record again (58 FR 16515, March 29, 1993) to allow additional time for PCI and other interested parties to submit comments. That comment period ended on May 28, 1993. The comments supported the inclusion of a fall protection plan as an alternative where employers engaged in precast concrete construction work were able to demonstrate infeasibility or greater hazard with the use of conventional fall protection systems. A more thorough discussion of the comments can be found at Sec. 1926.502(k) -- fall protection plans.

Based on a careful review of the information submitted by PCI and other rulemaking participants, OSHA has determined that precast concrete construction entails unique work conditions which should be specifically addressed by subpart M. The new provision requires employers who can demonstrate that the use of conventional fall protection systems would be infeasible or would create a greater hazard to implement a fall protection plan that complies with Sec. 1926.502(k) of the final rule. OSHA is providing specific guidance in this notice regarding what constitutes "infeasibility" or a "greater hazard" (See Sec. 1926.501(b)(2)). OSHA encourages employers who believe that the use of a written fall protection plan is appropriate for their precast concrete construction operations to discuss the basis for their belief with local OSHA compliance staff. Additional information regarding the criteria for use of a fall protection plan is provided in the discussion of Sec. 1926.501(b)(2) of this section and in the discussion of the criteria for fall protection plans, Sec. 1926.502(k), as well as in Appendix E to subpart M -- Model

Fall Protection Plans. The Agency considers the implementation of a fall protection plan, outlining alternative fall protection measures, to be a "last resort," allowed only where the other options for fall protection have been exhausted.

Paragraph (b)(13), which also was not part of the proposed rule, requires that employers engaged in residential construction work protect employees from falls of 6 feet (l.8 m) or more to lower levels by the use of one of the three conventional fall protection systems unless such systems are infeasible or would create a greater hazard for affected employees. In those situations, OSHA requires the employer to develop and implement a Fall Protection Plan which meets the criteria of Sec. 1926.502(k), discussed in detail below.

As with paragraph (b)(12) discussed above, if another provision in paragraph (b) allows an alternative fall protection measure, such as covers over holes, those alternatives measures are also acceptable and do not need to be documented in a fall protection plan in order to be used.

OSHA is adding this new paragraph in response to comments received on the issues raised in the limited reopening of the rulemaking record [March 29, 1993; 58 FR 16515], regarding the ability of the residential construction industry to provide fall protection for certain employees. In that Notice, OSHA pointed out that Issue #2 of proposed subpart M (51 FR 42729) had asked if there were areas or operations which had unique fall protection needs not addressed by the proposed rule. OSHA specifically mentioned carpenters erecting roof trusses during house construction as a possible example. OSHA raised these issues in a reopening notice because the Agency had received a late comment in December 1992 from Ryland (Ex. 27-15) requesting that OSHA reopen the record for subpart M to allow input regarding the residential construction industry's ability to provide fall protection for employees erecting roof trusses and installing exterior wall panels. Ryland stated that there were no feasible means of fall protection for employees erecting roof trusses and installing exterior wall panels. The Ryland letter also explained the reasons they believed the proposed and existing fall protection requirements were infeasible or that compliance would create a greater hazard that non-compliance.

In the reopening notice, OSHA raised the possibility of allowing employers to develop and implement a fall protection plan in those situations where employers were able to demonstrate that it was infeasible or would create a greater hazard to use conventional fall protection systems. OSHA also requested information on the use of controlled access zones, warning line systems and safety monitoring systems as part of a fall protection plan. OSHA also asked what methods of providing fall protection were being used by builders to protect employees who are installing walls and erecting roof trusses; what contractors were using for anchorage points on roofs; and to what extent it was feasible to protect employees with conventional fall protection systems while erecting trusses and installing wall panels.

A number of home builders responded that they were pleased that OSHA had recognized the need to take the residential construction industry (Ex. 27-23, 27-24, 27-26, 27-27, 27-33, and 27-34) into account when revising subpart M. These commenters noted that the failure of various OSHA standards to distinguish between the residential/light commercial sector of the industry and the heavy commercial/industrial sectors had forced the residential sector into noncompliance. Ryland and the National Association of Home Builders (Exs. 27-23, 27-27, 27-33, 27-34) commented that they:

* * * would like to urge OSHA to establish in Subpart M a separate section applying to the residential/light commercial sector, even if [it] means repeating requirements from other sections of Subpart M that apply to all construction. We believe this action is imperative if OSHA is intent on improving safety in the residential/light commercial sector of the industry.

The Home Builders Association of Maryland (HBAM) and Hallmark Builders (Exs. 27-24 and 27-26) supported the above position. Both commenters stated the following:

Currently, the standards for enforcement of these industries are the very same used by OSHA to safeguard the heavy commercial and industrial sectors of the construction industry. Unfortunately, many practices that may be feasible within these heavier industries become impractical and sometime impossible within residential and light commercial construction.

Finally, they noted that a larger number of employees would benefit from increased protection through safer workplaces if separate standards were issued because they would be easily implemented and enforced and more widely accepted. This they noted, "* * * would further the goals of both OSHA and the employer.

The Home Builders Association of Denver (Ex. 27-39) also commented that the existing standards are written for general construction work, and that a new section is needed for residential construction only. They also noted that a majority of residential builders also perform some amount of light commercial work and the two types of construction should be categorized as "light construction."

The Home Builders Association of Denver also provided some information regarding the measures it believes an employer can take when the employer determines that conventional fall protection cannot be used. OSHA notes that the comment provides information which could be useful once an employer established that a fall protection plan, tailored specifically for the home being built, was appropriate. However, the comment does not address the more important issue: How does the employer establish, in the first place why none of the three conventional systems can be used? While the Agency encourages creative solutions to fall protection problems, OSHA does not expect employers (home builders) to pursue measures which would make their work unprofitable. For example, OSHA expects that there will be circumstances where a home builder will find it to be cost-effective to rent a crane for the purpose of hoisting roof trusses, particularly when several roofs can be set in a single day. Also, OSHA is aware, as documented in this final rule, that there are a number of devices readily available for use as attachment points for fall arrest equipment and that employers must be able to document why the use of such equipment is infeasible or creates a greater hazard to meet the criteria for using a fall protection plan.

On the other hand, the Agency believes it would be unreasonable to expect the home builder to rent a crane when the home site is difficult to access (terrain or remote location, such as in the mountains) or when the home builder has only a single roof to raise. In addition, OSHA does not expect home builders to erect scaffolds around the entire perimeter of a house, or to take other extremely burdensome measures such as erecting separate structures (telephone poles, e.g.) and stringing a lifeline to use as an attachment point for personal fall arrest equipment. These measures are infeasible.

In the course of this rulemaking, only two specific tasks have been identified by OSHA as potentially creating an infeasible or greater hazard situation. One is bracing roof trusses and the other is erecting panelized walls. OSHA believes that, in general, it is feasible to set trusses from ladders, scaffolds, or other elevated work platforms provided there is sufficient space to set up ladders, scaffolds or elevated platforms. When space makes it impossible to use such measures, the employer will have to develop and implement a fall protection plan meeting the criteria of paragraph (k) of Sec. 1926.502.

The South Eastern Wyoming Home Builders Association (SEWHBA) (Ex. 27-35) stated "The feasibility of added protection for workers installing roof trusses and/or above grade wall panels is ineffective and possibly more hazardous than the current systems used..." The best protection of these workers would be in training for recognition of such hazards and proper caution. They also stated that "[a] `Fall Protection Plan' is the most effective way to provide protection. Warning lines would at least advise other crews of activity above, allowing proper caution in approaching the site." The commenter indicated that it didn't believe control zones were feasible. The SEWHBA also noted that fall protection plans for residential construction should be comparable to those in commercial construction noting that "Residential construction is essentially the same in most cases,except possibly "high rise" type activities.

David Welty of Welty Construction Co. Inc. (Ex. 27-31) stated that it was "too dangerous" to set rafters and trusses while walking on the top of 2 x 4 walls and described how he installed rafters and roof trusses working off ladders from inside the upper floors. Welty also commented there was an added risk to erecting guardrail systems, scaffolding, etc. and that "for erecting roof trusses, we believe it is sufficient to require workers to work from ladders inside the walls" citing feasibility problems with conventional fall protection systems. Finally, Welty noted that "fall protection plans, warning lines, and monitoring systems are probably not effective in enhancing safety."

Another builder, Schuck § Sons Construction Company (Ex. 27-37) stated "[p]rotecting employees from falls has been a real dilemma in the residential framing industry." He believes that a greater hazard occurs while employees are installing fall protection systems and the lack of solid anchorage points presents compliance problems.

Arguing against any separate treatment for residential construction was the United Brotherhood of Carpenters, (Ex. 27-25) who commented that there was little fall protection being provided to workers in the residential industry and that "[C]onventional fall protection measures are feasible." They also commented that when erecting roof trusses or installing exterior wall panels, "It would be safer to work from a scaffold rather than a ladder because of the larger area of work surface. Working from a scaffold would be feasible" and that "Present technology and fall arrest equipment is available which would make it possible to protect employees installing exterior wall panels." Finally, the Carpenters Union noted:

The fall protection safety requirements for residential construction should be the same as those for commercial construction. The fact that residential construction has gone unregulated and unenforced for so long is no reason to create a "double safety standard." The hazards in residential construction are every bit as real as those in commercial construction.

OSHA encourages employers to require their employees to work from ladders, scaffolds and other platforms rather than for example, walking the top plate when setting or bracing trusses. Employees who are required to be on the top plate to work must be protected from fall hazards (falls of 6 feet or more to the lower level) by one of the three conventional fall protection systems unless they are covered by a fall protection plan which specifies other alternative measures. OSHA reminds employers that subpart M does not require fall protection for employees working on ladders and scaffolds. (See subpart L for specific requirements for fall protection on scaffolds and subpart X for specific requirements for fall protection on fixed ladders).

NIOSH (Ex. 27-20) commented that they had performed several analyses and compared the proportion of workers' compensation claims in the residential building construction industry that involve falls from elevations to those in other sectors of the construction industry. The findings were that * * * injured residential construction workers had at least as high a proportion of their injuries due to falls from elevations as all other construction workers. They also found that injured residential construction workers had at least as high a proportion of their injuries due to falls from elevations as nonresidential construction workers.

Therefore, based on these analysis, NIOSH stated that fall protection requirements for employees in residential construction "should not be less stringent than fall protection requirements for employees in other construction categories."

OSHA also received comments from fall protection equipment manufacturers and consultants. For example, Sinco (Ex. 27-30) commented that they have developed many new products, notably fall protection for roofers, that are readily available now for use in residential construction. They also noted that many forward thinking contractors are developing fall prevention programs, purchasing fall protection systems, and when appropriate, altering means and methods for accommodating use of fall protection equipment. Sinco also commented on the existing anchorage requirement of 5,400 pounds, noting that it does present unique problems in compliance on wood frame buildings. However, engineered systems using OSHA fall arrest requirements in the powered platform rule, Sec. 1910.66, Appendix C, incorporating retracting lifelines, etc. would enable contractors to provide fall protection with secure anchor points. Sinco also made the following statements pertinent to this rulemaking:

Most residential builders have no plan for fall protection, subsequently they have no fall protection equipment, and most remain unenlightened about the fall protection systems that are readily available. Today, safety systems are available that will enable residential builders to substantially reduce their employee exposure to fall hazards during framing and roofing operations.

* * * manufacturers have developed engineered fall protection systems that can be secured to anchorages capable of supporting twice the potential impact load of an employee's fall. Anchor points can vary, some examples are ridge beams, rafters, trusses, and floor joints. With proper planning, a minimum of bracing and sheathing can develop the structural integrity necessary to support these types of anchorages. Scaffolding can be erected with the building interior and serve as a work platform during truss bracing operations. New products, such as the UNITRAC Truss Walk, provide an interior work platform as well as meeting a contractor's fall protection needs during truss installation and bracing.

In addition, Sinco presented information about other products they have available now for use during wall installation, truss installation, sheathing, and the application of roofing materials. Sinco also commented that the use of control zones, warning lines, and safety monitors should be an option extended through OSHA as a SITE SPECIFIC exemption only and that contractors should have to demonstrate by individual tasks that conventional fall protection measures are not appropriate at specific project sites. While Sinco stated "[t]he agency should require employers to provide fall protection for all facets of residential construction where fall hazards exist," it also stated that if the employer can demonstrate infeasibility or greater hazard, the Agency should grant an exemption on a case by case basis.

Griphoist (Ex. 27-40) suggested that OSHA require anchorages used with personal fall arrest systems in residential construction be required to withstand a load of 3,600 pounds, with employees wearing body harnesses, rather than 5,400 pounds. The commenter noted that the suggested figure is twice the potential impact load allowed by the ANSI standard, ANSI Z359.1-1992, of 1,800 pounds.

Dynamic Scientific Controls (Ex. 27-42) stated that "It is my opinion that conventional fall protection can be applied to residential roof construction, including truss erection, sheeting and roofing."

OSHA also received comment from Gary Sipe, President of Peakrider (Ex. 27-29), who commented on a new product currently being introduced to the market called "Peakrider." The product was designed to provide a measure of safety for employees setting prefabricated wood trusses for residential and small professional office construction. Mr. Sipe also noted that the product is new and not many construction firms know of its existence. Mr. Sipe also provided information on other products designed for use in residential construction to reduce the exposure of employees to fall hazards.

Finally, OSHA received comment from Douglas Browning (Ex. 27-32) who provided information on a scaffold system that has been field-tested for use in residential construction to reduce the exposure of employees to fall hazards during roof truss installation.

OSHA recognizes that some employers engaged in erecting and bracing roof trusses, because of their building methods, may find that it is infeasible or would create a greater hazard to provide and use conventional fall protection systems to protect employees performing these tasks. In these situations, OSHA suggests that employers review their building methods to determine if a change in work procedures could eliminate or reduce fall hazards. If the employer can demonstrate either infeasibility or greater hazard, applying the criteria discussed above and in relation to paragraph (b)(2) of this section, the employer must implement alternative safe work practices, such as requiring work to be performed from ladders, scaffolds or other types of work platforms and prohibiting the practice of standing on the top plate of the walls to set (secure) roof trusses to the walls. OSHA is also aware that some builders assemble the roof system on the ground, either partially or entirely, and then lift it into place. OSHA would expect any fall protection plans developed under this paragraph to explain why such

measures could not be implemented when other builders find them to be feasible alternatives. The evidence indicates that many home builders have yet to focus their attention on alternative safe work practices that can be implemented in those areas where concerns have been raised.

OSHA believes, based on the rulemaking record, that employers can protect their employees from fall hazards with conventional fall protection systems in virtually all situations involving residential construction work. OSHA is being responsive to the concerns raised by home builders, in particular, with support from some fall protection equipment manufacturers, that there may be some limited situations where the use of conventional fall protection systems is infeasible or would create a greater hazard than would exist if such systems were not used. It is for this reason that OSHA has established a regulatory mechanism (fall protection plan) through which an employer who satisfies the pertinent criteria must implement a fall protection plan instead of providing conventional fall protection.

OSHA encourages home builders in their efforts to improve the safety and health of their workers. While many of the home builders' comments urged OSHA to recognize the "inherent differences," between "light" construction and "heavy" construction, the evidence submitted was insufficient to convince OSHA that the methods of protecting workers from fall hazards associated with light construction and heavy commercial construction differed sufficiently to require different rules. OSHA is intent on improving safety in the residential sector of the construction industry and views the promulgation of Sec. 1925.501(b)(13) as a concrete step towards increased safety for workers in this part of the construction industry.

Based on a careful review of the information submitted by home builders and other rulemaking participants, OSHA has determined that residential construction work entails unique work conditions which should be specifically addressed by subpart M. Therefore, OSHA is promulgating a new Sec. 1926.501(b)(13), which specifically addresses this type of construction work. The new provision requires employers to use conventional fall protection systems unless they can demonstrate that the use of conventional fall protection systems would be infeasible (impossible to get the work done or technologically impossible) or would create a greater hazard and then they must implement a fall protection plan that complies with Sec. 1926.502(k) of the final rule.

Additionally, Sec. 1926.502(k)(5) requires that the fall protection plan document the basis for the determination that fall protection cannot be used. The Agency considers the implementation of a fall protection plan, outlining alternative fall protection measures, to be a "last resort," allowed only where the other options for fall protection have been exhausted. As noted above, OSHA is providing specific guidance in this notice regarding what constitutes "infeasibility" or a "greater hazard" (See discussion at Sec. 1926.501(b)(2)).

OSHA has included a sample fall protection plan for residential construction in non-mandatory Appendix E -- Model Fall Protection Plans to provide guidance to home builders.

Paragraph (b)(14) of the final rule (proposed Sec. 1926.501(d)) requires protection for employees who are exposed to the hazard of falling out or through wall openings. The final rule consolidates and clarifies requirements in existing Sec. 1926.500(c) (1) and (3). Under the final rule, wall openings (defined as openings 30 inches or more high and 18 inches or more wide, which have a bottom edge to lower level fall distance of 6 feet or more on the side away from the employees, and a bottom edge to walking/working surface height of less than 39 inches on the side facing the employees), must be equipped with a guardrail system, safety net system, or personal fall arrest system. OSHA believes the most practical method of compliance is the guardrail system because it provides protection at all times and for all employees who may have exposure at the wall opening. However, OSHA recognizes that there may be cases where employers may desire to use safety net systems or personal fall arrest systems, which also will provide an appropriate level of protection. For that reason, the provision has been revised to permit the use of these other systems.

The final rule is similar to the proposed rule, except for the change discussed above and the existing rule in Sec. 1926.500(c)(1) requires such protection to be provided when the fall distance exceeds 4 feet, and when the near side height is less than 36 inches. OSHA proposed to change the existing rule to make it compatible with the 6-

foot rule of other provisions in Sec. 1926.501, the minimum height requirements for guardrail systems of Sec. 1926.502(b)(1), and the definition of "unprotected sides and edges."

The SSFI (Ex. 2-89) recommended that employees on elevated work platforms adjacent to a floor or wall opening should be protected by a fall protection system regardless of the height of the platform. OSHA observes that proposed subpart L sets forth requirements for employees working on scaffolds [elevated work platforms] and that the final rule for subpart L will address this issue.

New paragraph (b)(15) is a "catch all" provision intended to clarify the overall thrust of paragraph (b). It sets forth clearly that all employees exposed to falls of 6 feet (1.8 m) or more to lower levels must be protected by a guardrail system, safety net system, or personal fall arrest system except where otherwise provided by Sec. 1926.501(b) or by fall protection standards in other subparts of part 1926. The Agency has determined that this provision will facilitate compliance for employers who do not fit any of the specific categories set by Sec. 1926.501(b).

Paragraph (c) -- Protection from falling objects. This provision, proposed as Sec. 1926.501(e), requires employers to protect employees from falling objects by either:

(1) Using toeboards, screens, or guardrail systems;

(2) Erecting a canopy structure and placing potential fall objects away from edges; or,

(3) Barricading the area to which objects could fall, prohibiting employees from entering that area, and placing potential fall objects away from the edges.

This requirement differs from the proposed requirement and the existing requirements. The existing requirements in Sec. 1926.500(b) (1), (2), (3)(ii), and (8) and Sec. 1926.500(d)(2) require toeboards to be erected around floor, roof,ramps, and platform holes and openings regardless of whether or not employees are working below. OSHA proposed to revise the existing requirement to require that, in addition to wearing hard hats (Sec. 1926.100), employees would have had to be protected from falling objects by one of a series of measures, which included the following:

-- installing toeboards, screens or guardrail systems to keep objects from falling from above;

-- erecting canopy structures;

-- marking the area with signs; or barricading the area to prohibit employees from entering the area; or,

-- placing objects away from edges from which they might fall.

In the proposal, OSHA stated that it believed the alternatives listed for providing falling object protection were more feasible than the existing requirements, which only specified the use of toeboards or screens. OSHA also noted that it did not specify a distance away from the edge that objects should be kept, as the distance varies according to the shape of the object. For example, the preamble to the proposal stated that round objects such as rolls of roofing felt would require more distance than a stack of flat shingles, and that the distance also depends on the height of the object or pile of objects. Both in the discussion of proposed Sec. 1926.501(e) and in Issue #12, OSHA requested public input regarding the proposed use of signs as a means of keeping employees out of areas where they might be exposed to falling objects. In addition, OSHA requested input on the criteria for falling object protection in Issue #8, discussed below.

In response, the States of California (CAL/OSHA) and Maryland (MOSH) (Exs. 2-15 and 2-31) remarked that signs were not acceptable substitutes for barricades to prevent employee exposure to the falling object hazards. Additionally, the ACCSH (Tr. 6/10/87; pp. 113-128) recommended to OSHA that all of the listed alternatives should be required with no option, except that employers could choose between a canopy structure and a barricaded area

as part of their protective measures. In short, their recommendation was that toeboards, screens and guardrails be erected; and that objects be kept back from the edge; and that employers either erect a canopy and signs or barricades.

OSHA has not incorporated the suggestion of the ACCSH because the record does not support requiring employers to take all of the recommended precautions. OSHA believes employees will be afforded an appropriate level of safety if the employer prevents objects from falling from above, or protects employees from objects that have fallen in spite of efforts to keep them from falling.

Many other commenters (Exs. 2-19, 2-20, 2-45, 2-46, and 2-99) also objected to the use of signs as an option for protecting employees. Other commenters (Exs. 2-20, 2-46 and 2-89) thought that signs could be useful in conjunction with more positive protection like barricades. The AGC (Ex. 2-16, 2-47 and 2-92) supported the proposed provision, noting that alternative methods provide for employer flexibility. The AGC also noted that signs had been used in the past successfully, depending on the type of exposure and the particular situation. The SSFI (Ex. 2-89) recommended that the use of signs be acceptable where no other fall protection measures could be used.

OSHA has determined, based on the record, that signs are not an appropriate alternative to barricades in the situations discussed in Issue #12. OSHA recognizes that signs can be useful when used in conjunction with other measures, such as barricades, to warn employees of the hazard, but believes that signs, alone, provide inadequate protection from falling objects. Accordingly, the Agency has deleted the option of using signs as a means of complying with Sec. 1926.501(c).

1926.502 -- Fall Protection Systems Criteria and Practices

This section specifies the criteria for measures required by Sec. 1926.501 and by other subparts in part 1926 where specific fall protection systems criteria and practice are not provided. The following discussion highlights changes from or additions to the proposed and existing standards. Provisions that are essentially unchanged from the proposal, especially where they did not elicit comments, are not discussed.

OSHA received one comment directed at Sec. 1926.502 in its entirety. The SSFI (Ex. 2-89) stated "language appearing within this section seems to be inconsistent with comparable paragraphs of subpart L." The commenter recommended that OSHA revise subpart M to be compatible with subpart L. Rather than comment on the general statement made by SSFI, OSHA will respond to their concerns in its discussion of the individual provisions where SSFI has stated that an inconsistency exists.

Paragraph (a) -- General. This paragraph requires that all fall protection conform to the criteria set in paragraph (b) for the particular system being used and that all fall protection equipment be provided and installed before employees begin any other work on or from the surface on which they will be protected. To be fully effective, fall protection must be in place at the earliest possible time.

There were two comments on paragraph (a). PCI (Ex. 2-44) commented on the need for employees to create the surface before protection systems can be provided and installed. NIOSH (Ex. 2-33) commented that "OSHA should clearly state that the first worker allowed upon a roof or leading edge is designated as the competent person under the requirements of the safety monitoring systems if that is, in fact, OSHA's intent."

OSHA's intent is that fall protection systems be in place at the earliest possible time when there is potential exposure to fall hazards. OSHA recognizes that there will be situations where it is infeasible to install and use fall protection because the working surface has not yet been created and there is no surface upon which to place guardrail systems, install safety nets, or anchor personal fall arrest systems. OSHA has discussed under Sec. Sec. 1926.501 (b)(2), (b)(12), and (b)(13), for example, the alternative measures (fall protection plan) that would be required in a situation where such infeasibility or greater hazard situations arise. With regard to the concern expressed by NIOSH, OSHA has determined that, while it would not be appropriate to mandate that the first

person allowed on a roof or leading edge necessarily be designated as the competent person for a safety monitoring system, it is appropriate to provide that no employee may begin any work until the fall protection systems are provided and installed that this would include having the competent person in position at the assigned work area and assuming the duties of the safety monitor when such monitoring systems are required as part of a fall protection measure.

Paragraph (b) -- Guardrail systems. This paragraph sets the criteria for guardrail systems. Paragraph (b)(1) specifies that the top edge of guardrail systems shall be 42 inches, plus or minus 3 inches, above the walking/working surface except when conditions warrant, the height of the top edge of the top rail may exceed the 45-inch limit. Paragraph (b)(1) also contains a note to remind employers that where employees are using stilts the height of the top rail must be increased a height equal to the height of the stilts which in effect serve as the walking/ working surface. This note has been added in response to comments received on Issue L-4 of the hearing notice published on January 26, 1988, in which OSHA asked questions about fall protection for workers on elevated platforms such as stilts. More detailed discussion of the issue will be found in the final rule on scaffolds to be published later.

The final rule is slightly different from the proposed rule in that OSHA is allowing the employer additional flexibility with regard to the height of the top edge of the top rail of the guardrail system. This change has been made because OSHA is aware that there will be situations where work conditions necessitate erecting the guardrail so that the top edge height is greater than 45 inches. The requirement is also consistent with the existing rule in Sec. 1926.500(f)(l), which requires that the guardrail system be "approximately 42 inches from upper surface of top rail to floor, platform, runway, or ramp level." OSHA proposed to revise the existing rule by deleting the term "approximately" and by having the height requirement of 42 inches, plus or minus 3 inches, apply to all walking/working surfaces.

The general, introductory text of paragraph (b)(2) requires midrails, screens, mesh, intermediate vertical members (i.e., balusters), solid panels, or equivalent structural members to be installed between the top edge of the system and the walking/working surface when there is no wall or parapet wall at least 21 inches high. This is identical to the proposed requirement and is essentially the same as the existing requirement Sec. 1926.500(f)(l)(vi)(c).

Paragraphs (b)(2) (i) through (iv) set requirements which apply specifically to midrails; screens and mesh; intermediate members; and other structural members respectively.

Paragraph (b)(2)(i) specifies that when midrails are used to comply with paragraph (b)(2), they must be installed midway between the top edge of the guardrail system and the walking/working level. This requirement is the same as the requirements in both the proposed rule and in the existing rule at 1926.500(f)(l).

Paragraphs (b)(2) (ii), (iii) and (iv) address the proper placement of screens, mesh, intermediate vertical members, and other structural members when they are used in lieu of midrails in the guardrail system. These provisions are essentially the same as the proposed provisions. The existing rule does not contain any requirements addressing the placement of structural members used in lieu of midrails.

NIOSH (Ex. 2-33) commented that the criteria in proposed Sec. 1926.502(b)(1) [promulgated as Sec. 1926.501(b)(14)] for the placement of a top rail of a guardrail system (42 inches) and the criteria in proposed Sec. 1926.502(b)(2)(iii) for placement of intermediate members (no more than 19 inches apart) were inconsistent with the dimensions of a wall opening which OSHA defined in proposed Sec. 1926.501(d) as an opening in a wall or partition that was 30 inches or more high and 18 inches or more wide.

OSHA notes that under Sec. 1926.501(b)(14) employees exposed to falling 6 feet (1.8 m) or more through wall openings (where the inside bottom edge of the wall opening is less than 39 inches above the walking/working surface) must be protected by a guardrail system. NIOSH stated its belief that the dimensions in the wall opening provision should be made consistent with the dimensions of openings in guardrails. OSHA believes that Sec. Sec. 1926.501(b)(14) of the final rule and 1926.502 (b)(1) and (b)(2) (iii) and (iv) address different situations and,

therefore, need not be reconciled. In particular, falling through window and door openings in walls presents a different hazard than falling through the openings in guardrail systems. Accordingly, OSHA has not made the suggested change.

SSFI (Ex. 2-89) recommended that proposed paragraph (b)(2)(i) be changed to require the installation of midrails "approximately" midway between the top edge of the guardrail systems and the walking/ working level." The Agency notes that the use of terms such as "approximately" have caused uncertainty among employer who have expressed their desire for OSHA to be clear in its rules. OSHA has determined that employers need clear direction when attempting to comply with paragraph (b)(2). Therefore, the Agency has not made the suggested revision.

Paragraph (b)(3) requires guardrail systems to be capable of withstanding a 200-pound force applied within 2 inches of the top edge in an outward or down ward direction. Paragraph (b)(4) requires that when the 200 pound load is applied in a downward direction, the top edge of the guardrail shall not deflect to a height less than 39 inches above the walking/working level. These are the same as the proposed requirements and essentially the same as the existing requirement in Sec. 1926.500(f)(1)(vi)(b), except that in paragraph (b)(4) the existing language, "with a minimum deflection," has been changed to read "when the 200 pound test load is applied in a downward direction, the top edge of the guardrail shall not deflect to a height less than 39 inches above the walking/working surface." Deflection is specified for the top edge because that is the point an employee is most likely to fall against and it must be high enough, at all times, to prevent the employee from falling over the top rail.

There were four comments on the proposed provisions. Seedorf Masonry (Ex. 2-153) commented, "Paragraph 3 says that the guardrail must withstand at least 200 lbs. with apparently no more deflection than 2 inches." OSHA notes that the 2-inch figure in paragraph (b)(3) specifies where the force should be applied above the top rail to test the strength of the guardrail system. Paragraph (b)(4) sets the limit on top rail deflection -- the top rail cannot deflect below 39 inches, which would be 3 inches if the top rail was at the 42 inch height when the load was applied or 5 inches if the top rail were at 45 inches.

Regarding proposed paragraph (b)(3), the SSFI (Ex. 2-89) commented that proposed subpart L did not require force to be applied "within 2-inches" and expressed concern with regard to the perceived inconsistency with subpart L. SSFI also commented that in paragraph (b)(4) there is a difference for the height of the top rails of guardrail systems between subparts L and M. OSHA, in turn, observes that the criteria for guardrails on scaffolds are explicitly excluded from the scope of subpart M (See Sec. 1926.500(a)(3)(i)), because OSHA recognizes that the performance requirements for guardrails on scaffolds will differ from those for employees on other walking/working surfaces.

Two commenters (Ex. 2-104 and 2-151) stated that proposed paragraph (b)(4) was unworkable because a guardrail system capable of sustaining a 200-pound load with a maximum 3-inch deflection would require enormous strength. The commenters suggested that OSHA specify a 50-pound load and 5-inches of deflection, but did not indicate any reason other than the inability to comply. The Agency believes that it is both necessary and feasible to engineer a guardrail system so that the top edge of the top rail does not deflect below 39 inches to protect employees from going over the rail and that a 200-pound test load is appropriate. Therefore, the Agency has not made the suggested change.

As noted above, subpart M does not set the performance requirements for guardrails on scaffolds because the Agency has recognized that the two subparts address different concerns. Therefore, the provisions do not need to be consistent.

Paragraph (b)(5), which is identical to the proposed paragraph, provides that midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members shall be capable of withstanding, without failure, a force of at least 150 pounds, applied in any downward or outward direction at any point along the midrail or other member. OSHA chose the 150-pound test strength because the Agency has determined that such

members need not satisfy the 200-pound strength test set for top rails to provide the necessary protection. OSHA also determined that a limit on deflection was not needed for midrails and other members to protect employees appropriately. OSHA received no comments on this provision.

Paragraph (b)(6) requires that guardrail systems be smooth surfaced to prevent employee injury due to lacerations or tripping caused by snagged clothing. The provision is based on the existing rule in 1926.500(f)(1)(vi)(a). The proposed revision was effectively identical to the final rule, except that the proposed paragraph ended with the phrase, "which could cause an employee to fall."

OSHA received two comments on this provision. CAL/OSHA (Ex. 2-15) suggested that OSHA remove the words "which could cause employees to fall." OSHA had used those words to explain why guardrail systems should be surfaced to prevent snagging of clothing. However, California interpreted the phrase to be a "qualifier," meaning that if the snagging of clothing would not result in a fall, employers did not have to take any action to eliminate the potential for snagging.

OSHA agrees that the phrase should be removed in the final rule. It was not OSHA's intent to limit protection to those situations where such snagging would actually result in a fall. OSHA realizes that other hazards, such as exposure to falling objects, could arise if an employee's clothing snagged on a guardrail surface.

The SSFI (Ex. 2-89) commented that this provision is unrealistic and would prove to be extremely costly. They recommended that the provision be eliminated. OSHA disagrees with the SSFI. As noted above, paragraph (b)(6) is essentially the same as the existing rule, which has not posed such difficulties in practice.

Paragraph (b)(7) requires that top rails and midrails not be so long as to constitute a projection hazard. This provision, which is identical to the proposed provision, is based on existing Sec. 1926.500(f)(l) and (f)(1)(vi)(d). No comments were received regarding this provision.

Paragraph (b)(8) prohibits the use of steel banding and plastic banding as top rails or midrails. This provision is identical to the proposed provision. While such banding can often withstand a 200-pound load, it can tear easily if twisted. In addition, such banding often has sharp edges which can easily cut a hand if seized.

While OSHA did not receive any comments specifically on proposed paragraph (b)(8), it did receive a recommendation from the ACCSH (Tr. 6-9-87, p. 212) regarding a similar provision in proposed subpart L (Sec. 1926.451(e)(4)(xiii). In particular, the ACCSH suggested that OSHA ban the use of manila rope and plastic rope as well as steel and plastic banding as top rails for scaffold guardrail systems. This recommendation reflected ACCSH's concern that manila rope and plastic rope lose strength quickly when exposed to water and sun.

In Issue M-3 of the hearing notice (53 FR 2054, January 26, 1988), OSHA discussed the ACCSH recommendation, stating that ACCSH had recommended that OSHA add a ban on the use of manila rope or plastic rope for top rails or midrails of guardrail systems used on scaffolds. OSHA also noted that ACCSH had not made a similar recommendation for change in proposed subpart M. OSHA requested comment on whether or not the ACCSH concern should be addressed in the final rule for subpart M.

At the hearing, the Scaffold Industry Association (SIA) (Tr. 3-22-88 pp. 160-161) testified that it should not be necessary to restrict the type of materials used since OSHA established the strength requirements for guardrail systems. Upon further questioning, the participant suggested (pp. 165-166) that experts in the field should address the recommendation and again stated his belief that as long as the rope met the strength criteria, it should be considered adequate.

OSHA also received comments on Issue M-3 from three other parties. One commenter (Ex. 6-3) stated the following:

Manila and plastic rope used as guardrails for short periods of time until more permanent rails can be installed should not be banned from use providing they are capable of supporting a 200-pound load applied in any direction with a minimum of deflection.

In addition, the commenter noted that while some lumber is subject to deterioration, no lumber is banned. Finally, the commenter stated that OSHA could insert a note or warning in the standard regarding deterioration hazards and that the Agency could add an inspection requirement such as was proposed for safety nets in Sec. 1926.502(c)(5). The other two commenters (Exs. 6-5 and 6-17) stated that OSHA should ban the use of manila rope or plastic rope from use as midrails or top rails.

Based on an evaluation of the record, OSHA has decided not to ban the use of manila or plastic rope. Instead, OSHA has determined that the concerns of the ACCSH are appropriately addressed by adding a new provision in Sec. 1926.502(b)(15), discussed below, which requires employers to inspect top rails and midrails if manila, plastic or synthetic rope has been used, as frequently as necessary to ensure that the rails have not deteriorated beyond their ability to meet the strength requirements set forth in Sec. 1926.502(b)(3), above.

Paragraph (b)(9) of the final rule, like the proposal, requires that top rails and midrails be at least one-quarter inch (0.6 cm) in nominal diameter or thickness. OSHA believes that the minimum thickness requirement is needed to prevent the use of rope that would cause cuts or lacerations. In addition,final rule paragraph (b)(9) adds a new requirement that top rails constructed of wire rope shall be flagged at not more than 6-foot intervals with high-visibility material. This requirement supplements the strength requirements for guardrails specified in paragraphs (b) (3), (4), and (5) of this section. The purpose of this requirement is to assure that rails made of high strength materials are not so thin that a worker grabbing a rail is injured, such as by cuts or lacerations, because of the small size of the rail.

CAL/OSHA (Ex. 2-15) suggested that OSHA require top rails, such as those made with wire rope, to be made more visible by installing bits of flagging or cloth strips at 10-foot intervals. Roberts Safety Consultants (Ex. 2-18) supported the requirement for 1/4 inch minimum diameter wire rope. Maryland Occupational Safety and Health officials (MOSH) (Ex. 2-31) commented that OSHA should specify that the provision is referring to wire rope. The Tennessee Valley Authority (TVA)(Ex. 2-20) suggested that OSHA eliminate the provision since the standard already contains a strength requirement.

OSHA agrees with California that wire rope, especially the 1/4 inch diameter rope, could be difficult to see, and has therefore incorporated in the final rule their suggestion that the rope be flagged for visibility. To maintain consistency with other requirements in the final rule, such as those for flagging of warning lines in Sec. 1926.502(f)(2)(i) and flagging of control zone lines in Sec. 1926.502(g)(3)(i), OSHA is requiring flagging at 6-foot intervals rather than at 10-foot intervals. OSHA also notes that flagging of wire rope is a common industry practice.

In response to TVA's comment, OSHA notes that, as discussed above, this provision addresses the need to protect workers from cuts and lacerations, not the strength of the wire rope.

Paragraphs (b) (10) through (13) address the use of guardrail systems. The requirements in paragraphs (b) (10) through (13) are identical to those found in paragraphs (b)(11) to (b)(14) of the proposed rule. OSHA had also proposed specific requirements pertaining to guardrail systems used at hoisting areas during the performance of roofing operations on low-slope roofs (proposed at paragraph (b)(10)). However, because revised Sec. 1926.501(b)(3) addresses fall protection at all hoist areas, including hoist areas on low-slope roofs where roofing operations are being performed, there is no need to have the additional, redundant requirements proposed at paragraph (b)(10) and they have been deleted in the final rule. Further discussion on the remaining provisions (b)(11) to (b)(13) can be found in the notice of proposed rule for subpart M [51 FR 42724].

Paragraph (b)(14) provides that guardrail systems on ramps and runways be erected along each unprotected side or edge. The proposed requirement contained essentially the same requirements as existing Sec. 1926.500(d) (2) and (3). The proposed rule contained an exception for installing guardrails on ramps and runways where the

guardrails would interfere with the operation of work as long as the ramp or runway was 18 inches wide. Existing Sec. 1926.500(d)(3) also allowed this exception. However, based on OSHA's enforcement experience, OSHA has decided that the exception is no longer valid.

It is OSHA's contention that the purpose of installing guardrails on ramps and runways is solely to keep employees from falling off the unprotected sides or edges of such ramps and runways when employees are exposed to falls of 6 feet or (1.8 m) or more to a lower level. OSHA recognizes that there may be circumstances where the movement of materials or equipment across ramps or runways would be impeded by guardrails and situations where that interference is such that compliance with this provision would be infeasible (i.e., the work cannot be done) or would create a greater hazard. OSHA believes, in general, that preplanning of work will ensure that compliance with paragraph (b)(14) is feasible and does not create a greater hazard.

CAL/OSHA (Ex. 2-15), noted that the proposed provision would be the subject of considerable interpretation and stated that OSHA should provide examples of operating conditions that would permit employers to follow the guardrail configuration described. The commenter also stated that ramps should be 2 feet wide and railed on both sides.

OSHA notes that the existing rule was based on ANSI A 12.1-1967, Safety Requirements for Floor and Wall Openings, Railings, and Toe Boards, which provides examples of special purposes where operating conditions may preclude the use of guardrails on one side of the runway. Such purposes were identified as oiling, shafting or filling tank cars. OSHA also notes that the ANSI A 1264.1-1989, Safety Requirements for Workplace Floor and Wall Openings, Stairs, and Railing Systems, which replaced the ANSI A 12.1-1967, also contains the same provision, but does not provide examples of special purposes which necessitate omitting guardrails on one side. In any event, the example provided covered non-construction work, raising further questions about the appropriateness of the exception. Upon further consideration and evaluation of the proposed provision, OSHA has determined that since it cannot readily identify situations where operating conditions would preclude the use of guardrails on one side it should not write an exception into the rule and, therefore, the agency has no reason to specify a platform width. OSHA agrees with CAL/OSHA that the provision would be subject to wide interpretation. As a consequence, OSHA has decided to delete this provision from the final rule.

Paragraph (b)(15), which was not part of the proposed rule, requires that manila, plastic and synthetic rope used in guardrail systems be inspected as frequently as necessary to detect deterioration. This new requirement has been added in response to the comment received on Issue M-3, discussed above, in which OSHA solicited information on the need to prohibit the use of manila and plastic rope. As discussed earlier in this preamble, OSHA has determined that paragraph (b)(15) appropriately responds to ACCSH's concern that such ropes may deteriorate and lose their strength.

OSHA observes that Non-mandatory Appendix B contains detailed specifications for minimum sizes of guardrail system components. These specifications are based on existing Sec. 1926.500(f)(1) (i), (ii), and (iii) and should provide useful information to help employers to design guardrail systems. The transfer of this guidance from existing regulatory text to a non-mandatory appendix does not reduce the level of safety achieved through compliance with the existing standard. The existing specific provisions are consistent with the performance-oriented requirements in the final rule. The promulgation of non-mandatory Appendix B removes redundant provisions from the standard.

Paragraph (c) -- Safety net systems. This paragraph replaces the criteria in existing Sec. 1926.105 -- Safety nets. OSHA has relocated the regulation of safety nets to subpart M as part of the Agency's effort to consolidate the standards that generally cover protection of construction employees from fall hazards.

OSHA received one general comment on this paragraph. The ISEA (Ex. 2-23) suggested that OSHA refer to safety nets as personnel nets, so as to differentiate personnel nets and debris nets. This commenter also suggested that debris nets should be addressed separately. OSHA has not taken any action with respect to the

suggestion because the criteria set forth apply to nets used to protect employees from the hazards of falling. If an employer selects and uses a net labeled as a "debris net" to provide fall protection for employees, then such net must meet all of the criteria and conditions for use set forth in the safety net section. On the other hand, just because a net is labeled a "personnel net" does not mean that it is acceptable to OSHA for use as a safety net.

Paragraph (c)(1) requires the installation of safety nets as close as practicable under the walking/working surface where employees need to be protected, but in no case more than 30 feet below such level. Both proposed paragraph (c)(1) and existing Sec. 1926.105(a) require that nets be installed no greater than 25 feet below the working level. However, the recently revised ANSI A 10.11-1989 standard for nets allows net installation 30 feet below the working level. In addition, OSHA notes that the National Bureau of Standards study of nets included test data of 30-foot falls. The data indicate there is no significant difference between a 25 and a 30-foot fall into a net (Reference 14). OSHA also notes that both the existing rule and the proposed rule were based on earlier versions of the ANSI consensus standard which prescribed that nets be positioned not more than 25 feet below the working level.

Therefore, based on the record developed in the course of this rulemaking, OSHA has determined that a safety net installed as much as 30 feet below a walking or working level will provide adequate fall protection and has revised proposed paragraph (c)(1) accordingly.

Paragraph (c)(1) also requires that when nets are used on bridges, there must be an unobstructed fall to the net. In other words, nets must not be used when a falling employee could hit an obstruction before reaching the net. This is a new provision added in response to comments received on Issue #13 discussed below.

In proposed paragraph (c)(1), OSHA provided an exception to the proposed 25-foot limitation in the case of nets used in bridge construction. However, that portion of the proposed rule has not been finalized. The proposed paragraph required only one level of nets during bridge construction regardless of the distance between the walking/working surface and the net. However, the record developed on that proposed provision supported limited the fall distance to 30 feet.

OSHA solicited input regarding the appropriateness of the proposed exception in Issue #13. In particular, the Agency requested comment on whether personal fall arrest systems should be required for employees performing bridge construction work when employees do not have an unobstructed fall to a safety net. In response, the ACCSH recommended that OSHA allow one level of nets during bridge construction, provided the fall was unobstructed and the fall distance did not exceed 25 feet. Otherwise, the Advisory Committee recommended that affected employees also use personal fall arrest systems. One ACCSH member noted that the wording of the proposed provision could allow falls from 75 or 80 feet, and that even if the fall were unobstructed, injuries would occur. That ACCSH member also spoke of two such cases where employees were paralyzed from the waist down after falling into a net. (Tr. 6/10/87; pp. 137-141).

The ACCSH recommendation was echoed by other commenters. Bristol Steel and the NEA (Exs. 2-12 and 2-43) commented that during erection or painting of tall steel bridges, such as trusses and arches, one level of netting would not be adequate. They also stated the following:

Not only is there the problem of falling employees striking bridge structural members before they fall into the safety net, but also the fall distance from upper bridge levels of the safety nets will frequently exceed 50 feet or even 100 feet or more. Safety nets on the upper levels of such bridges are not a desirable or feasible alternative * * *.

These commenters suggested that OSHA require "safety railings in accordance with subpart R (Steel Erection), body belt/harness systems, or safety monitoring systems where the fall distance into the safety net exceeds 25 feet." They also identified types of bridge construction where "the risk of harm from striking bridge members during a fall is significantly reduced. Most falling employees will be deflected by bridge members with forces not so great

as to cause serious harm ** *." They did not feel that these situations warranted both safety nets and body belt systems, but they did believe body belt systems, in addition to safety nets, were warranted when the fall distance exceeded 25 feet.

MOSH (Ex. 2-31) commented that they could not understand why safety nets were not being required for second levels of bridges, noting that they had experienced severe accidents involving employees falling from the top chords of bridges.

The AGC (Exs. 2-16, 2-47 and 2-92) commented that many site work situations do not allow for systems such as body belts and that "The standard should reflect existing conditions and permit flexibility."

Many commenters (Exs. 2-19, 2-20, 2-23, 2-36, 2-46, and 2-50) indicated that a single level of safety nets may not provide adequate fall protection on bridges, particularly where an employee could strike a bridge structural member before hitting the net. These commenters also indicated that personal fall protection should be required in addition to nets or that additional netting systems should be required.

OSHA has determined that a one-level net system does not provide adequate protection if there are intervening members between the working surface and the net which an employee might strike. In addition, OSHA notes that even when the fall area is unobstructed, one level of nets will not provide adequate protection if the fall distance exceeds 30 feet. In such situations, the record demonstrates that severe injuries are likely to occur (Exs. 2-12, 2-31, and 2-43). Therefore, the final rule does not permit a one-level net system when the fall distance exceeds 30 feet. When the distance exceeds 30 feet, additional netting will have to be provided or employees will have to be protected by another fall protection system such as a personal fall arrest system.

Paragraph (c)(2) sets minimum horizontal projection requirements for safety net systems, based on the vertical distance between the working level and the net. Existing Sec. 1926.105(c)(1) requires that nets extend 8 feet. Proposed paragraph (c)(2) would have required that nets extend 15 feet. In the proposal, OSHA explained that the National Bureau of Standards (NBS) had conducted tests to evaluate the proposed requirement. Their findings indicated that at least 13 to 15 feet would be required to fully contain a body falling 25 feet (Ex. 14:50). Based on their findings, OSHA proposed the 15-foot requirement. Since that time, however, the ANSI A 10.11 Committee issued a revision to the consensus standard on Personnel and Debris Nets, in which it varied the horizontal distance of the net according to the vertical distance between the working level and the net. The ACCSH, in turn, recommended that OSHA replace the 15-foot requirement of proposed paragraph (c)(2) with the language of the then-draft ANSI A 10.11 provision (subsequently adopted by ANSI in 1989) [Tr. 6-10-87, pp. 197-199].

There were few comments on proposed paragraph (c)(2). The TVA (Ex. 2-20) commented that OSHA should include criteria on rigging supports to extend safety nets the required distance. OSHA observes that the rigging supports are considered part of the total safety net system for which OSHA has specified criteria. The Builders Association of Missouri (Ex. 2-42) commented that the cost would be increased to extend the nets the proposed distance of 15 feet and the danger to workers would increase. (The commenter did not explain how workers would be at increased risk.) In addition, the Building Trades Employee Association of Boston and Eastern Massachusetts, Inc. (Ex. 2-26) stated that in many cases an employer will not have 15 feet of horizontal space at the perimeter of a building in which to construct a safety net system, due to the proximity of other structures. OSHA agrees that there may be circumstances where it is not possible to have a safety net system extend far enough to satisfy the extension requirements of the proposal or the final rule. Under those circumstances, employers would have to select another fall protection system.

OSHA points out that employers have the choice of two other fall protection systems -- guardrail systems or personal fall arrest systems -- when safety net systems cannot be installed in a way that will comply with Sec. 1926.502(c). The purpose of this section is merely to set out the criteria that must be followed when safety nets are chosen by the employer to meet the duty to provide fall protection set in Sec. 1926.501.

OSHA raised Issue M-4 in the hearing notice [53 FR 2048], asking for input regarding the ACCSH safety net recommendation. In the Issue, OSHA discussed the concerns of ACCSH regarding the above-mentioned study performed by the National Bureau of Standards which indicated that nets which extended only 8 feet from a structure would not catch someone who had fallen 25 feet [Tr. 6/10/87; pp. 198-199]. Issue M-4 also discussed the draft document of the ANSI A 10.11 Committee (Personnel and Debris Nets) which would replace the current ANSI Standard on Safety Nets in which ANSI varies the horizontal distance of the net, depending on the vertical distance from the walking/working surface to the net. There was no testimony or other information submitted in relation to Issue M-4.

Paragraph (c)(3) requires nets to be rigged with sufficient clearance under them to prevent contact with the lower level when the net is subjected to the impact forces specified in paragraph (c)(4). This is basically the same requirement as in existing Sec. 1926.105(c)(l), and the proposed rule. There were no comments on the proposed provision.

Paragraph (c)(4) specifies the capacity requirements for safety nets and safety net installations. The paragraph requires employers either to show that nets and net installations meet the capacity requirements by conducting drop tests meeting designated criteria or, when an employer can demonstrate that drop testing is not feasible or practicable, certify, based on information received from a qualified person, that the net and net installation meet all specified criteria. One example of where a drop test may not be feasible or practicable is when the net is strung over a public thoroughfare and the test could endanger people below. Another example is where the test weight cannot be readily retrieved from the net once it has been dropped.

For the purposes of paragraph (c)(4), OSHA considers two or more net panels joined together to be one net. Safety net installations which do not share the same net are considered to be separate systems. In addition, each time a safety net system is erected, it is considered to be a separate installation which must be tested or certified. This is a clarification of existing Sec. 1926.105(b), which requires all net installations to be drop-tested. Paragraph (c)(4)(i) sets forth the criteria for performing drop tests on net installations. In most respects, these criteria are the same as the requirements in section 8 of ANSI A 10.11-1979, proposed paragraph (c)(4)(i), and section 8 of ANSI A 10.11-1989, except that the final rule requires the test to be conducted from a level at least 42 inches (1.1 m) above the highest walking/working surface on which employees are to be protected as opposed to the 25-foot height required by ANSI, so that the test more closely resembles the type of fall from which the worker is to be protected. OSHA believes the use of a 400-pound weight to test the system will ensure that a proper margin of safety is obtained. OSHA also notes that in the proposal the drop test would have been conducted by dropping the weight from the highest walking/working level on which employees were to have been protected. The final rule adds 42 inches to this height to take into consideration the center of gravity of the 95th percentile man and also to take into consideration those situations where the net is installed at the same level from which the employee is to be protected.

There were several comments on proposed paragraph (c)(4), particularly with regard to the exception proposed in paragraph (c)(4)(ii). The ISEA (Ex. 2-23) objected to the proposed certification in lieu of drop test provision, stating that nets will probably rarely undergo an actual drop test. As indicated above, OSHA will allow certification only when the employer can demonstrate that it is not feasible or practicable to conduct a drop test. The ISEA also stated that prototype tests should be required, stating that on-the-job drop test could weaken the nets. However, OSHA is concerned with the total system (i.e., the net and the net installation) and prototype tests do not address the Agency's concern.

NIOSH (Ex. 2-33) suggested that OSHA clarify whether testing will be required each time the safety net is moved to a different location at the job site. It was OSHA's intent that a net be tested or certified whenever it is newly installed at a location before it is allowed to be used for fall protection system. OSHA has rewritten the provision to

make it clear that nets must be drop-tested at the jobsite following initial installation; whenever nets are relocated; whenever a major repair to the net has been made; and at 6 month intervals when the net has been left in the same location.

The Building Association of Missouri (Ex. 2-42) commented that "Drop tests should not be required nor even allowed on nets." They stated their belief that drop tests make nets unsafe, citing the requirement in existing Sec. 1926.104(a) that employers remove a lanyard from service if it has been subjected to in-service loading. Based on its experience with fall protection systems, the Agency has come to the conclusion that safety nets, unlike lanyards, can remain in use after loading if the pertinent criteria can still be satisfied.

CAL/OSHA (Ex. 2-15) commented that the certification requirements were unclear. OSHA has revised proposed paragraph (c)(4)(ii) to be specific in how and who must certify the net and net installation.

In addition, the MSA (Ex. 2-35) recommended that after the net installation test, the net section should be examined by a qualified person and replaced if needed. OSHA notes that paragraph (c)(5), either as proposed, or as revised in the final rule (see below), effectively requires the inspection of nets and replacement of defective components necessary to ensure that nets are always in safe condition.

Paragraph (c)(5) prohibits the use of defective nets and requires safety net systems to be inspected at least once a week for wear, damage, or other deterioration. The provision also requires inspection after any occurrence which could affect the integrity of the safety net system. Defective components must be removed from service. This provision was proposed as a new requirement. Issue #9 of the proposal asked if the proposed frequency of inspection was appropriate. The Issue noted that similar requirements had been proposed for body belt/ harness systems and positioning device systems.

There were several comments relating to the appropriate frequency of net inspection. The ACCSH recommended that nets be inspected weekly or whenever any object has been dropped into the net that is of such weight that it might damage the net. (Tr. 6/10/87, pp. 130-131.) The National Constructors Association (NCA) and the ANSI Z359 Committee (Exs. 2-45 and 2-50) commented that the frequency of inspection was appropriate as proposed. The NCA, however, noted its opposition to added paperwork.

WMACSA, (Ex. 2-56), stated that record should be maintained of the results of the weekly inspection. Other comments, including Bristol Steel, AGC, and NEA, stated that weekly inspection, itself, was not necessary; that nets should be maintained in a satisfactory condition; and that weekly inspection would impose recordkeeping burdens without enhancing employee safety. (Exs. 2-12, 2-16, 2-43, 2-46, 2-47, 2-51 and 2-92).

OSHA has determined that while keeping records of inspections may assist employers in meeting their obligations under this paragraph, maintaining records of net inspections will not directly enhance employee safety. It is the routine performance of the inspection and the removal of any defective components that leads to employee safety. Thus, OSHA has revised the language of the final rule to prohibit the use of defective nets and to require that nets be inspected at least once a week to determine their condition. If any defects are discovered at the time of inspection, the defective components must be removed and replaced. OSHA is making the slight language modification because it realizes that although once a week inspections should ordinarily be sufficient to detect any net defects, there are some circumstances that may require employers to conduct more frequent inspection. For example, as ACCSH mentioned, when large weights have fallen into the net, the net must be inspected. Or, as Dr. Nigel Ellis stated in his comment (Ex.2-36): "Inspection should be regular and at frequent intervals depending on the use and environment."

The BCMALU (Ex. 2-46) noted that, "where high winds or storms or hazardous chemicals have been used in the area, it becomes a necessity to inspect the safety nets as often as may be needed." Consequently, the revised language requires inspection at least weekly and as often as necessary to ensure that defective nets are not used.

Paragraph (c)(6) requires debris and tools to be removed as soon as possible from the net, but not later than the start of the next work shift. Such materials pose safety hazards to anyone who falls into the net. This provision was also proposed as a new requirement. The one commenter on the proposed provision, (Ex. 2-26), stated that the proposed requirement created a serious safety hazard and suggested that OSHA reconsider the proposed language. OSHA considers clearing the net of debris necessary to prevent injury to workers who may fall into the net and believes this task can be performed without undue risk to employees. Therefore, OSHA promulgates paragraph (c)(6) as proposed.

Paragraph (c)(7) specifies the maximum allowable mesh opening, limiting the size of the opening to a maximum of 36 square inches. This requirement is the same as the proposed requirement. Existing Sec. 1926.105(d) also provides for a maximum of 6 inches (15 cm) on any side of an opening, but did not explicitly limit the size of the opening. OSHA proposed the limit because mesh openings can be manufactured with more than four 6-inch sides; and a limit of 36 square inches is necessary to ensure that an employee's head cannot go into it during a fall, possibly breaking the employee's neck. This requirement is essentially identical with that in paragraph 6.3 of ANSI A 10.11-1989, Personnel and Debris Nets. There were no comments on the proposed provision.

Paragraph (c)(8) specifies a minimum breaking strength of 5,000 pounds for border ropes used for net webbing. This requirement is essentially the same as in the proposal and in existing Sec. 1926.105(d). There were no comments on the proposed provision.

Paragraph (c)(9) requires connections between net panels to be as strong as integral components and to be spaced not more than 6 inches apart. This provision is identical to the proposed provision. Existing Sec. 1926.105(f), in effect, sets the same strength requirement as paragraph (c)(9), but does not contain a 6-inch spacing requirement. OSHA proposed this as a new requirement, basing it on paragraph 9.3 of the ANSI A 10.11-1979. OSHA notes that this requirement is also consistent with paragraph 10.4 of the ANSI A 10.11-1989.

The NEA (Ex. 2-43) commented that the new ANSI A 10.11 safety net standard required a 1-foot spacing between connectors (rather than 6 inches as OSHA proposed) when two nets were joined together, and that the OSHA requirement should be consistent with the ANSI requirement which has the support of contractors and net manufacturers. OSHA notes that, as discussed above, ANSI specifies 6-inch (15 cm) spacing, thus OSHA's requirement is consistent with the ANSI A 10.11 standard.

The requirement in existing Sec. 1926.105(d) that all new nets must meet accepted performance standards of 17,500 foot-pounds minimum impact resistance, as determined and certified by the manufacturer, was proposed to be deleted as it applied only to the net itself, and not to the complete net installation. OSHA believes the important consideration is the safety net system as a whole, and that the provisions of paragraph (c)(4) of this section are sufficient to assure proper safety for employees. The best net can be rendered useless by an improper installation. For these same reasons, the existing Sec. 1926.105(d) requirement for a label of proof test was also proposed to be deleted. In addition, existing Sec. 1926.105(e) requiring forged steel safety hooks or shackles to fasten nets to supports was proposed to be deleted. The existing rule is unduly specific as there are other acceptable methods such as wire rope to fasten nets to supports. OSHA received no comments on those proposed deletions and has proceeded to make those deletions in the final rule.

Paragraph (d) -- Personal fall arrest systems. This paragraph replaces all of the existing provisions in Sec. 1926.104 -- Safety Belts, Lifelines, and Lanyards and relocates coverage of personal fall arrest systems to revised subpart M. This is being done as part of the consolidation of fall protection requirements for construction.

There have been a number of revisions to the proposed requirements for body belt/harness systems. First, the title of the paragraph has been changed to "personal fall arrest systems." The reason for this change was explained in the definitions section, where OSHA discussed its substitution of the term "personal fall arrest systems" for "body belt/harness systems." Many provisions have been revised, relocated or added as discussed below.

Second, OSHA is phasing out, and then prohibiting, the use of body belts as a component of personal fall arrest systems. After December 31, 1997, body belts will no longer be permitted for use in a personal fall arrest system. They will, however, continue to be acceptable for use as part of a positioning device system [See paragraph (e)] or as a part of a ladder safety device system required in subpart X of part 1926 since positioning device systems and ladder safety device systems are not used to arrest a fall. The Agency recognizes that an immediate ban on the use of body belts in personal fall arrest systems would impose unreasonable burdens on employers. OSHA believes this phase out period will allow all body belts currently in use to be used through their life expectancy, eliminating any economic burdens to employers and permitting manufacturers to prepare to meet the demand for body harnesses.

In Issue #14 of the proposal, OSHA discussed various reports and studies which recommended restricting or banning the use of body belts. Also in Issue #14, OSHA solicited information on whether it should restrict the use of body belts as personal fall arrest systems and also asked for additional information on the effects of prolonged suspension in a body belt among other questions. OSHA referenced a number of studies in the proposal (Exs. 3-7, 3-9, and 3-10) which indicated that persons suspended in body belts suffer internal injuries and cannot tolerate suspension long enough to allow for retrieval. The rulemaking record for Powered Platforms also contained studies (Docket S-700, Exs. 11-3, 11-4, 11-5, 11-6, 2/21-42) which indicated that the initial fall impact and pressure exerted during suspension made body belts inappropriate for use in a personal fall arrest system. OSHA notes that all comments received on the proposed rule for powered platforms were referenced in the proposal for subpart M (Ex. 3-13).

In response, OSHA received a number of comments including several that requested their comments from the Powered Platforms rule be considered (Exs. 2-23, 2-36, and 2-50). A number of commenters indicated their belief that the biggest problem with a ban on the use of body belts would be worker acceptance (Exs. 2-6, 2-9, 2-19, and 2-41). Typical of such comments were "It is hard enough to get the typical construction worker to wear a safety belt let alone a full harness * * * a harness, which is more uncomfortable than the belt * * * would have more resistance from workers to wear them * * *" (Ex. 2-9). Other commenters (Exs. 2-16, 2-27, and 2-51) noted that they currently use body belts and have not had any problems. The AGC (Exs. 2-16, 2-47, 2-92, and 2-103) stated that body belts have been used with "only positive results" and that it would be appropriate to let employers choose between body belt and body harness. The commenter did note specific circumstances (manholes and small diameter tanks) where it agreed that employees would be better protected through the use of body harnesses. Also, commenters (Exs. 2-19, and 2-140) indicated that compliance with the proposed rule (Sec. 1926.502(d)) would provide adequate protection for employees using body belts in personal fall arrest systems. OSHA also points out that these comments were made before 1988 and since that time, many changes have taken place in the construction industry. Another commenter (Ex. 2-154) stated that OSHA should allow continued use of body belts for fall protection except where "a person is working alone or could not be readily rescued."

USTAG (Ex. 9-33 in the powered platform rulemaking record), stated the following, among other comments:

The restriction on forces for body belt and chest-waist harness systems is based on our serious concern about the suitability of body supports other than the full body harness with a sub-pelvic (buttocks) support as well as other design considerations. There is a growing body of evidence which points to hazards related to the use of body supports other than an appropriate fully body harness. Studies performed in Europe and by the U.S. Air Force indicate high risks associated with the body belt in both fall arrest and suspension modes. Further, the possibility of falling out of a body belt and chest-waist harness is significant and has appeared in accident reports.

For these reasons we recommend that use of body belts and chest-waist harnesses be restricted to a free fall distance of two feet and an actual loading of 900 pounds.

USTAG also noted that British standards impose restrictions on the body belt; French standards prohibit the use of body belts; German standards essentially prohibit the use of body belts, except in certain applications, and that the draft ISO standards put conditions on the use of body belts.

OSHA received a number of comments (Exs. 2-3, 2-20, 2-36, 2-46, 2-50, 2-89, and 2-135) which supported a prohibition on the use of body belts for fall arrest. For example, one commenter (Ex. 2-3) stated "The use of body belt systems should be prohibited in favor of body harness systems. There is a possibility of back injuries associated with the use of safety belts." Another commenter (Ex. 2-89) stated, "Members of the SSFI would recommend the following: a) Body Belts be used as a work positioning device; and, b) Body Harnesses should be referred to as a fall arrest device."

OSHA believes that U.S. workers should be afforded the same level of protection as workers of other nations, and that the evidence in the record clearly demonstrates that employees who fall while wearing a body belt are not afforded the level of protection they would be if the fall occurred while the employee was wearing a full body harness. In addition, RTC (Ex. 2-36) presented evidence of injuries resulting from the use of body belts. The best available evidence the Agency has at this time requires it to ban the use of body belts as part of a personal fall arrest system after a reasonable period to allow existing belts to be worn out. While the ban of body belts begins January 1, 1998, OSHA encourages employers to phase out the use of body belts in personal fall arrest systems as soon as possible so that employees may be spared exposure to the injuries which have resulted from body belt use.

In addition, OSHA points out that paragraph (d)(16) requires that personal fall arrest systems, when stopping a fall, to limit maximum arresting forces on the employee to 900 pounds (4 kN) when using a body belt. Thus, employers who continue to use body belts until the ban, must rig the system to ensure that fall arrest forces are at or below 900 pounds. Essentially this will require limiting the free fall distance, the use of shock absorbing lanyards and other measures to meet the criteria for using body belts as part of a personal fall arrest system.

Today, many employers permit only the use of body harnesses, having recognized the limits of body belts. While OSHA has no direct record evidence to support this claim, it has received much informal communication from employers and from manufacturers which indicate that there is already a movement toward the use of body harness instead of body belts for fall arrest situations. In addition, worker acceptance of body harnesses has grown in the years since OSHA first proposed its fall protection rules in November 1986. As more and more prudent employers have, on their own, prohibited the use of body belts, compliance with and acceptance of the use of body harnesses has become increasingly routine. OSHA is also aware of efforts by segments of the fall protection equipment manufacturing community to develop a personal fall arrest system that is lighter and hence will increase worker comfort and proportionately increase worker acceptance and use of body harnesses.

In addition, CAL/OSHA (Ex. 2-15) suggested that OSHA require permanent marking of all personal fall arrest system components with information that assures compliance with the pertinent standards, so that persons responsible for providing this equipment are spared the "substantial financial burden" of verifying compliance. OSHA notes that such a requirement would not add to the inherent safety of the personal fall arrest system components. In addition, based on the response to Issue #18, discussed below in relation to Sec. 1926.502(d)(4) of the final rule, OSHA believes that equipment manufacturers are already voluntarily marking their products. Accordingly, any benefit resulting from addition of such a requirement would be minimal. Therefore, OSHA has not added the suggested language.

Paragraph (d)(1) (proposed as paragraph (d)(9)) requires connectors to be drop forged, pressed or formed steel, or made of equivalent materials. This provision is essentially the same as the proposed requirement except that the term "hardware" was used in the proposed rule and the term "connectors" is used in the final rule. The reason for the change in the term was discussed above under the Definitions section. There were no comments on the substantive portion of the proposed provision.

Paragraph (d)(2) (proposed as paragraph (d)(10)) requires connectors to have a corrosion-resistant finish, and all surfaces and edges to be smooth to prevent damage to interfacing parts of the system. This provision is essentially the same as the proposed provision except that, as explained above, the term connector is being used instead of the term hardware.

In response to a comment in the powered platform rulemaking (Ex. 3-13), the proposal raised Issue #22 to solicit comments, with supporting information, regarding the need to quantify the corrosion resistance requirements applying the ASTM Salt Spray Testing Standard.

Some commenters (Exs. 2-12, 2-43 and 2-89) stated that the proposed requirement for corrosion resistance was sufficient. One commenter recommended "* * * that hardware be tested to ASTM B-117-73, a nationally recognized test method to determine corrosion resistance." Another commenter (Ex. 2-36) stated "[s]alt spray preconditioning of hardware is reasonable prior to static tensile strength tests." Also, a commenter (Ex. 2-50) stated "[c]orrosion-resistance requirements should be quantified. Reference to the appropriate part of the ASTM Salt Spray Testing standard should be considered."

OSHA has determined that the proposed language provides adequate guidance to employers regarding the selection of corrosion-resistant hardware and that a requirement for salt spray testing would be unnecessary. Accordingly, the Agency has not adopted the recommended language from Issue #22.

Paragraph (d)(3) requires that dee-rings and snaphooks have a minimum breaking strength of 5,000 pounds (22.2 kN). This provision corresponds to the final rule for Powered Platforms and is based on proposed paragraph (d)(16) which required that all components of body belt/harness systems whose strength was not otherwise specified (i.e. "hardware") to be capable of supporting a minimum fall impact load of 5,000 pounds (22.2 kN). As noted above, the term hardware was used in the proposal to describe dee-rings and snaphooks, etc. This provision is consistent with the related provisions and replaces existing Sec. 1926.104(f), which requires that all hardware be capable of withstanding a tensile load of 4,000 pounds, but which does not specify where the 4,000 pound load is to be applied. There were no comments relating to this provision.

Paragraph (d)(4), which was not part of the proposed rule, requires that dee-rings and snaphooks be 100 percent proof-tested to a minimum tensile load of 3,600 pounds (16 kN) without cracking, breaking, or taking permanent deformation. Issues 18, 20, and 24 of the proposed rule requested information on proper testing of personal fall arrest system components. Issue 18 solicited comments regarding the level of testing, in general, needed for personal fall arrest systems and system components and information regarding current industry practice. Issue 20 discussed suggestions from participants in the powered platform rulemaking that OSHA require dynamic and static strength testing of dee-rings and snaphooks and solicited input regarding the need for such testing and the availability of recognized test methods. Issue 24 specifically requested comments regarding the need for 100 percent proof-testing and suggestions for possible implementation.

Some commenters on Issue 18 (Exs. 2-12, 2-43 and 2-45) stated that OSHA should set mandatory testing and labeling of prototypes to ensure that individual components comply. Two of those commenters, Bristol Steel and the NEA, (Exs. 2-12 and 2-43) also stated that testing of complete systems should be non-mandatory, left to the discretion of the manufacturer. The ISEA and MSA (Exs. 2-23 and 2-35) stated that most manufacturers of fall protection equipment test and label their products according to the ANSI A 10.14-1975, "Requirements for Safety Belts, Harnesses, Lanyards, Lifelines and Drop Lines for Construction and Industrial Use." In particular, the ISEA (Ex. 2-23) stated that "qualification testing should be mandatory and * * * should be monitored by an independent third-party organization. * * *" Also, the R&TC a commenter (Ex. 2-36) stated that it "tests equipment according to the subpart M requirements and labels according to draft 1910.129 at present." In addition, NIOSH (Ex. 2-33) stated that "[m]anufacturers * * * are * * * testing to existing and proposed standards and regulations. The need exists for a single standard for testing of equipment whether it is employed in construction or general industry."

Two commenters (Exs. 2-36 and 2-50) who addressed Issue 20 supported a requirement for testing. In particular, the ANSI Z359 Committee (Ex. 2-50) recommended that OSHA require 100 percent proof-testing at 3,600 pounds to ensure that the strength requirement was met. The commenter stated that heat treating and other manufacturing processes used did not always produce dee-rings and snap-hooks with the necessary strength.

In response to Issue 24, several commenters (Exs. 2-12, 2-23, 2-41, 2-43, and 2-45)stated that manufacturers should have the responsibility for testing their products. Another commenter (Ex. 2-35) stated that testing should focus on finished systems, not on components. Also, a commenter (Ex. 2-36) stated that 100 percent testing at 5,000 pounds would impose an unreasonable cost burden because hardware might break on its second proof loading. That commenter also noted that there is evidence that snaphooks in fall protection systems have broken due to low strength.

The Agency has determined that proof-testing 100 percent at 3600 pounds will provide appropriate reassurance that the hardware has the necessary strength for use in a personal fall arrest system. OSHA has revised the proposed rule accordingly. OSHA has already adopted this approach in Sec. 1910.66, Appendix C, Section I -- Mandatory and has proposed to adopt it in proposed Sec. 1910.128(c)(7), as well (55 FR 13436, April 10, 1990).

Paragraph (d)(5), which is a new provision, requires that employers either use snaphooks that are sized to be compatible with the members to which they are connected, or use locking type snaphooks which have been designed to prevent disengagement. The Agency considers a hook to be compatible in size where the diameter of the dee-ring to which the snaphook is attached is greater than the inside length of the snaphook measured from the bottom (hinged end) of the snaphook keeper to the inside curve of the top of the snaphook, so that no matter how the dee-ring is positioned or moved (rolls) with the snaphook attached, the dee-ring cannot touch the outside of the keeper so as to depress it open. The intent of this requirement is to prevent unintentional disengagement (roll out) of the snaphook. This provision also prohibits the use of nonlocking snaphooks after December 31, 1997.

Issue 16 of the proposed rule addressed the design criteria for snaphooks, particularly with regard to the prevention of "roll out" (where snaphooks become accidentally disengaged during use). The Agency discussed information it had received regarding the need to mandate the use of locking snaphooks. Some input indicated that such a mandate was appropriate, while other informants suggested that properly designed and properly applied single action (nonlocking) snaphooks should be acceptable. OSHA requested suggestions, information and supporting rationale as to the type of snaphook that should be allowed.

A number of commenters (Exs. 2-12, 2-16, 2-19, 2-23, 2-35, 2-43, 2-45, 2-47 and 2-92) responded that there was no reason to bar the use of single-action snaphooks. Some (Exs. 2-23 and 2-45) contended that such a ban would be unreasonably expensive. Others (Exs. 2-12 and 2-43) stated that the increased hardware cost was "an insignificant consideration," but that properly designed and applied single-action snaphooks have not posed problems. Another commenter (Ex. 2-35), stated "When used with a correctly matched dee-ring, the assembly is as safe as any locking snaphook assembly * * * The possibility of misuse exists, as some detractors have noted, but locking snaphooks are just as subject to misuse." Testimony favoring the continued use of single-action snaphooks was presented at the rulemaking hearings (Tr. 144-146, 3-22-88). That testimony, however, also acknowledges that the use of locking snaphooks facilitated the inter-changeability of system components.

Several commenters (Exs. 2-36, 2-41, 2-50 and 2-89) recommended that OSHA mandate the use of locking snaphooks, citing the roll-out problems experienced with single-action snaphooks. Two commenters (Exs. 2-36 and 2-50) provided information which indicated that locking snaphooks were superior to single-action snaphooks in minimizing roll-out accidents. In addition, the State of Maryland (Ex. 2-31) stated, in response to proposed paragraph (d)(19), "Roll out is usually caused by an oversized hook. If the hook is matched to the de ring, then roll out should not occur."

OSHA has determined, based on the rulemaking record, that in general, locking snaphooks provide a higher level of protection to employees than the single-action (nonlocking) type of snaphooks. Based on the above discussion, the Agency has determined that it is reasonably necessary to require the use of locking snaphooks, designed to prevent roll-out in personal fall arrest systems or in positioning device systems (See Sec. 1926.502(e)(7) of the final rule). In order to avoid imposing undue hardship on employers who already have non-locking snaphooks, the Agency will permit the continued use a non-locking snaphooks until December 31, 1997. OSHA believes, based on informal communication with manufacturers of snaphooks, that all of the nonlocking snaphooks currently in use

will be worn out within the 3 years and recommends that those worn out prior to that time be replaced with the locking type snaphooks. The more than 3 year phase out allowed by this standard will eliminate any cost burdens on employers and is well within the life expectancy of equipment currently in use. OSHA notes this phase out corresponds with the phase out period for the use of body belts as part of a personal fall arrest system. Therefore, the Agency has added paragraph (d)(5) to the final rule, requiring one or the other condition (locking snaphook or compatibly sized as described above) be met. Aside from the phase out of nonlocking snaphooks, OSHA has already adopted a similar approach in Sec. 1910.66, Appendix C, Section I -- Mandatory, and has proposed to adopt it in proposed Sec. 1910.128(c)(8) (55 FR 13436, April 10, 1990).

Paragraph (d)(6) limits the use of snaphooks for certain connections unless the snaphook is a locking type, designed for those connections. Only locking snaphooks designed to be connected directly to webbing, rope or wire rope; to other snaphooks; to a dee-ring that already has another snaphook, or other connector attached; to a horizontal lifeline; or to any object that could depress the snaphook keeper because it is incompatibly sized or dimensioned in relation to the snaphook can be used for these connections. This provision reflects OSHA's determination that certain connections increase the likelihood of rollout and that only locking snaphooks specifically designed for such connections are needed to provide adequate assurance of employee safety. Accordingly, even before outright prohibiting the use of nonlocking snaphooks, OSHA is limited the circumstances in which they can be used.

Proposed paragraphs (d)(17), (18) and (19) prohibited snaphook engagement to webbing, to other snaphooks and to a dee-ring with another snaphook attached, respectively, based on the Agency's concern about roll-out.

One commenter (Ex. 2-31) stated, regarding proposed paragraph (d)(19), "[i] n many instances to hook back to the de ring is the only way to shorten the lanyard. OSHA should take this into consideration; weigh the hazard of rollout and how often it occurs to the hazard of falling a full six feet and being stopped by a lanyard." As discussed above in relation to paragraph (d)(5) of the final rule, the same commenter noted that rollout is usually caused by an oversized hook so rollout would not occur when the hook and dee-ring were compatibly sized and other commenters (Exs. 2-36 and 2-50) stated that only locking snaphooks should be permitted, because the locking mechanism prevents roll-out or inadvertent disengagement. In particular, one commenter (Ex. 2-50) suggested that OSHA prohibit the engagement of single action snaphooks to horizontal lifelines and to incompatibly sized or dimensioned objects because of roll-out and disengagement concerns.

OSHA agrees that locking snaphooks provide the most adequate assurance against roll-out or inadvertent disengagement for the specified uses and that efforts to match the size of a single-action snaphook to its connection will not provide adequate assurance that the hook will remain attached to that connection under foreseeable conditions in use. OSHA has revised the proposed provisions accordingly. The Agency acknowledges that this provision will have no application after January 1, 1998, because after that time, non-locking snaphooks will not be used for any purposes. OSHA has already adopted this approach in Sec. 1910.66, Appendix C, Section I -- Mandatory, and has proposed to adopt it in proposed Sec. 1910.128(c)(1) (55 FR 13436, April 10, 1990).

Paragraph (d)(7) requires a device used to connect to a horizontal lifeline which may become a vertical lifeline to be capable of locking in both directions on the lifeline. This provision applies only when horizontal lifelines are used on suspended scaffolds or similar work platforms, and the horizontal lifeline would become a vertical lifeline if the scaffold or platform were to fall. This provision, which was not proposed, has been added in response to comments (Ex. 2-36 and 3-13) which pointed out that employees attached to a horizontal lifeline would face a fall hazard if either end of the horizontal lifeline support failed and the line became a vertical lifeline. In particular, OSHA notes that, potentially, a rope grab which did not lock in both directions on the lifeline would fail to hold, allowing the employee to fall to a lower level. OSHA has already adopted this approach in Sec. 1910.66, Appendix C, Section I -- Mandatory, and has proposed to adopt it in proposed Sec. 1910.128(c)(2) (55 FR 13436, April 10, 1990).

Paragraph (d)(8) requires that horizontal lifelines be designed, installed and used, under the supervision of a qualified person, as part of a complete personal fall arrest system which maintains a safety factor of at least two. Proposed paragraph (d)(14) would have required horizontal lifelines to have the tensile strength to support a fall impact load of 5,000 pounds, per employee using the lifeline, applied anywhere along the lifeline. Issue 25 of the NPRM solicited comments and information regarding the need to require that horizontal lifeline subsystems be designed by "qualified persons" and to provide more specific guidance for employers using horizontal lifelines.

Two commenters on proposed paragraph (d)(14) (Exs. 2-23 and 2-35) asserted that the proposed rule did not adequately take into account the differences between vertical and horizontal lifelines. In particular, one commenter (Ex. 2-23) stated:

The physics of the horizontal lifeline system are such that a line suitable for a vertical lifeline could be rigged so as to be completely inadequate for a horizontal lifeline. Since this is not necessarily obvious, earlier OSHA drafts included a chart specifying tensile strength versus angle of sag. Inclusion of this chart could avoid tragic mistakes and should be included in this section.

Another commenter (Ex. 2-89) stated:

The 5000 # tensile strength is not applicable to all situations and had been developed from the ANSI A 10.14 Committee which is now withdrawn from being an ANSI standard. It would be the recommendation of the SSFI that lifelines be capable of an anchorage equal to 2 (two) times the maximum arrest force.

Some commenters on Issue 25 (Exs. 2-12, 2-43, and 2-45) stated that OSHA should not add more detail to the proposed paragraph or require "qualified" persons. In addition, two commenters (Exs. 2-12 and 2-43) asserted that the proposed 5,000 pound tensile strength requirement was too restrictive and was infeasible, adding that a system able to support twice the impact load, as provided in proposed paragraph (d)(12), should be allowed.

Other commenters who responded to Issue 25 (Exs. 2-23, 2-36, and 2-50) stated that more detailed guidance was needed for proper use of horizontal lifelines. Also, two commenters (Exs. 2-35 and 2-89) asserted that the person designated to supervise work performed under proposed paragraph (d)(14) should be a "competent person." OSHA notes that a "competent person" as defined in Sec. 1926.32(f) has the ability to recognize hazards and the authority to have them corrected, but does not necessarily have the technical capability to resolve the safety issue. Such capability is included in the definition of a "qualified" person as defined in Sec. 1926.32(l). The Agency believes that this provision warrants the services of a person who is both qualified to design, install and use horizontal lifelines and authorized to have the problem corrected. OSHA believes, therefore, that the language in the final rule that requires a "qualified person" with supervisory authority will address the concerns of the commenters.

Paragraph (d)(9) (proposed as paragraphs (d)(13) and (d)(15)) requires lanyards and vertical lifelines to have a minimum breaking strength of 5,000 pounds (22.2 kN). This provision is essentially the same as the two separate proposed provisions except that the final provisions uses the term "breaking strength" instead of the term "tensile strength" used in the proposed provisions. OSHA has made this editorial change to clearly indicate the intent of the provision. Proposed paragraph (d)(13) also provided that self-retracting lifelines and lanyards that limited free-fall to 2 feet or less were required to have a tensile strength of 3,000 pounds. That language has been relocated to paragraph (d)(12) of the final rule. The SSFI (Ex. 2-89) commented that the 5000 lb. tensile strength for vertical lifelines"* * * is not applicable to all situations * * *" and recommended that OSHA require "* * * lifelines be capable of an anchorage equal to 2 (two)times the maximum arrest force." The SSFI did not specify which situations the 5,000 pound requirement was not applicable. OSHA notes that the anchorage requirement is discussed under paragraph (d)(15) below. Another commenter (Ex. 2-50) recommended that compliance with the proposed 5000 pound tensile strength requirement be evaluated using Federal Standard 191 Test Method 6015 or 6016. The Agency is not aware of any reason to specify the use of the above mentioned test methods, nor did the commenter provide any such reasons. Therefore, OSHA has not made the suggested change.

Paragraph (d)(10) (proposed as paragraph (d)(11) prohibits more than one employee being attached to any one lifeline, except as provided in paragraph (d)(10)(ii). The exception allows two employees to be attached to the same lifeline during construction of elevators, provided the employees are working atop a false car that is equipped with guardrails and the breaking strength of the lifeline has been increased to 10,000 pounds [5,000 pounds per worker attached] and all other criteria of paragraph (d) for personal fall arrest systems has been met. This exception recognizes the potential for a greater hazard (entanglement) in the elevator shaft with the additional lifeline.

There was one comment on this provision. The National Elevator Industry, Inc. (NEII) (Ex. 2-11) stated as follows:

In the Elevator Industry, work in hoistway is performed by a team of two employees. This is a relatively small area and work is usually performed at the same level from a false car that is equipped with guardrails. The Lifeline/Safety Belt system provides protection in the event of a catastrophic failure of the false car system. Under these circumstances, the Elevator Industry feels that if a lifeline had adequate breaking strength for supporting two employees then one lifeline would be sufficient. The employees working at the same level on a false car that is equipped with guardrails would virtually eliminate the chance of one pulling another off the false car. The small area of an elevator hoistway makes the use of multiple lifelines impractical due to the chances for entanglement, etc.

OSHA has observed the working conditions described above and agrees that NEII's recommended alternative measures will provide appropriate fall protection for the affected employees. OSHA has incorporated these measures into paragraph (d)(10)(ii) of the final rule.

Paragraph (d)(11) (proposed as paragraph (d)(3)) requires lifelines to be protected against being cut or abraded. This provision which is identical to the proposed provision, is based on existing Sec. 1926.104(e). A commenter, (Ex. 2-89), suggested that the proposed provision be reviewed for "* * * consistency and that the term "lifeline" could be used with another term, i.e., "dropline * * *" OSHA has eliminated the terms "dropline" and "trolley line" to avoid confusion. The terms vertical lifeline and horizontal lifeline are used and both are required by this provision to be protected against being cut or abraded. Therefore, OSHA promulgates paragraph (d)(11) as proposed.

Paragraph (d)(12) (proposed as part of paragraph (d)(13)) requires that, when in the fully extended position, self-retracting lifelines and lanyards which automatically limit free fall distance to 2 feet or less be capable of sustaining a minimum tensile load of 3,000 pounds (13.3 kN). This provision is essentially the same as the proposed rule except that it has been editorially revised to make it clear that the 3000 pounds is to be determined by applying the load while the lifeline or lanyard is in the fully extended position. There were no comments on this provision of the proposed rule.

Paragraph (d)(13) of the final rule requires that, when in the fully extended position, self-retracting lifelines and lanyards which do not limit free fall to two feet or less, as well as ripstitch, tearing and deforming lanyards, be capable of sustaining a minimum tensile load of 5,000 pounds (22.2 kN). Proposed paragraph (d)(13) set a general requirement for vertical lifelines to have 5,000 pounds tensile strength, except where self-retracting lifelines and lanyards automatically limited free fall to two feet or less. The other provisions of the proposed paragraph have been relocated to paragraphs (d)(9) and (d)(12) of the final rule. OSHA is promulgating paragraph (d)(13) to maintain the coverage set by the proposed rule. The Agency has specifically identified some of the types of lanyards covered by this paragraph (i.e. ripstitch, and tearing and deforming lanyards) to facilitate compliance.

Issue #23 of the NPRM solicited comments and suggestions, with supporting information, regarding the regulation of self-retracting lifelines and lanyards in proposed paragraph (d)(13). In particular, in the first part of the issue, OSHA asked if self-retracting lifelines and lanyards should be required to meet the minimum load requirement with the line or lanyard fully extended. In the second part of the issue, OSHA asked whether it should specify the

maximum arrest force to be transmitted by those devices given the kind of body belt or harness used. The response to the second element of Issue #23 is addressed in relation to Sec. 1926.502(d) (16) of the final rule, below.

Some commenters (Exs. 2-35 and 2-36) stated that it was appropriate to set 3,000-pound minimum strength for a self-retracting lifeline or lanyard that arrested falls within two feet. Another commenter (Ex. 2-50) supported a requirement for the lines and lanyards to meet minimum strength when fully extended.

The SSFI (Ex. 2-89) commented that the proposed 5,000-pound tensile strength requirement is not applicable to all situations and that OSHA should revise the provision to require that lifelines be capable of an anchorage equal to twice the maximum arrest force.

Two other commenters (Exs. 2-12 and 2-43) stated that OSHA should specify maximum arrest force for self-retracting lifelines and lanyards, with an upper limit of 1,125 lbs. The commenters indicated that such an upper limit would be easily attainable using available equipment and would be consistent with the draft ISO international standard.

OSHA believes, based on the evidence in the record, that the 5,000 pound requirement is appropriate. No evidence or convincing arguments have been presented to the Agency, to date, to demonstrate that this requirement should be changed to a lower number, or that there is any specific situation where the 5,000 pound requirement is not appropriate.

Paragraph (d)(14), which was not part of the proposed rule, requires that ropes and straps (webbing) used in lanyards, lifelines and strength components of body belts and body harnesses not be made from natural fibers. A commenter (Ex.2-50) recommended that OSHA require the use of synthetic fiber rope in personal fall arrest systems because natural fiber rope is not reliable or predictable as it ages during use and because the strength deterioration of natural fiber rope is not obvious or always detectable during inspection. In addition, a National Bureau of Standards (NBS) report (Ex. 3-8) advises against the use of natural fiber rope due to unpredictable deterioration. OSHA agrees that natural fiber rope would not be sufficiently reliable for use in a personal fall arrest system and has revised the proposed rule accordingly. OSHA has already adopted this approach in Sec. 1910.66, Appendix C, Section I -- Mandatory, and also has proposed to adopt it in proposed Sec. 1910.128(c)(12) (55 FR 13436, April 10, 1990).

Paragraph (d)(15) (proposed as paragraph (d)(12)) requires that anchorages used for the attachment of personal fall arrest equipment be capable of supporting at least 5,000 pounds (22.2 kN) per employee attached or the anchorage must be designed, installed and used under the supervision of a qualified person and as part of a complete personal fall arrest system which maintains a safety factor of at least two. This provision differs from both the proposed provision, which required that anchorages be able to support at least twice the potential impact load of an employee's fall, and existing Sec. 1926.104(b), which requires anchorages to be capable of supporting a minimum dead weight of 5,400 pounds. OSHA proposed to replace the existing provision, which was based on the rated strength of manila rope, and was not based on the actual load the anchor must support when an employee falls. The proposed provision was more performance-oriented and addressed the actual forces involved.

Issue #26 of the proposed rule requested public comment on the applicability of the fall protection provisions of Appendix D in the proposed rule for powered platforms (50 FR 2890, January 22, 1985) to the construction industry. Some commenters (Exs. 2-12, 2-36, 2-41, 2-43 and 2-45) recommended that OSHA promulgate paragraph (d)(12) as proposed. Other commenters (Ex. 2-23 and 2-35) suggested that OSHA revise proposed paragraph (d)(12) to require that the anchorage sustain twice the potential load or 5,000 pounds, whichever is greater. Those commenters expressed concern that, applying the proposed rule, an inexperienced rigger would simply double the weight of the affected employee and think that the resulting system is safe. They also noted that OSHA could set 3,600 pounds as the minimum, because proposed paragraph (d)(12) limited impact load to 1,800 pounds, but they thought that would make it difficult for OSHA to justify the 5,000 pound load requirements

elsewhere in the proposed rule. Another commenter (Ex. 2-50) recommended that the strength of anchorages be either at least twice the potential dynamic loading force if certified by a qualified person, or 5,000 pounds when not so certified. In addition, comments on the proposed rule for powered platforms (Ex. 3-13) indicated a need to set a minimum strength requirement as well as to allow employers the option of designing, installing and using a complete system which maintains a safety factor of two.

OSHA agrees with the commenter who suggested that anchorages be required to sustain a 5,000 pound load when they have not been certified by a qualified person as able to sustain twice the potential load. The Agency believes that only anchorages that are certified by a qualified person can be relied upon to provide adequate protection at the lower strength level. On the other hand, when not so certified OSHA believes it is appropriate for the anchorage to sustain at least 5,000 pounds. OSHA has already adopted this approach in Sec. 1910.66, Appendix C, Section I -- Mandatory, and has proposed to adopt it in proposed Sec. 1910.128(c)(10) (55 FR 13436, April 10, 1990).

Paragraph (d)(16) (proposed as paragraphs (d)(4), (d)(5) and (d)(6)) consolidates the performance criteria for personal fall arrest systems. Paragraph (d)(16)(i) limits the maximum arresting forces on an employee to 900 pounds when a body belt is used. Paragraph (d)(16)(ii) limits the maximum arresting forces on an employee to 1,800 pounds when a body harness is used. As discussed in relation to the introductory text of paragraph (d), above, the Agency has decided that body belts must be phased out from use in personal fall arrest systems because employees wearing them have been seriously injured by the impact loads transmitted and by the pressures imposed while suspended after fall arrest. Paragraphs (d)(16)(i) and (d)(16)(ii)reflect the Agency's determination that fall arrest systems which use body belts up to the time the prohibition takes effect must minimize the related hazards by limiting the impact load to half that allowed when body harnesses are worn.

Proposed paragraph (d)(6) required that body belt/harness systems not produce an arresting force on an employee of more than 10 times the employee's weight or 1,800 pounds, whichever was less. Issue 14 of the proposed rule asked if the proposed 1,800-pound limit was appropriate for body belts. The comments on proposed Appendix D of the powered platform rulemaking (Ex. 3-13), discussed in detail at 54 FR 31449-31451, July 28, 1989), which supported an identical requirement in the general industry rule, were considered by the Agency as support for the provisions of subpart M to limit the maximum arrest force for body belts at 900 pounds and to maintain the limit for body harnesses at 1800 pounds. In comments addressing Issue 14 directly, two commenters on proposed subpart M (Exs. 2-36 and 2-50) supported a 900-pound limit. The R&TC (Ex. 2-36) stated "[b]elts should have a nine-hundred pound, or lower, limit because no human can tolerate a live demonstration of an eighteen-hundred pound fall arrest in a belt. That rulemaking participant also testified (Tr. 2-17 to 2-19, 3-23-88) regarding specific incidents which indicated the advantages of using body harnesses instead of body belts. Several commenters (Exs. 2-12, 2-19, 2-23, 2-43 and 2-140) stated that it was inappropriate to distinguish between body belts and body harnesses.

OSHA has determined that the hazards posed by body belts, as discussed earlier, necessitate setting a lower impact load limit for systems which use them, until January 1, 1998, at which time, as discussed above, bodybelts will be prohibited for use as part of a personal fall arrest system. Therefore, the Agency is promulgating paragraphs (d)(16)(i) and (d)(16)(ii).

Paragraph (d)(16)(iii) requires that personal fall arrest systems be rigged so that an employee can neither free fall more than six feet nor contact a lower level. Paragraph (d)(16)(iv) requires that after the free fall distance, the personal fall arrest system must bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet. These two paragraphs are essentially identical to proposed paragraphs (d)(4) and (d)(5).

Issue 14 of the proposal asked if OSHA should limit the free fall distance to two feet, rather than six feet, where a body belt was being used. Several commenters (Exs. 2-12, 2-19, 2-23, 2-43 and 2-140) supported proposed paragraph (d)(4), stating that it was inappropriate to distinguish between body belts and body harnesses. In

particular, a commenter (Ex. 2-23) stated "[T]he maximum 6 foot free fall limitation is acceptable for body belts, and no 2 foot limit should be imposed." Other commenters (Exs. 2-36 and 2-50) stated that OSHA should limit the free fall distance to two feet where body belts are used, citing Australian and New Zealand standards. One commenter (Ex. 2-36) stated "[r]etracting lifelines can be considered for continued belt usage by employers in the U.S.A., since free fall is usually less than two feet and self-recovery likelihood is excellent."

Other commenters on these provisions noted some confusion between the two. For example, one commenter (Ex. 2-20) stated that proposed paragraphs (d)(4) and (d)(5) could be "misinterpreted" and suggested "modification of the wording." Another commenter (Ex. 2-23) stated that OSHA should add a sentence to the proposed paragraph (d)(4) saying "[t]he rigger must consider total fall distance and thus include the lifeline elongation." and "[t]he present wording of this section is very confusing, so we suggest more precise wording to explain that the 42-inch limit is for the deceleration device." In addition, the comments on proposed Appendix D of the powered platform rulemaking (Ex. 3-13), discussed in detail (54 FR 31450, July 28, 1989), indicated concern regarding the distinction between deceleration distance and free fall distance.

The Agency notes that the final rule defines the terms "Deceleration distance" and "Free fall distance" (discussed above in relation to Sec. 1926.500(b)) and believes that the definitions make it clear when free fall begins and ends and how to determine deceleration distance. OSHA has already adopted this approach in Sec. 1910.66, Appendix C, Section I -- Mandatory, and has proposed to adopt it in proposed Sec. 1910.129(b)(1)(iii) (55 FR 13436, April 10, 1990).

Paragraph (d)(16)(v), which was not part of the proposed rule, requires that the personal fall arrest system have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet, or the free fall distance permitted by the system, whichever is less. The comments on proposed Appendix D of the powered platform rulemaking (Ex. 3-13), discussed in detail (54 FR 31450, July 28, 1989), supported a requirement for personal fall arrest systems to be designed with a safety factor of at least two. The Agency has specified that the ability of a system to satisfy this requirement must be assessed based on a fall distance of 6 feet or the distance allowed by the system, whichever is less, so that this provision coordinates with paragraph (d)(16)(iii), above. OSHA has already adopted this approach in Sec. 1910.66, Appendix C, Section I-Mandatory, and has proposed to adopt it in proposed Sec. 1910.129(b)(1)(iv) (55 FR 13436, April 10, 1990).

OSHA has added a note to paragraph (d)(16) which references the criteria and protocols in Sec. 1910.66, Non-mandatory Appendix C, as examples of means by which employers can determine if their personal fall arrest systems comply with the standard. The note also indicates that systems used by employees having a combined tool and body weight of 310 pounds or more would need to modify the criteria and protocols to account for the greater weight, in order to apply Appendix C. OSHA has already adopted this approach in Sec. 1910.66, Appendix C, Section I-Mandatory, and has proposed to adopt it in proposed

Sec. 1910.129(b)(2) (55 FR 13436, April 10, 1990).

Paragraph (d)(17) (proposed as paragraph (d)(7) requires that personal fall arrest systems be worn so that the attachment point for body belts is located in the center of the wearer's back, and that the attachment point for body harnesses is located either in the center of the wearer's back near shoulder level, or above the wearer's head. The proposed rule was essentially identical. There were no comments on the substance of the provision and OSHA promulgates paragraph (d)(17) as editorially revised. The AGC (Exs. 2-16, 2-47, 2-92 and 2-103) commented as follows:

Proper positioning of the lanyard or deceleration device is crucial for the prevention of injuries in a fall situation. Construction employers have emphasized to employees this aspect of body belt usage. However, AGC believes that mandated as such in the proposed rule is inappropriate and unworkable. Subsequent to required training, employers cannot be responsible for each employees positioning of this type device.

In response, OSHA again notes that under the OSH Act, employers bear direct responsibility for compliance with OSHA regulations. Accordingly, the Agency has not revised the proposed rule based on the AGC comment. OSHA has already adopted this approach in Sec. 1910.66, Appendix C, Section I -- Mandatory, and has proposed to adopt it in proposed Sec. 1910.129(c)(4) (55 FR 13436, April 10, 1990).

Paragraph (d)(18) (proposed as paragraph (d)(1)) requires that body belts, harnesses, and components be used only for employee fall protection or positioning. This means that those systems or components may not be used as material or equipment hoist slings, bundle ties, or for other such purposes. This is substantively the same requirement as the proposed provision and as the existing provision in Sec. 1926.104(a). One commenter (Ex. 2-23) stated that OSHA should also indicate in this provision that body belt and harness systems can be used "* * * for work positioning and retrieval as well * * *" Also, a commenter (Ex. 2-35) stated "I believe the purpose of this requirement is to prevent the equipment being used for such things as material handling. But you have never defined a positioning belt/harness system, only a `personal fall arrest system.' Therefore, this provision prevents the use of belts for positioning or such things as controlled descent."

The SSFI(Ex. 2-89) said they felt clarification was needed for the sentence indicating how body belt/harness systems could be utilized. They recommended that the body belt/harness system could be used for fall and/or work positioning.

OSHA acknowledges that the proposed provision could have been construed to prohibit the use of body belts or body harnesses in positioning device systems. OSHA intended simply to prevent the use of such systems for material hoisting or related purposes. The Agency is concerned that a fall protection system that had been used to hoist material would then be issued to an employee as a fall protection system. OSHA has revised the provision to indicate clearly its intent that components of fall arrest and positioning device systems are only to be used for those purposes. OSHA has already adopted this approach in Sec. 1910.66, Appendix C, Section I -- Mandatory, and has proposed to adopt it in proposed Sec. 1910.128(c)(14) (55 FR 13436, April 10, 1990). The Agency has also added the identical language to Sec. 1926.502(e) of the final rule as paragraph (e)(10), to facilitate compliance.

Paragraph (d)(19) (proposed as paragraph (d)(2)) requires that personal fall arrest systems or components of subject to impact loading (as distinguished from static load testing) be immediately removed from service, and prohibits subsequent use unless inspected by a competent person who determines the system or component to be undamaged and suitable for reuse. This is essential the same as the proposed requirement and the existing requirement in Sec. 1926.104(a) except the existing provision prohibits any further use of belts for employee protection. In the proposed rule, OSHA explained that impact loading did not necessarily adversely affect the integrity of a body belt/ harness system. OSHA further explained that a relatively short fall of one foot may leave the belt/harness system undamaged; however, a long fall of six feet or greater probably would destroy or seriously damage the belt or harness. There are many factors, such as the employee's weight and the type of deceleration device used, which can affect a system's potential capacity for reuse as fall protection. Therefore, a blanket prohibition of reuse after any impact loading is not appropriate.

There were two comments on the provision. One commenter (Ex. 2-15) stated "[n]of only should the components be removed from service, but they should be marked as "defective" to ensure the equipment won't be inadvertently used again until it is found not to be defective or made to be no longer defective by a competent person."

The other commenter (Ex. 2-23) suggested that OSHA revise the proposed provision to rule out reuse after an impact load.

OSHA believes that it is unnecessary to mandate that equipment be marked or labeled "defective" and that it is sufficient to remove equipment from service so that it cannot be used, at least until its strength has been evaluated. The Agency does not believe it necessary to specify the manner in which employers choose to identify components that need to be evaluated before they can be reused. The Agency is concerned solely that the

method chosen effectively prevent the reuse of equipment that has not been cleared for reuse. In addition, OSHA believes that an absolute ban on the reuse of fall arrest system components would be unnecessary because such equipment may still have the strength needed for continued use. The employer, in turn, needs to ensure that procedures for inspection and evaluation of equipment will prevent the reuse of damaged components. OSHA has already adopted this approach in Sec. 1910.66, Appendix C, Section I-Mandatory, and has proposed to adopt it in proposed Sec. 1910.128(c)(15) (55 FR 13436, April 10, 1990).

Several commenters on proposed Appendix D of the powered platform rulemaking (Ex. 3-13), discussed in detail at 54 FR 31452, expressed concern regarding the need for prompt rescue after fall arrest, especially when body belts are being used, because prolonged suspension may be harmful to employees. OSHA agrees with these comments and has added paragraph (d)(20) to the final rule. Under this provision, the employer is required to evaluate the potential for fall arrest and to determine which rescue strategy will be used to rescue a suspended employee safely. When it is not possible to evaluate the self-rescue capacity of employees in advance, prudent employers should assume that employees will need rescue assistance and, accordingly, be prepared to offer it. See paragraph (f) Rescue considerations of Appendix C, Part II, for guidance in meeting the requirements of this provision. OSHA has already adopted this approach in Sec. 1910.66, Appendix C, Section I-Mandatory, and has proposed to adopt it in proposed

Sec. 1910.129(c)(6) (55 FR 13436, April 10, 1990).

Paragraph (d)(21) (proposed as paragraph (d)(20)) requires that personal fall arrest systems be inspected prior to each use for damage and deterioration, and that defective components be removed from service. This provision is essentially identical to the proposed provision in Sec. 1926.502(d)(20).

OSHA raised Issues #9 and #17 in the proposal to request public comment regarding the frequency of inspection and whether or not more definitive inspection criteria were needed for determining when personal fall arrest systems (or positioning device systems, as regulated in paragraph (e)(5), below) are no longer suitable for use. OSHA also asked commenters what inspection criteria should be specified.

A commenter (Ex. 2-23) suggested that OSHA delete the words "if their strength or function has been adversely affected." OSHA agrees that deleting those words will make the rule easier to understand, i.e., employers would simply remove components that are defective, in that they do not meet the criteria set in paragraph (d), without having to make a specific determination about strength or function.

The majority of the commenters thought the criteria provided in the standard were sufficient as proposed (Exs. 2-12, 2-19, 2-23, 2-43, and 2-45). However, several commenters suggested that additional information should be conveyed to employees through training programs, by following manufacturer's specifications, or by OSHA in the form of guidelines (Exs. 2-16, 2-23, 2-35, 2-36, 2-41, 2-47 and 2-92). OSHA observes that such training is required under new Sec. 1926.503, discussed below. The ISEA, the ANSI Z359 Committee and the Roofers Union (Exs. 2-23, 2-50 and 2-99) supported the proposed requirement for inspection prior to each use.

The AGC (Exs. 2-16, 2-47 and 2-92) agreed that inspections were needed and noted, as they have with other provisions (see discussion at paragraph (d)(17) of the final rule above, that employees, rather than employers, should be held responsible for ensuring that fall protection equipment is functioning properly prior to each use. Other commenters (Exs. 2-41, 2-42 and 2-51) supported the AGC position. In that regard, OSHA again observes that under the OSH Act, employers bear direct responsibility for compliance with OSHA regulations.

The GLFEA and the BCMALU (Exs. 2-19 and 2-46) thought inspection should be weekly rather than prior to each use. The GLFEA supported its position with the statement that "A more frequent schedule does not enhance the safety of the employees."

Essentially, there was no objection to the substance of the rule, only disagreement on the frequency of inspection. OSHA believes it is critical to inspect equipment before each use; otherwise, employees may use defective equipment which could result in loss of life in the event of a fall. Therefore, OSHA has not reduced the frequency of inspection and has determined that the provision, as proposed, is appropriate. Further information on inspection criteria has been provided in paragraph (g) Inspection considerations in Part II of Appendix C relating to Sec. 1926.502(d) -- Personal Fall Arrest Systems. OSHA also notes that this provision is consistent with the inspection requirements for personal fall arrest systems in the powered platforms standard, Sec. 1910.66.

Paragraph (d)(22) requires that body belts be at least one and five-eighths (1 5/8) inches (4.1 cm) wide. This provision is identical to the provision in proposed paragraph (d)(8). There were no comments on the proposed provision and OSHA promulgates paragraph (d)(23) as proposed.

Paragraph (d)(23) (proposed as paragraph (d)(21)) prohibits the attachment of personal fall arrest systems to hoists or guardrail systems, except where otherwise provided in part 1926. This requirement is essentially the same as existing Sec. 1926.500(g)(5)(iv), which applies only to built-up roofing operations on low-pitched roofs, and does not include the guardrail restriction. OSHA proposed to extend the rule to prohibit using any hoist or guardrail system as an anchorage attachment point. Additionally, the existing rule in Sec. 1926.104(b) specifies minimum anchorage requirements for body belts.

Neither hoists nor guardrail systems are designed as anchorages for personal fall arrest systems since they are not built to withstand the impact forces generated by a fall. Therefore, in the interest of employee safety, OSHA is prohibiting the use of hoists and guardrails as attachment points.

There were two comments on the proposed provision. The ISEA (Ex. 2-23) noted that the provision "* * * would eliminate the common practice of workers attaching to a `man basket' while riding in it." OSHA notes that the more specific rule Sec. 1926.550(g)(6)(vii), in the crane safety standards, regulates "man baskets." The SSFI (Ex. 2-89) recommended that the provision be changed to indicate that a body belt/ harness system should never be attached to any guardrail system, not just those at hoist areas. OSHA agrees that the reasons workers should not attach to guardrail systems or hoists at hoist areas as for any other hoist or guardrail, regardless of where it is located and therefore, OSHA has revised the language of provision to make that clear.

Paragraph (d)(24) (proposed as paragraph (d)(22)) specifies that personal fall arrest systems used at hoist areas are to be rigged to allow the movement of employees only as far as the edge of the walking/ working surface. This is the same requirement proposed at Sec. 1926.502(d)(22). It is essentially the same as existing Sec. 1926.500(g)(5)(v), which applies only to built-up roofing operations on low-pitched roofs. OSHA proposed to extend the requirement to cover all hoist areas. The limitation on movement when wearing a personal fall arrest system is made because of the employees' tendency to lean out over the edge at hoist areas. There were no comments on this provision.

Paragraph (e) -- Positioning device systems. This paragraph sets the minimum performance criteria for "positioning devices," which are systems similar to personal fall arrest systems and which can be comprised of many of the same components. The significant difference is that personal fall arrest systems are used to arrest falls, whereas employees use positioning devices so they can maintain a leaning position without using their hands while working on vertical surfaces. For example, these devices may be used during the placement of reinforcing bars in the vertical face of a wall under construction. The employees often stand on bars already in place and must lean backward, similar to a lineman on a telephone pole, to place additional bars. The positioning device allows this to be done without the employees having to use their hands to maintain position.

Several provisions of proposed Sec. 1926.502(d) have been incorporated into final rule paragraph (e). In issuing the proposal, OSHA considered the pertinent paragraph (d) requirements to cover both personal fall arrest systems and positioning device systems. The Agency has subsequently concluded that placing those provisions

directly in paragraph (e) will best assure that employers who have employees use positioning device systems have clear direction on safe use of those systems. OSHA has specifically identified the added provisions below.

A general comment relating to proposed Sec. 1926.502(e) came from CAL/OSHA (Ex. 2-15) who commented that components of positioning device systems should be permanently marked to indicate that they meet the applicable standards. CAL/OSHA also recommended that equipment covered by paragraph (d) personal fall arrest systems be permanently marked. As with paragraph (d), OSHA does not believe that requiring the marking of positioning device systems is necessary for employee protection in this standard. The criteria set forth in paragraph (e) must be met, in any event, in order to assure that the equipment protects the employee. In addition, based on the response to Issue #18, discussed above in relation to Sec. 1926.502(d)(4) of the final rule, OSHA believes that equipment manufacturers are already voluntarily marking their products. Accordingly, any benefit resulting from addition of such a requirement would be minimal. Therefore, OSHA has not added the suggested language.

Paragraph (e)(1) requires that positioning device systems be rigged so that an employee cannot free fall more than 2 feet. The proposed rule was identical. OSHA set this distance less than the 6 foot free fall distance set in paragraph (d)(16) for personal fall arrest systems because lanyards used with positioning devices usually do not stretch under fall impact loading and deceleration devices normally are not used to reduce the forces incurred during a fall. There were no comments on paragraph (e)(1).

Paragraph (e)(2), proposed as paragraph (e)(3), requires that positioning devices be secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds, whichever is greater. This provision differs from OSHA's proposed provision by the addition of the language "or 3,000 pounds, whichever is greater."

There were several comments on the proposed provision. The ISEA and MSA (Exs. 2-23 and 2-35) suggested that OSHA add language to the provision to make it consistent with the strength requirement proposed in paragraph (d)(13) of this section for self-retracting lifelines and lanyards that limit free fall to 2 feet. OSHA agrees that adding the suggested language will provide employers with useful and consistent guidance, and has revised the provision accordingly.

NIOSH (Ex. 2-33) stated that the proposed provision placed responsibility on the employee to determine the proper anchorage point, and that the provision should be rewritten to specify that a supervisor or site safety officer has the responsibility. In response, OSHA notes that many provisions in OSHA standards require direct employee action in order to achieve compliance. Regardless of who performs the necessary duties under the standard, the employer has direct responsibility to provide a safe workplace by complying with the OSH Act and with the pertinent regulations, and it is the employer who will be cited should a violation occur. Accordingly, the Agency does not believe that specifying the personnel responsible for identifying anchorage points is necessary for employee protection. Therefore, OSHA has not made the suggested change.

Paragraph (e)(3) requires connectors to be dropped forged, pressed or formed steel, or made of equivalent materials. This is a new requirement and has been added to maintain consistency with final rule Sec. 1926.502(d)(1) which addresses connectors used as part of a personal fall arrest system. This provision and its rationale are identical to those for paragraph (d)(1) of this section, above.

Final rule paragraph (e)(4), proposed as paragraph (e)(2), requires that connectors be of a corrosion-resistant finish and that all surfaces and edges be smooth to prevent damage to interfacing parts of the systems. OSHA solicited comments on the need for quantification of corrosion resistance requirements in Issue #22 of the proposal. The response to that issue is discussed in relation to paragraph (d)(2), above. As with paragraph (d)(2), the Agency has decided that additional corrosion resistance testing requirements are also not needed in paragraph (e)(4). OSHA has editorially revised the proposed provision so that it is identical to paragraph (d)(2)of this section which contains the same requirement. Specifically, the words "attached belt or connecting assembly"

has been revised to read "interfacing parts of the system." This is the same language that OSHA used in its final rule for Powered Platforms for Building Maintenance [54 FR 31470, July 28, 1989] and in proposed Sec. 1910.128(c)(2) [55 FR 13436, April 10, 1990].

Final rule paragraph (e)(5), proposed as paragraph (e)(4), requires that connecting assemblies (which are de rings, snaphooks, lanyards and other components of the positioning device system) have a minimum breaking strength of 5,000 pounds. This provision is identical to the proposed rule. There were two comments on the proposed provision.

The MSA (Ex. 2-35) commented that this provision should be changed to require a minimum breaking strength of 3,000 pounds, to be consistent with provision (e)(3) above. The SSFI (Ex. 2-89) objected to OSHA's use of 5,000 pounds because, as they have expressed earlier under paragraph (d), they believe lifelines should be capable of anchorage equal to two times the maximum arrest force and all requirements therefore should be consistent with that capability.

OSHA observes that this provision is consistent with other similar provisions in Sec. 1926.502(d) which prescribe the breaking strength of lanyards, connectors, snaphooks, dee-rings, etc. While a breaking strength of 3000 pounds might be adequate if the fall was limited as it should be when a positioning device system is used, 3000 pounds would not be adequate if the connecting assembly was inadvertently used as part of a fall arrest system. Since there is no way to determine by simple observation whether the connecting assembly has a breaking strength of 3000 pounds or 5000 pounds, users of connecting assemblies could easily interchange components. Therefore, in the interest of worker safety, it is appropriate that OSHA require all connecting assemblies to have the same minimum breaking strength. In this way, if the connecting assembly is used as part of a personal fall arrest system, the strength will be adequate and the connecting assembly will not break.

Final rule paragraph (e)(6), like final rule paragraph (d)(4), requires that dee-rings and snaphooks be proof-tested to a minimum tensile load of 3600 pounds without cracking, breaking, or taking permanent deformation. A complete discussion of this provision can be found at Sec. 1926.502(d)(4) above. This new provision, which was not proposed, has been added to facilitate safe use of positioning devices.

Final rule paragraph (e)(7), like final rule paragraph (d)(5), requires that snaphooks be sized to be compatible with the member to which they are connected or be of a locking type designed to prevent disengagement of the snaphook and, that after December 31, 1997, only locking type snaphooks can be used in positioning device systems. In addition, final rule paragraph (e)(8), like final rule paragraph (d)(6), provides that for certain specified connections, only locking snaphooks designed for those connections can be used.

As discussed above in reference to paragraphs (d)(5) and (d)(6), OSHA solicited information in Issue 16 of the proposal regarding the need to require locking snap-hooks in personal fall arrest systems. The same concerns apply to the use of snap-hooks in positioning device systems. Therefore, the language of paragraph (d)(5) and (d)(6) of the final rule has been adopted as paragraphs (e)(7) and (e)(8) to ensure that only locking snaphooks are used and then only those designed for certain connections be used in the specified circumstances.

The SSFI (Ex. 2-89) noted that proposed Sec. 1926.502(e) had not set forth requirements for snaphooks or diameters of attachments to prevent "roll-out" and suggested that OSHA include them in the final rule, referencing its comments on Issue #16. As stated above, OSHA agrees that employees need the protection afforded by the snaphook requirements for both personal fall arrest systems and positioning device systems. OSHA also notes that compliance with this requirement will not impose increased burdens on employers, since all snaphooks will be subject to the same criteria whether they are used as part of a personal fall arrest system or part of positioning device system. OSHA also notes that these provisions on snaphooks are consistent with OSHA's final rule for Powered Platforms for Building Maintenance [54 FR 31471, July 28, 1989] and proposed Sec. 1920.129(c)(1) [55 FR 13437, April 10, 1990].

Final rule paragraph (e)(9), proposed as paragraph (e)(5), requires that positioning device systems be inspected prior to each use for damage and deterioration and that defective components be removed from service. This provision differs from the proposed provision, in that the phrase "if the strength or function has been adversely affected" has been deleted. As discussed in reference to final rule Sec. 1926.502(d)(21), Issue #17 raised questions regarding the need for more specific inspection criteria.

The ISEA (Ex. 2-23) suggested that OSHA delete the words "if their strength or function has been adversely affected." The implication was that if these words were deleted, the rule would be easier to understand, i.e., employers would simply remove components that were defective without having to make some determination about strength or function. As with Sec. 1926.502(d)(21) of the final rule, discussed above, OSHA agrees that deleting those words would make the rule easier to understand. Employers will simply remove components that are defective, in that they do not meet the criteria of paragraph (e), without having to make a specific determination about strength or function.

OSHA received several comments in response to Issue #17. As noted in regard to paragraph (d)(21), above, the response to Issue #17 regarding positioning device systems was the same as that regarding personal fall arrest systems.

After evaluation of the pertinent record materials, OSHA has determined that further information on the employer's inspection of positioning device systems should be provided in an appendix. Therefore, OSHA has included a specific paragraph on inspection considerations in the Non- mandatory Appendix D to subpart M to address the inspection requirements in Sec. 1926.502(e).

Final rule paragraph (e)(10), like final rule paragraph (d)(18), requires that body belts, harnesses, and components be used only for employee fall protection or positioning and not to hoist materials. This is a new provision and has been added to maintain consistency and facilitate compliance. Paragraph (e)(10) has been added for the same reasons discussed above in relation to paragraph (d)(18).

Paragraph (f) -- Warning line systems. This paragraph, which sets the same requirements as in the proposed rule and in existing Sec. Sec. 1926.500(g)(3)(i), (ii), and (iii), provides the criteria for use of a warning line system. OSHA notes that this paragraph is also consistent with proposed Sec. 1910.28(d), Designated areas, which would regulate analogous General Industry situations [44 FR 13402, April 10, 1990]. The basis for the existing requirements was discussed in detail in the preamble of the final rule for the Guarding of Low-Pitched-Roof-Perimeters During the Performance of Built-Up Roofing Work [45 FR 75618, November 14, 1980]. In brief, the Agency permitted the use of warning lines, under certain conditions, to warn employees that they were approaching an unprotected edge. The warning line system was permitted when work conditions made it impossible to use conventional fall protection systems.

One commenter, CAL/OSHA (Ex. 2-15), stated that warning line components should be marked to ensure compliance with the standard. As discussed above, CAL/OSHA also advocated marking personal fall arrest system components and positioning device system components. As with the other proposed paragraphs, OSHA has determined that such a requirement is not necessary for employee safety. However, employers are responsible for ensuring that rope, wire, or chains used for warning lines comply with the strength requirements of paragraph (f). OSHA's position is that it is compliance with the substantive provisions of paragraph (f), not the act of marking equipment, that improves employee protection. Therefore, OSHA has not made the suggested change.

In Issue #10 of the NPRM, OSHA noted that the term "mechanical equipment" was used to describe the type of equipment addressed in the provisions of proposed Sec. 1926.502(f) which related to built-up roofing work. The proposed definition of "mechanical equipment" provided that wheelbarrows and mopcarts would not be considered "mechanical equipment," continuing the approach taken by existing Sec. 1926.500(g); that is, that these two types of equipment do not require employees to move backward when using them and, therefore, they should not be

considered "mechanical equipment" for the purpose of determining the location of the warning line. Issue #10 asked if mopcarts and wheelbarrows should remain the only equipment not considered "mechanical equipment" for the purpose of the provisions of paragraphs (f)(1)(i) and (ii).

In response to Issue #10, three commenters recommended that the provision stay as proposed (Exs. 2-12, 2-43 and 2-99). The ACCSH recommended that no additional equipment be exempted from the provision. (Tr. 6/10/87; pp. 131-132) After evaluation of the record on this issue, OSHA has determined that wheelbarrows and mopcarts will remain outside the definition of "mechanical equipment," because no other equipment that merits exclusion from the definition has been identified.

Based on the rulemaking record, OSHA has determined that the provisions of paragraph (f) are appropriate as proposed, except that the term "built-up" which was used in proposed paragraph (f)(3) have been removed because the provision is no longer exclusive to built-up roofing work, but applies to all roofing work on low-sloped roofs. See change made in the definitions section (Sec. 1926.500) and under Sec. 1926.501(b)(10).

Paragraph (g) -- Controlled access zones. This paragraph sets minimum performance criteria for controlled access zones (CAZ). In the introductory text of paragraph (g), OSHA reminds employers that CAZ may only be used where employees are performing overhand bricklaying and related work or work under a fall protection plan, as provided by Sec. Sec. 1926.501(b)(2), (b)(9), (b)(12), and (b)(13).

OSHA proposed the use of controlled access zones as a way to limit the number of workers that would be exposed to the hazard of falling from unprotected sides or edges at those locations where the use of conventional fall protection systems is infeasible or creates a greater hazard. The only work situation where use of a CAZ is specifically permitted instead of conventional fall protection systems is where overhand bricklaying operations are taking place. However, employers who develop a fall protection plan under Sec. 1926.501(b)(2), (b)(12), or (b)(13), will also be required to establish controlled access zones.

Employers engaged in overhand bricklaying work may use a CAZ as long as the employee does not have to reach more than 10 inches below the walking/working level to do the work. Employers engaged in leading edge work, precast concrete erection work, or residential construction work who demonstrate infeasibility or greater hazard with the use of conventional fall protection systems will be required to develop and implement a fall protection plan which meets the requirements of paragraph (k). Paragraph (k)(7) requires the employer to establish a CAZ which meets the requirements of this paragraph (g).

In general, a controlled access zone is formed by erecting a line or lines -- referred to as control lines -- to restrict access to an area or to define the area in which employees will work without conventional fall protection. Sometimes only one line will be needed to define the area. The control line warns the employee that access to the CAZ is limited to authorized personnel. The line also designates the area where conventional fall protection systems are not in use.

As discussed in Sec. 1926.500(b), Definitions, the Mason Contractors Association of America (MCAA) (Ex. 2-95) suggested that OSHA change the name for the zone from "control zone" to "Controlled Access Zone (CAZ)." MCAA also suggested that OSHA provide diagrams of the zone so that the provisions of the control zone section could be more clearly understood. As discussed in the definitions section of this final rule, OSHA agrees with the MCAA that the revised term -- Controlled Access Zone -- more clearly describes the function of the zone by indicating that access to the zone is being controlled. OSHA has removed portions of the proposed provisions that were confusing and therefore is not providing diagrams.

Paragraph (g)(1) sets the distance from an unprotected side or edge that control zone lines are to be erected when leading edge operations or other activities are being performed and controlled access zones are permitted. When control lines are used, they shall be erected no closer than 6 feet nor farther than 25 feet away from the leading edge or unprotected edge. An exception is provided for the erection of precast concrete members, in which case, the control line must be no closer than 6 feet nor farther than one-half the size of the precast member being

erected, to a maximum of 60 feet. This exception is being made for precast concrete erection because it is sometimes necessary to "turn" a precast member which may be as long as 120 feet. If the control lines are too close, they could become entangled or uprooted as the concrete member is being positioned.

As a whole, paragraph (g)(1) is identical to the proposed provision, other than the location of the control line for precast concrete work and the clarification that any effective means to restrict entry to the zone is permitted. For example, if a home builder were operating under a fall protection plan, the home builder may designate the entire upper level of the home as a CAZ and restrict entry to that zone to only those workers needed to set roof trusses. The home builder could restrict entrance to the zone by placing a sign or by using tape or a chain to communicate to workers that access to the upper floor is restricted to only those employees identified in the fall protection plan. If the only way to reach the upper level is by stairway, the sign, tape or chain could be placed at the top or bottom of the stairway.

The same situation could arise on a precast concrete site where the entire upper level is designated as the CAZ and all entrances to the level are marked to indicate that access is restricted. The intent of the provision is to restrict access to the danger zone. As long as the means chosen to restrict access is effective, i.e., workers do not enter the restricted area unless they are authorized by the fall protection plan to enter the CAZ, the intent is accomplished.

The 6-foot limitation was proposed as an adequate distance away from the edge to warn employees that they are approaching an unprotected side or edge. The 25 foot maximum allows a reasonable amount of work to be done before the CAZ needs to be moved.

Paragraph (g)(1) of the final rule also requires that the control line be connected on each side to a guardrail system or to a wall. OSHA proposed this language to ensure that there was no gap between the coverage of the controlled access zone (CAZ) and that of the fall protection required for other areas of the pertinent work zone. OSHA reminds employers that all employees working outside the controlled access zone (CAZ) must be provided fall protection as required by Sec. 1926.501(b)(1) if they may be exposed to fall hazards. As the CAZ changes [moves forward as the work progresses at the leading edge], it exposes unprotected sides and edges perpendicular to the leading edge. The employer must ensure that any employees who may be exposed to falls of 6 feet (1.8 m) or more at those perimeters are provided with fall protection that complies with Sec. 1926.501(b)(1). Again, OSHA notes that this situation only occurs when two groups of workers are working on the same level and one group of workers is working in a CAZ and the other is being protected by conventional fall protection systems.

For example, precast concrete workers may be connecting floor or roof members at the leading edge while other workers are engaged in "grouting" activities outside the CAZ. As each precast member is added, the CAZ moves forward and the control line moves forward, creating sections of unprotected sides and edges outside the CAZ from which workers engaged in grouting or other activities could fall. Those employees must be afforded protection from falls of 6 feet or more from the unprotected sides and edges of the floor, roof, or other walking/ working surface as required by Sec. 1926.501(b)(1); or as required under fall protection plans where such plans are permitted.

Seedorf Masonry (Ex. 2-153) commented that the proposed provision caused confusion and asked if its system of using special stanchions which bolt onto floor edges to support guardrail systems would be eliminated by proposed paragraph (g)(1). OSHA observes that nothing in this final rule prohibits the use of the special stanchions described by Seedorf Masonry.

The Precast/Prestressed Concrete Institute (PCI) (Exs. 2-44, 2-107, 25-4, 27-7, and 27-10) recommended that the control zone lines for precast concrete erection be kept as much as 60 feet away from the leading edge and reinstalled from time to time as the leading edge changes location. They explained that "* * * a member may be as long as 120 feet and, if it is necessary to rotate the member, at least half its length -- 60 feet -- would be required

to avoid entanglement in the control zone lines". As noted above, OSHA agrees that additional distance may be necessary when performing precast concrete erection work for the reasons stated, and has revised paragraph (g)(1) accordingly.

Paragraph (g)(2) requires control zones used during overhand bricklaying operations to be not less than 10 feet nor more than 15 feet from the working edge where the overhand bricklaying operations are underway. These limits were developed after extensive consultation with industry and union representatives and review by the ACCSH. The enclosed zone is intended to provide overhand bricklayers with an area free of interference from other employees not performing related work. Paragraph (g)(2) prohibits employees, other than those performing overhand bricklaying and related operations, from being in CAZs that have been set up for the bricklaying operations.

This provision is essentially the same as the proposed provision. One commenter (Ex. 2-21) suggested that the line designating the control zone be erected not less than 6 feet from the edge instead of the proposed 10 feet, while another commenter, Seedorf Masonry (Ex. 2-153) stated its total agreement with the proposed 10-foot requirement. OSHA agrees that at least 10 feet of space is necessary to provide overhand bricklayers with adequate working space. Another commenter (Ex. 2-56), apparently confused by the requirement, noted that the provision needed clarification "as it will relate to bricklayers working on the leading edge * * *." OSHA observes that overhand bricklaying operations are not considered leading edge operations. While the use of a controlled access zone is permitted for both operations, the criteria for the zone vary depending on whether the employee is laying bricks (or related work), constructing a leading edge, or performing some other activity in the controlled area.

Paragraph (g)(3) requires the control lines to be made of ropes, wires, tapes, or other equivalent materials (i.e., material that can meet the requirements of paragraph (g)(3)), and supported on stanchions. Paragraph (g)(3)(i) requires the system to be flagged or otherwise clearly marked at 6-foot intervals. Paragraphs (g)(3)(ii) regulates the height of the control zone lines. Overhand bricklaying control zone height limits are higher than those for other work to allow the ready passage of materials underneath the line. Paragraph (g)(3)(iii) requires the line to have a minimum breaking strength of 200 pounds. This minimum strength is required to assure that the lines will not break if an inattentive worker walks into the line.

The proposed paragraph was identical, except as discussed below. There was only one comment on this provision. Seedorf Masonry (Ex. 2-153) noted its total agreement with all of paragraph (g)(3).

OSHA notes that it has revised proposed paragraph (g)(3) by removing the reference to "access path." In the proposed rule, access path lines would have been used to identify paths from the controlled access zone to other areas on the floor or roof that bricklayers might need to gain access. OSHA has decided that these provisions could cause considerable confusion and, accordingly, has deleted the mention of access paths. Instead, OSHA has simply stated that a controlled access zone must be enlarged as necessary to permit overhand bricklaying and related work to take place.

Paragraph (g)(4) sets forth criteria for setting up a controlled access zone on a floor or roof where guardrail systems are not in place prior to the beginning of overhand bricklaying operations. Paragraph (g)(5) sets forth criteria for setting up a controlled access zone on a floor or roof where guardrail systems are in place prior to the beginning of overhand bricklaying operations. These two paragraphs are essentially the same as proposed paragraphs (g)(4), (g)(5) and (g)(6).

If a guardrail system has not already been set on the pertinent floor or roof where the bricklaying work is to be done, the controlled access zone must be large enough to enclose all points of access, materials handling areas and storage areas. Final rule paragraph (g)(5), which is essentially identical to proposed paragraph (g)(6) provides that where guardrail systems are already in place (because other trades are using them), and bricklaying work is to be done, those guardrail systems may be removed to the extent necessary to accomplish that day's work.

One commenter stated that the proposed paragraphs (4) and (5) were quite confusing (Ex. 2-153). OSHA agrees that the language of the proposed paragraph (g)(4) was confusing because it included provisions for forming access paths which were two lines similar to control zone lines. As OSHA did in paragraph (g)(3) above, it has removed references to access path lines in paragraph (g)(4). The provision is now clear that if there are no guardrail in place already, the CAZ must be large enough to enclose all areas where the masons and mason tenders are exposed to fall hazards from unprotected edges. Seedorf (Ex. 2-104) also noted that the proposed provision appeared to prohibit employees from leaving the control zone unless there were guardrails on the open floor. OSHA observes that this perception is basically correct. The concept of a controlled access zone is to establish an area of limited size in which only certain employees can enter and work without fall protection because conventional fall protection systems cannot be used. Employees must be protected at all times from fall hazards at unprotected sides and edges when they leave the controlled access zone. For example, if a bricklayer is working on one side of the floor, a controlled access zone will be established for that area. When the bricklayer leaves the control zone and is exposed to fall hazards elsewhere on the floor or roof, fall protection is required.

Proposed paragraph (g)(7) has been deleted because paragraph (g)(2) of the final rule already makes it clear that only those employees engaged in overhand bricklaying (including related work (Sec. 1926.501(b)(9)) are permitted in the controlled access zone. The only other employees that are permitted to work in CAZs are those employees so designated in a fall protection plan. In such cases, Sec. 1926.502(k)(9) requires the employer to identify those employees and does not permit other employees to enter the zone.

Paragraph (h) -- Safety monitoring systems. This paragraph contains the criteria which must be followed when safety monitoring systems are being used. Safety monitoring systems may be used to protect employees engaged in roofing operations on low-slope roofs (See Sec. 1926.501(b)(10)) and employees engaged in leading edge operations, precast concrete or residential construction work through the use of safety monitoring systems as part of a fall protection plan (See Sec. 1926.502(k)). Existing rule Sec.1926.500(g) provides for the use of safety monitoring systems on low-slope roof perimeters during built-up roofing work and the existing definition in existing Sec. 1926.502(p)(7) provides criteria for safety monitoring systems.

Paragraph (h)(1) requires the employer to designate a competent person as the safety monitor and to ensure that the monitor meets certain requirements including being able to recognize fall hazards. The safety monitor is required to warn an employee who appears to be unaware of a fall hazard or is acting in an unsafe manner. The monitor must also be on the same surface and within visual sighting distance of the monitored employee and close enough to communicate orally with the monitored employee. The monitor may have additional supervisory or non-supervisory responsibilities, provided that the monitor's other responsibilities do not interfere with the monitoring function. This provision effectively restates existing Sec. 1926.502(p)(7).

Paragraph (h)(2) prohibits the use of mechanical equipment where safety monitoring systems are being used to protect employees from falling off low-slope roofs. This is essentially the same requirement as in existing Sec. 1926.500(g)(4).

Paragraph (h)(3) prohibits employees not engaged in roofing work on low-sloped roofs or employees covered by a fall protection plan from being in an area where other employees are protected by a safety monitoring system. As explained in the preamble to the proposal, OSHA believes that the presence of extraneous employees in these areas can interfere with work procedures necessary for the effective use of the safety monitoring system. OSHA notes that this provision is consistent with the provisions of paragraph (k) which also prohibits employees from entering a CAZ because a safety monitoring system or other non-conventional fall protection system is in use in the CAZ.

Paragraph (h)(4), which has been added to the final rule, requires that each employee performing work in safety monitoring systems areas comply with directions from safety monitors to avoid fall hazards. Both the existing rule (Sec. 1926.502(p)(7)) and the proposed rule (Sec. 1926.502(h)(1)) clearly indicate that the safety monitor must be a "competent person," which means that the monitor must be capable of identifying workplace hazards and have

the authority to take prompt corrective measures. Within the context of the safety monitoring system, the "corrective measures" are to have the affected employees move away from the unprotected side or edge or use other work procedures to avoid fall hazards. OSHA has added this requirement to indicate clearly that employers must direct their affected employees to comply with the warnings of the safety monitor.

There were several comments on the criteria for the use of safety monitoring systems. MOSH (Ex. 2-31) recommended that OSHA delete requirements relating to the safety monitoring systems which it felt would be difficult to enforce. In the final rule, OSHA allows the use of safety monitoring systems only where the employer can demonstrate that it is infeasible or creates a greater hazard to use other conventional systems, except on low-slope roofs, where employers may generally use a combination safety monitoring system and warning line system. OSHA believes that the use of safety monitoring systems are appropriate in situations where conventional fall protection systems cannot be implemented. It is, however, necessary for employers to recognize that merely designating an employee as the safety monitor will not meet the criteria of this paragraph. Persons who do not satisfy all of the criteria specified in this paragraph and whose other duties compromise their ability to monitor employees exposed to fall hazards do not meet the requirements for being safety monitors. Hence, the employer who uses such a person as a safety monitor will not be in compliance with the duty requirements of Sec. Sec. 1926.501 or 1926.502. In other words, having a designated safety monitor "in name only" is the same as not having a monitor at all. OSHA emphasizes that safety monitoring systems are a last resort when other conventional systems are infeasible -- meaning that is it is impossible to accomplish the work using the conventional systems -- or the conventional systems create a greater hazard. Hence, when employers encounter the infrequent situation which permits the use of safety monitoring systems as an alternative fall protection measure, employers must comply with each and every provision of this paragraph, because otherwise the safety monitoring system is invalid.

NIOSH (Exs. 2-33 and 27-6), which expressed its opposition to the use of safety monitoring systems on leading edges (see discussion under Sec. 1926.501(b)(2) above), recommended that if such systems were permitted, OSHA should modify paragraph (h) to specify both the number of workers that can be monitored by one person, specify the area over which these workers may be distributed, and to set a maximum noise level to ensure effective communication. However, they offered no specific suggestions as to what those criteria should be. While OSHA is not specifying the number of employees that can be monitored by any one safety monitor, OSHA will expect such information to be included in fall protection plans when they are developed and the number of monitors will depend on the different functions the employees are performing while being monitored, the closeness of workers to monitors, and other such considerations. In other words, if one safety monitor is assigned to monitor employees who are not all in the same area, OSHA will deem the monitor unable to meet the requirements of(h)(1) and, therefore, conclude that there is no monitoring system in effect. OSHA expects there will be situations where one monitor is designated to monitor only 2 employees and other situations where a few more could be monitored. If a monitor is assigned to monitor 5 employees and 3 of those employees are working in front of the monitor, and the other 2 are working behind the monitor, OSHA will determine that there is no monitor for the 2 employees who obviously cannot be under supervision if the monitor is monitoring the other three. Likewise, weather conditions can limit the use of safety monitors. OSHA will expect such information to be discussed in fall protection plans. For example, OSHA would not expect safety monitoring systems to be implemented in weather conditions that interfere with visibility.

The Building Trades Employers' Association of Boston and Eastern Massachusetts, Inc. (Ex. 2-26) commented that, while it did "not find fault with the concept [safety monitoring systems]," it opposed the requirement in proposed paragraph (h)(1)(vi) -- that monitors must not be so busy with other responsibilities that their monitoring function is encumbered -- because that provision would, in effect, cause the hiring of additional personnel to act exclusively as monitors.

OSHA observes that proposed paragraph (h) is intended to guide employers who must follow what OSHA itself considers to be the least acceptable option for protecting employees from falls.

Another commenter, the Precast/Prestressed Concrete Institute (Ex. 2-107) stated "1926.502(h), Safety Monitoring Systems, is a practical and reasonable method to perform the work of the concrete hollow core industry * * *."

In addition, Seedorf Masonry (Ex. 2-153) stated its agreement with the requirements in paragraph (h)(1), but stressed that it would not want them to apply in control zones where overhand bricklaying operations are taking place. OSHA observes that safety monitoring systems are not listed as an option for fall protection in overhand bricklaying operations, so paragraph (h) would not be applicable. Again, OSHA points out that the use of safety monitoring systems is allowed only to protect employees engaged in roofing operations on low-slope roofs or employees constructing leading edges, or engaged in precast concrete or residential construction work, who are operating under a fall protection plan meeting the requirements of Sec. 1926.502(k).

Paragraph (i) -- Covers. This paragraph sets the performance criteria for covers when they are used to protect employees from falling into or through holes in floors, roofs, and other walking/working surfaces. The proposed requirements, based on existing Sec. 1926.500(f)(5), were identical to the final rule, except as discussed below.

Paragraph (i)(1) requires that covers in roadways and vehicular aisles be capable of supporting, without failure, at least twice the maximum axle load of the largest vehicle expected to cross over the cover. There were no comments on this provision.

Paragraph (i)(2) requires that all other covers (those not addressed by paragraph (i)(1)) be capable of supporting, without failure, at least twice the weight of any employee (including any equipment or material the employee may be carrying) who may be on the cover. This provision differs from both the proposed and the existing rules. Existing Sec. 1926.500(f)(5)(ii) requires floor opening covers not located in roadways or vehicular aisles to be capable of supporting the maximum intended load. The proposed rule kept the maximum intended load requirement and added a requirement that a cover be able to support 250 pounds, based on what OSHA considered to be the average maximum weight of an employee with tools. One commenter (Ex. 2-46) was apparently concerned with OSHA's determination that 250 pounds represented the average employee with tools. The ACCSH recommended that no weight at all be placed on the covers addressed in proposed paragraph (i)(2) (Tr. 6/10/87; pp. 109-113). However, OSHA feels that it is reasonable to anticipate that employees will walk on covers. OSHA is also concerned that employees could fall onto the covers, going through them if they were not sufficiently strong and secured. As one ACCSH member put it, (Tr. p. 110) "Sometimes a material used for covers is not sufficient to handle weights on them."

Based on the comments and recommendations received, OSHA has determined that it is inappropriate to prohibit employees from being on covers and that employees will be adequately protected by a requirement for each cover to be strong enough to prevent them from falling into holes. Therefore, OSHA is revising proposed paragraph (i)(2) to require covers to support twice the weight of the employees, equipment and materials that may be put on the cover. As noted above, paragraph (i)(1) has set "twice the weight" as the strength requirement for covers over which vehicles will pass. OSHA believes twice the weight of the employee, equipment and materials would be appropriate here also.

Paragraph (i)(3) requires covers to be secured when installed so as to prevent accidental displacement by wind, equipment, and employees. Proposed paragraph (i)(3), which was based on existing Sec. 1926.500(f)(5)(ii), required covers to be installed so as to prevent accidental displacement. OSHA has revised the proposed paragraph to state more clearly OSHA's intent that covers be secured when installed so that employees cannot easily remove them, and so that wind and equipment will not accidentally cause covers to be displaced.

Paragraph (i)(4) requires all covers to be color coded or the word "HOLE" or "COVER" must appear on the cover to serve as a warning to employees of the hazard. A note in paragraph (4) indicates that OSHA does not intend for employers to color code or mark the permanent cast iron manhole covers or steel grates which cover street or roadways openings or similar kinds of covers that may be encountered on a construction worksite.

Paragraph (i)(4) is a new requirement in the final rule. The change in paragraph (i)(3) and the new provision in (i)(4) have been made after consideration of recommendations presented to OSHA by ACCSH (Tr. 6/10/87; pp. 109-113) and as a result of the evaluation of the comments received in response to Issue #7 of the proposed rule, in which OSHA specifically asked whether or not covers should be marked or color coded.

Many commenters, in response to Issue #7, supported adding a requirement that employers mark or color code covers to prevent accidental displacement (Exs. 2-12, 2-20, 2-36, 2-41, 2-43, 2-45, 2-46, 2-50, 2-89, and 2-99). For example, the BCMALU (Ex. 2-46) commented that covers should be marked and color-coded so the worker does not pick up a cover and walk into the hole. They explained that the marking on the cover would alert the worker that it is something other than a plain piece of lumber. Other commenters supported both marking and color coding. One commenter (Ex. 2-99) approved of marking covers, but stressed the importance of covers being sufficiently strong and secured. Another commenter (Ex. 2-153) supported the provisions in paragraph (i) as they were proposed.

Bristol Steel and the NEA (Exs. 2-12 and 2-43) commented, "Lifting covers unintentionally and then stepping through the uncovered hole is a significant hazard which could be reduced if covers were marked or fastened down." They listed three accidents caused by unintentional removal of covers. The accidents resulted in one fatality and two permanent disabilities. They also pointed out "it is not always feasible to fasten covers to permanent building materials without causing unacceptable damage; consequently the alternative for marking covers is proposed." Bristol Steel and NEA suggested that Sec. 1926.502(i)(3) be changed to read "All covers shall be installed so as to prevent accidental displacement. Covers shall be marked to indicate their function as a cover or shall be securely fastened down to prevent unintentional removal."

The United Union of Roofers, Waterproofers and Allied Workers (Ex. 2-99) commented that covers should be strong enough to withstand the weight of men and materials, and that they should be securely fastened to prevent their being displaced. In addition, while stating that they had no objection to marking covers to indicate their function, they stated that marking covers "must not be allowed in lieu of securely fastening such a cover to prevent accidental displacement."

The ACCSH recommended that covers be painted a distinctive color and be fastened in place and that no weight should be permitted on them. (Tr. 6/10/87; pp. 109-113).

A few commenters responded that covers should neither be marked nor painted because of maintenance problems, i.e., the markings would wear off. (Exs. 2-16, 2-19, 2-47, 2-92 and 2-140). As discussed above, OSHA agrees that painting or labeling covers is necessary for the enhanced safety afforded affected employees.

Paragraph (j) -- Protection from falling objects. This paragraph sets forth the performance criteria for providing protection from falling objects. All of the provisions are identical to the proposed provisions, except as provided below.

Paragraph (j)(1) requires toeboards, when used, to be erected along the edge of overhead walking/working surfaces for a distance sufficient to protect employees working below. This is a change from existing rules in Sec. 1926.500(b)(1), (2), (3)(ii), and (8), which require toeboards around floor, roof, and platform holes and openings regardless of whether or not employees are working below. However, paragraph (j)(1) is consistent with the intent of the existing rule in Sec. 1926.500(d)(1) and Sec. 1926.501(e) of the final rule which require protection only where employees below are exposed to the hazard of falling objects.

Paragraph (j)(2) is a new requirement and it specifies toeboards shall be capable of withstanding, without failure, a force of at least 50 pounds. This requirement was proposed to set a minimum strength for toeboards to ensure the ability of the toeboard to restrain falling objects.

Paragraph (j)(3) specifies how toeboards are to be installed and is essentially the same as the existing requirement in Sec. 1926.500(f)(3)(i), except the minimum height of the toeboard has been reduced from 4 inches to 3 1/2 inches. In the NPRM, OSHA proposed to change not only the maximum vertical height of the toeboard, but the size of the opening or gap between the toeboard and the walking/working surface. The existing rule set the maximum size of that opening at 1 4-inch and OSHA proposed to allow a 1/2-inch clearance. OSHA received one comment on the proposed provision. The TVA (Ex. 2-20) noted that "many small tools can pass through a one-half inch opening * * *." OSHA also notes that the ANSI A 1264.1-1989 standard sets 1/4 inch as the maximum clearance. Based on this information, OSHA has determined that the existing rule more adequately addresses the hazard and has revised the proposed provision accordingly.

Paragraph (j)(4) provides that additional protection, such as paneling or screening erected from the working level or toeboard to the top of the top rail or midrail, must be used where tools, equipment, or materials are higher than the top of a toeboard. This requirement is substantively the same as the existing requirement in Sec. 1926.500(f)(3)(ii).

Seedorf Masonry (Ex. 2-153) questioned whether employers would have to install a screening system on floors or scaffolds since they typically pile brick and block units on floors and scaffolds and the pile is higher than the height of a toeboard. OSHA notes that the use of toeboards, screens or guardrail systems is one of the options allowed in Sec. 1926.501(c) of the final rule. Paragraph (j)(4) simply requires that employers who choose to use toeboards as the method of preventing objects from falling onto employees working below, take the necessary precautions to ensure that objects do not fall over the toeboard. Employers can choose from among other options listed in Sec. 1926.501(c) to provide the necessary protection. However, if an employer chooses to use toeboards, the employer would be required to install panels or screens that are high enough to keep bricks from falling to lower levels if the height of the bricks exceeds the height of the toeboard, so that appropriate protection is afforded employees working below.

Paragraph (j)(5) requires that when guardrails are used to prevent objects from falling, the openings in the guardrail must be small enough to retain the potential falling objects. This is essentially the same as the existing requirement in Sec. Sec. 1926.500(c)(1)(ii) and (f)(7)(ii) except the specific limitations on hole size have been deleted.

Paragraph (j)(6) contains housekeeping provisions for overhand bricklaying operations which are intended to prevent tripping and to prevent displacement of materials and equipment to areas below the walking/working surface.

Paragraph (j)(7) sets forth provisions for storing materials and equipment during roofing operations. These are essentially the same requirements as those set in existing 1926.500(g)(5) (vi) and (vii).

Paragraph (j)(8), which did not appear in the proposal, requires that when canopy structures are erected, they shall be strong enough to prevent collapse or penetration of falling objects.

In Issue #8, OSHA noted that proposed Sec. 1926.501(e) [final rule Sec. 1926.501(c)] allowed the use of protective canopies for falling object protection and requested comments on what criteria should be specified in Sec. 1926.502(j) to ensure proper protection. SSFI (Ex. 2-89) commented that "Historically canopies have been designed for 150 to 300 pound design loads or `light debris'. It is recommended that use of this type of canopy be continued." The National Constructors Association (Ex. 2-45) commented that a performance standard would be more appropriate, stating "It is not practical to attempt to write regulations on protective canopies * * * ." ACCSH (Tr. 6/10/87; p. 113) recommended that canopy structures be strong enough to avoid collapse or penetration when falling objects strike them. Bristol Steel and the NEA (Exs. 2-12 and 2-43) stated, "No additional criteria for protective canopies are needed." Miller and Long (Ex. 2-41) commented that many methods of protection against

falling objects are available and that, given the changeability of the work environment, "a variety of methods should be included. Another commenter, Ex. 2-46, stated "Canopies or catch alls should be used when chipping of concrete with electric or pneumatic chipping guns are used."

In view of the comments received, OSHA has determined that the record does not contain sufficient information to formulate detailed criteria for the many types of canopy structures. However, the record does support OSHA action to set a minimum level of performance for canopies suited to their function which is to prevent falling objects from reaching employees. OSHA agrees that the canopy must be strong enough to perform its intended function if the employer provides canopy structures as the method to protect employees from falling objects.

Paragraph (k) -- Fall protection plan. OSHA is promulgating paragraph (k), which was not part of the proposed rule, to address the measures that employers who are constructing leading edges, or are engaged in precast concrete construction or residential construction work must take when they establish, pursuant to final rule Sec. Sec. 1926.501(b)(2), (b)(12) or (b)(13), that it is either infeasible or would create a greater hazard to protect employees from fall hazards using guardrail systems, safety net systems, or personal fall arrest systems for employee fall protection. OSHA has explained under Sec. Sec. 1926.501(b)(2), (b)(12) and (b)(13) what conditions could enable a contractor to meet the criteria to use a fall protection plan.

Final rule Sec. Sec. 1926.501(b)(2),(b)(12) and (b)(13) contain notes which indicate clearly that OSHA approaches the pertinent work activities with the presumption that it is feasible and will not create a greater hazard to implement at least one of the three specified conventional fall protection systems. The notes also underscore that the employer has the burden of establishing that it is appropriate to implement a fall protection plan which complies with Sec. 1926.502(k) for a particular workplace situation. OSHA believes that the inclusion of these notes will facilitate understanding of and compliance with paragraph (k) of the final rule.

Paragraph (k) had its origin in comments received in response to Issue #2 of the notice of hearing in which OSHA asked if there were areas or operations, in addition to those already identified in proposed Sec. 1926.501, which had unique fall protection requirements not addressed by the proposed standards and in a Notice of Record Reopening in (57 FR 34659; August 5, 1992) discussed above in relation to Sec. 1926.501(b)(12). OSHA requested commenters to describe such areas and operations in detail and to discuss the fall protection measures which would be appropriate for those situations.

In response, the Precast/Prestressed Concrete Institute (PCI), in addition to their written comments (Ex. 2-44, 2-106, and 2-107), presented testimony at the public hearing noting that, "* * * our field erection is work not appropriately covered by the proposed regulations; rather, precast concrete erection should be listed as a separate subpart (or preferably included along with steel erection in Subpart R)." A full discussion of PCI's comments, along with OSHA's decisions, are provided along with the discussion of Sec. 1926.501(b)(12) above.

A number of commenters (Exs. 27-5, 27-7, 27-10, 27-21, 27-22, and 27-28) responded to the reopening of the record and suggested that OSHA promulgate the criteria from the Notice of Record Reopening as the alternative "fall protection plan" for the precast concrete construction industry.

Several commenters (Exs. 27-1, 27-2, 27-6, 27-9, 27-25, 27-36, and 27-42) opposed allowing precast concrete construction employers to protect their employees by any means other than conventional fall protection (guardrail systems, personal fall arrest systems and safety net systems). Some of these commenters (Exs.27-6, 27-9 and 27-25) were especially skeptical of safety monitoring systems as an alternative to conventional measures. In particular, one commenter (Ex. 27-25) stated:

There are no conditions where OSHA should allow precast concrete construction employers to institute anything other than a conventional fall protection system to protect workers.

Safety monitoring, controlled access zones systems and a fall protection plan are examples of additional controls which should be considered in addition to conventional fall protection systems.

Regulations must be developed which will require design and installation of anchor points during the construction process so that workers will have attachments available for fall arrest protection. Exposure time should not be a considering factor when evaluating whether to protect a worker. The protection of any worker who needs to come within two feet of a floor or roof edge for a few seconds should not rely on an observer when it could be accomplished by an area limiting tethering device, or other fall arrest system. the use of a "safety monitor" should not be allowed in place of personal fall protection equipment.

This commenter invoked a comment by NIOSH (Ex. 27-6) which stated as follows:

Reliance on passive measures, such as safety harnesses, is generally recognized as more effective than reliance on active measures that require worker involvement and attention in order to function. Using a monitor to keep another worker from the edge would require the active involvement of both the monitor and the worker to ensure safety.

As discussed above in relation to Sec. 1926.501(b)(2) of the final rule, OSHA believes that construction employers, including those who erect precast concrete structures, can, in general, protect their employees from fall hazards with conventional fall protection, and is requiring that they do so as a general rule. The Agency agrees with the commenters who have stated that including fall protection in the planning and designing of construction work (such as by including anchor points for personal fall arrest systems in the construction design specifications) can enable construction employers to implement appropriate protection. OSHA acknowledges, however, that there may be circumstances where, despite their best efforts, construction employers cannot provide conventional fall protection, such as when grouting operations are underway, and when home builders are setting or bracing roof trusses. When an employer establishes, through compliance with Sec. 1926.501(b)(12), that such circumstances exist, the Agency believes that it is appropriate to require the implementation of alternative measures through which the employer minimizes the fall hazards for affected employees.

OSHA has already recognized that circumstances may arise in the course of overhand bricklaying and roofing operations which would preclude the use of conventional fall protection. In such cases the Agency requires that employers take specific alternative measures to minimize fall hazards for affected employees. The Agency believes that requiring those alternative measures, when conventional fall protection cannot be used, will provide the best opportunity to avert employee injury and death. OSHA has determined that it is also appropriate to set alternative measures for leading edge construction, precast concrete construction, and residential construction work so employers have clear direction as to what they must do if the use of conventional fall protection is infeasible or would cause a greater hazard in a particular work area.

As discussed above, the Agency has set criteria in Sec. 1926.501(b)(2), (b)(12), and (b)(13) for employers who seek to establish that the use of fall protection is infeasible or would create a greater hazard for employees when constructing leading edges or performing precast concrete or residential construction work. Employers who satisfy those criteria must implement a written "fall protection plan" which complies with Sec. 1926.502(k). OSHA is adding Non-mandatory Appendix E to provide a sample fall protection plans which contains the elements and the detail necessary for the Agency to consider the plan to be in compliance with paragraph (k). This non-mandatory appendix is provided for the benefit of employers who need guidance in developing their fall protection plans.

Paragraph (k)(1) provides that a written fall protection plan must be prepared by a "qualified" person (as defined by 29 CFR 1926.32(m), that the plan be developed specifically for the site where the work is being done, and that the plan be maintained up to date. The definition in Sec. 1926.32(m) describes "qualified" as a person who "has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project." The inclusion of these requirements was suggested by PCI (Ex. 25-4) and addressed in the August 5, 1992, record reopening notice (57 FR 34656).

Employers whose workplace situations satisfy the criteria of 29 CFR 1926.501(b)(2), (b)(12) or (b)(13) still must develop and implement alternative measures that protect affected employees from fall hazards. It is clear that the abilities of the personnel who develop those measures will strongly influence their effectiveness. The Agency has determined that the abilities of a qualified person are needed to ensure that the fall protection plan minimizes fall hazards. OSHA notes that an employer may use the services of more than one qualified person to comply with these requirements, as long as (1) those persons, collectively, are qualified to prepare the fall protection plan and approve any changes; and (2) the resulting plan complies with the applicable requirements of the standards.

Paragraph (k)(1) also provides that the fall protection plan must be developed for the specific site where the work is being done. OSHA notes that the designs, erection plans and circumstances for one site will, in many cases, differ significantly from those for another site. Accordingly, the fall protection plan for the one site may well be inapplicable to the other or may require substantial modification before it can be used. This provision was suggested by PCI (Ex. 25-4) and was addressed in the August 5, 1992, notice of record reopening (57 FR 34659). The Agency anticipates that compliance with this requirement will enable an employer to take measures which minimize the fall hazards at each site.

Paragraph (k)(1) also requires that the fall protection plan be maintained up to date. The employer must review the fall protection plan as necessary to determine if it still fits the workplace situation and must modify the plan as necessary to maintain its effectiveness, such as when elements of the plan have become inapplicable due to changes in the design, erection plan or other circumstances of a site. This provision was suggested by PCI (Ex. 25-4) and was addressed in the August 5, 1992, notice of reopening (57 FR 34659). It provides clear notice to employers that they have an on going responsibility to monitor their projects and to revise their fall protection plans to address changed conditions.

Paragraph (k)(2) provides that any changes in a fall protection plan must be approved by a qualified person. The qualified person may either sign or initial and date the changed portion of the fall protection plan to indicate approval of the plan as modified. This provision, like paragraph (k)(1), reflects the Agency's belief that the characteristics set out in 29 CFR 1926.32(m) are needed to assure that the person who sets the terms of the fall protection plan has the requisite ability and judgment. This provision was suggested by PCI (Ex. 25-4) and was addressed in the August 5, 1992, notice of record reopening (57 FR 34659). The decision regarding the acceptability of any potential plan changes may be made by any person or persons "qualified" to do so. OSHA believes that compliance with this paragraph will ensure that changes to fall protection plans receive the same careful scrutiny as the original plans.

Paragraph (k)(3) requires that a copy of the fall protection plan, with all approved changes, be maintained at the job site, available for inspection by employees and their authorized representatives. In many cases, the opportunity to review the plan will provide the necessary reassurance to employees that the employer has taken appropriate measures to minimize exposure to fall hazards. In other cases, review of the plan will alert employees to deficiencies that need to be brought to the employer's attention for correction. This provision was suggested by PCI (Ex. 25-4) and was addressed in the August 5, 1992, notice of record reopening (57 FR 34659). The Agency believes that compliance with this paragraph will both facilitate operations and help ensure that the fall protection plan fits the actual workplace conditions.

Paragraph (k)(4) provides that the implementation of the fall protection plan must be supervised by a "competent person". That term is defined in 29 CFR 1926.32(f) to mean "one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them." The proper implementation of a fall protection plan will require unflagging vigilance and decisive action. Without the "built-in" protection of a guardrail, safety net or personal fall arrest system, employees must rely on safety monitors and

other measures to warn them away from fall hazards. This provision indicates clearly that employers must assign supervisors who can promptly identify and correct any problems arising under the plan. This provision was suggested by PCI (Ex. 25-4) and was addressed in the August 5, 1992, notice of record reopening (57 FR 34659).

OSHA notes that a "competent person" who also has the abilities of a "qualified person" will be particularly well-positioned to develop and implement solutions to fall protection problems. The Agency has not required that the supervisor be both "competent" and "qualified", because OSHA believes that such consolidation of function is not essential for employee protection. Also, the Agency recognizes that more than one person can be a "competent person" for the purposes of paragraph (k)(6), as long as those persons, collectively, exercise the requisite oversight and authority.

Paragraph (k)(5) provides that an employer who determines that conventional fall protection cannot be used at a particular worksite must document the reason why the use of conventional fall protection systems (guardrail systems, safety net systems, or personal fall arrest systems) are infeasible or why their use creates a greater hazard. OSHA has provided guidance in its discussion of Sec. 1926.501(b)(2), (b)(12) and (b)(13) to assist employers in identifying what constitutes infeasibility and greater hazard. Employers must explain in writing, before work begins, for each of the three conventional systems, why those systems cannot be used at the specific location where the fall hazard is present. This provision was suggested by PCI (Ex. 25-4) and was addressed in the August 5, 1992, notice of reopening (57 FR 34659).

The process of developing the rationale will help the employer to understand the real limits, if any, on the use of fall protection. An employer who at first assumes that conventional fall protection cannot be used may well discover upon closer examination that employees in all or part of those operations can use conventional fall protection. In addition, the documentation required by paragraph (k)(5) will enable OSHA to determine if there is an objective basis for the employer's finding that its operations meet the criteria of Sec. 1926.501(b)(2), (b)(12), or (b)(13). The purpose of paragraph (k)(5) is to limit the use of fall protection plans to those situations where such use is justified.

Paragraph (k)(6) requires the employer, after complying with paragraph (k)(5) above, to document in the written fall protection plan the measures that the employer will take to reduce or eliminate the fall hazard in work areas where conventional fall protection systems cannot be used. For example, if safety monitoring systems and control zone systems are going to be used, the written plan must so state. The employer must comply with all of the provisions described in the fall protection plan as alternative measures. It will not be acceptable for employers, under paragraph (k)(6) to list "nothing" or "no measures to be taken" as the alternative measure. At the very minimum, the safety monitoring system (see paragraph (k)(8) must be employed and all of the criteria in paragraph (h) of this section followed. OSHA notes, at this point, that if a safety monitoring system is to be used, the designated monitor must fulfill all of the criteria in paragraph (h). If monitors are given other work assignments, such as those discussed under paragraph (h) of this section, which render them unable to monitor other employees effectively, OSHA will view that situation as "not in compliance." Therefore, employers may need to designate more than one monitor so that a monitor is always available to fulfill the criteria of Sec. 1926.502(h).

In situations where conventional systems are not used, OSHA does not encourage employers to elect the safety monitoring system as a first choice. Rather, the Agency will permit it to be used in those circumstances when no other alternative,more protective measures can be implemented. Examples of such more protective measures include having employees work from scaffolds, ladders, or vehicle mounted work platforms to provide a safer working surface and thereby reduce the hazard of falling. The written plan must include a discussion of these other measures and the extent to which they can be used. The employer should also note where the use of those measures would not reduce exposure, would be unreasonable, infeasible or would create a greater hazard. The employer's failure to perform this evaluation as part of the plan will support an OSHA determination that the employer does not have a fall protection plan and OSHA will consider the employer to be in violation of Sec. 1926.501(b)(2), (b)(12), or (b)(13). OSHA will also expect safe work practices to be elements of the alternative

measures. For example, employees engaged in grouting operations would be expected to position themselves so their backs are not to the fall hazard. Employees on ladders would use a leg lock to position themselves more securely than they would otherwise be. In brief, employers need to preplan the work and plan the use of safe work practices that eliminate or reduce the possibility of a fall.

The choice of alternative fall protection systems will be particularly important when, pursuant to 29 CFR 1926.501(b)(2), (b)(12), or (b)(13), an employer establishes that it must use alternatives to conventional fall protection. Accordingly, OSHA has determined that the employer must do what it can to minimize exposure to fall hazards, before turning to the use of safety monitoring systems (29 CFR 1926.502(h) under a fall protection plan. The inclusion of this requirement is based on submission from the PCI (Ex. 25-4) and was addressed in the August 5, 1992, record reopening notice (57 FR 34657).

Paragraph (k)(7) requires the employer to identify in the plan, each location where conventional fall protection cannot be used and to classify those locations as controlled access zones. Controlled access zones must conform to the criteria in paragraph (g). Compliance with this provision will provide a reference point to enable the employer to distinguish between those work areas where the fall protection plan applies and those where it does not. This provision was suggested by PCI (Ex. 25-4) and was addressed in the August 5, 1992, notice of record reopening (57 FR 34657). It was also recommended by Ryland, the Home Builders Association of Maryland, and Hallmark Builders (Ex. 27-23, 27-24, 27-26).

OSHA has determined that, when it is impossible to perform the work with conventional fall protection, the work must be performed in a controlled access zone (CAZ). The CAZ prevents employees who are not engaged in the activities covered by the fall protection plan from being exposed to fall hazards in the areas where those activities are being conducted.

Paragraph (k)(8) requires that a safety monitoring system must be implemented where no other alternative measures have been implemented. Safety monitoring systems must comply with the criteria in Sec. 1926.502(h). There has been considerable discussion above in relation to Sec. Sec. 1926.501(b)(2) and 1926.502(h) regarding the role of safety monitoring systems in minimizing exposure to fall hazards. OSHA has added this requirement because it believes that employers must, at a minimum, have a competent person assigned to monitor those employees who have not been provided conventional fall protection to warn the employees when they are acting in an unsafe manner or approaching an unprotected side or edge, among other activities when other, more protective measures, are not used.

PCI (Ex. 27-7) as discussed above, supported the use of safety monitoring systems and also commented that some contractors use safety monitoring systems now as part of their fall protection efforts, stating that "* * * safety monitoring or controlled access zones systems in conjunction with a fall protection plan is more safe * * *." Rocky Mountain Prestress (Ex. 27-8) also supported the use of safety monitors as part of a fall protection plan.

Paragraph (k)(9) provides that the fall protection plan must identify, by name or other method, those employees who are authorized to work in CAZs. The paragraph further requires that only employees identified in the fall protection plan be allowed to enter CAZs. This provision was suggested by PCI (Ex. 25-4) and was addressed in the August 5, 1992, notice of record reopening (57 FR 34657).

OSHA anticipates that compliance with this paragraph will enable an employer to maintain control over access to a CAZ, minimizing the number of employees exposed to fall hazards. This provision, like the rest of paragraph (k), reflects the Agency's position that although there may be situations where fall protection cannot be used, any deviation from the general requirements for fall protection must be construed as narrowly as possible.

Paragraph (k)(10) provides that, if an employee falls while performing work covered by a fall protection plan or there is other reason to believe that the substance or implementation of the plan is deficient (e.g., a near miss), the employer must review the fall protection plan and make any changes in work practices, training, erection

procedures, or construction practices needed to correct any deficiencies in the plan. Given the immediacy of the hazards to which employees covered by a fall protection plan may be exposed, it is essential that contractors promptly revise their plans to incorporate what they learn through experience.

This paragraph underscores the Agency's determination that employers must minimize any fall hazards to which employees might be exposed through the use of fall protection plans. This provision was suggested by PCI (Ex. 27-22), and was endorsed by Rocky Mountain Prestress, Inc. (Ex. 27-28) for the precast/prestress concrete industry. Rocky Mountain further stated that they had implemented a fall protection plan and it "has been very successful on several major precast projects * * *."

Both PCI and Rocky Mountain submitted sample fall protection plans (Exs. 27-22 and 27-28) which have been used by OSHA in the development of non-mandatory appendix E -- Sample Fall Protection Plans.

One final comment that is not related to any of the above discussion was heard at the public hearing on the proposed rule, when WACO International (Tr. 03/22/88, p. 45) presented testimony regarding a hydraulic, self-climbing safety screen. They suggested that it was an alternative to safety net systems and other conventional devices used for protecting workers from exterior fall hazards. WACO requested that OSHA revise existing Sec. 1926.105(a) to specifically identify safety screens as a viable option for compliance with perimeter protection safety standards. They also stated that safety screens, unlike safety nets, do not require added hours of perimeter exposure after the installation to maintain them.

OSHA observes that information on the use of such safety screens is limited since the screens have been used in Australia, not in the United States. The WACO representative did testify, however, that no one had fallen off the side of a building in the 10 years that the screen had been used in Australia (Tr. 3/22/88. pg. 47).

Based on the limited information and evidence available to OSHA at this time, OSHA has decided not to incorporate specific provisions for safety screens in the final rule at this time. However, OSHA notes that such screens may be acceptable as a safety net system or guardrail system provided the screen can meet the performance criteria set forth in the various paragraphs in Sec. 1926.502 for such systems. Therefore, nothing in subpart M shall be construed to prohibit the use of safety screens.

Sec. 1926.503 -- Training

The introductory text states that this section supplements and clarifies the requirements of Sec. 1926.21 regarding the hazards addressed in subpart M.

The paragraph (a) requires employers to provide a training program for each employee exposed to fall hazards so that each employee can recognize fall hazards and know how to avoid them. This section identifies components of the requisite training, but does not specify the details of the training program.

Employers need not retrain employees who were trained by a previous employer or were trained prior to the effective data of the standard, as long as the employee demonstrates an understanding of the subjects covered by paragraph (a) of this section.

Paragraph (a) also states the subject areas to be addressed in the required training programs. The list of subjects reflects OSHA's determination that fall protection equipment and systems are only effective when they are properly designed, built, located, maintained, and used. Employers are required to ensure that each employee is trained, as necessary, by a competent person qualified in the following areas: The nature of the fall hazards in the work area; the correct procedures for erecting, maintaining, disassembling, using and inspecting the fall protection systems to be used; the role of employees in the safety monitoring systems when used; the role of employees in fall protection plans; and the standards contained in subpart M.

Employees covered by a fall protection plan will, for example, need training to understand and to work effectively within the constraints of a CAZ. Affected employees will also need training on how to work with a safety monitor if a monitor is in use, to ensure that they respond appropriately when they hear a warning. OSHA recognizes that much of the information covered by training will be site-specific, so the Agency is framing this provision in performance-oriented terms.

This approach to training provides flexibility for the employer in designing the training program. The proposed paragraph has been amended to require that the training be provided by a "competent person." This provision was added at the recommendation of the ACCSH (Tr. 6/9/ 87; P. 266). OSHA agrees that the involvement of a competent person who is qualified in the subject areas provides appropriate assurance that employees will be adequately trained. OSHA has also deleted the words "and instructed" from the introductory text of proposed paragraph (a)(1) for the sake of clarity.

In Issue #5, OSHA requested public comment on whether or not a more specific requirement for training would be appropriate. OSHA also asked for data on the costs and effectiveness of training requirements in reducing the risk of injuries or fatalities, and whether more or less specific requirements were appropriate. In addition, commenters were asked to respond with information about currently available safety programs and their adequacy; the safety records of employees who have been trained; the scope and necessary elements of training programs; the relationship of the additional specific provisions in Sec. 1926.503(a)(2) with the more general Sec. 1926.21 requirements; costs and benefits related to this issue; and any recordkeeping burdens these provisions might impose.

Many commenters responded to this issue by commenting on the need and value of employee training. (Exs. 2-6, 2-9, 2-12, 2-19, 2-23, 2-43, 2-46, and 2-50). Most of these commenters also stated their belief that the proposed requirements for training and retraining were adequate, with some commenters noting that further requirements were unnecessary (Exs. 2-12, 2-19, 2-23, 2-43). Bristol Steel and the NEA (Exs. 2-12 and 2-43) commented as follows: "Suitable training is an essential element of accident prevention. The specific training requirements proposed in Section 1926.503 are appropriate and necessary to inform employees of accident prevention measures* * *."

The AGC (Exs. 2-16, 2-47, and 2-92) indicated that specific training requirements did not provide the flexibility needed to cover all construction situations, observing that foremen and supervisors provided the more specific type of training. Also, a commenter (Ex. 2-51) noted the mobility of the workforce and other factors and recommended that OSHA refrain from being specific in the training requirements. The commenter also stated that the general requirements for training in Sec. 1926.21 are more pertinent to construction. The MCISC (Ex. 2-140) stated, "We believe that training is the key to accident reduction but also that it is already covered in the existing OSHA standard under 1926.20 and 1926.21."

On the other hand, R&TC (Ex. 2-36) commented that more specific requirements were needed for live demonstrations (under controlled conditions). The National Constructors Association (Ex. 2-45) also commented that "Requirements for training should address specifics as to task and hazard involved." The ANSI Z359 Committee (Ex. 2-50) suggested that "Fall protection training should perhaps be the subject of a national standard." ACCSH recommended that the training be given by a competent person. (Tr. 6/10/87; p. 95).

Also, the Roofers Union (Ex. 2-99) in support of more specific requirements, commented that "These requirements must be specific to avoid employers merely handing out material for workers to read." The commenter also stated that competent persons must conduct the training.

Finally, other commenters (Exs. 2-89 and 2-95) offered to develop training programs in support of the OSHA training requirements. The SSFI (Ex. 2-89) commented that its members "are willing to assist OSHA in developing training programs that would be used for these purposes by the employer prior to the employee starting work at a

job site." They also commented that on-the-job training should not be a substitute for prior training. The MCAA (Exs. 2-95) also commented that it would endeavor to develop training aid programs for its membership. OSHA encourages these groups and appreciates their efforts to develop training programs.

The Agency is adding a new paragraph (b) to final rule Sec. 1926.503 to require employers to verify that employees have been trained as required by paragraph (a). In particular, final rule paragraph (b)(1) requires employers to prepare a written certification record. Final rule paragraph (b)(1) further specifies that the written certification record shall contain the name or other identity of the employee trained, the date(s) of the training, and the signature of the person who conducted the training or the signature of the employer.

As noted above, OSHA does not require retraining provided the employee can demonstrate the ability to recognize the hazards of falling and the procedures to be followed to minimize fall hazards as required by paragraph (a). OSHA recognizes that in many cases an employer will be unable to identify the date on which the previous training was provided. Accordingly, when employers relying on previous training prepare their certification records, they shall indicate the date the employer determined the prior training was adequate rather than the date of actual training.

The certification record can be prepared in any format an employer chooses, including preprinted forms, computer generated lists, or 3 x 5 cards.

OSHA recognizes that many employers have already been providing affected employees with training that complies with final rule Sec. Sec. 1926.503(a) and that requiring those employers to repeat the pertinent training would be unreasonably burdensome.

Paragraph (b)(2) requires that the latest certification record be maintained.

These provisions, which were not proposed, have been added because, based on the discussion of the need for training records in Issue #5 and the response to that Issue, OSHA has determined that verification of training through a written certification is reasonably necessary for the protection of employees.

The AGC (Exs. 2-16, 2-47 and 2-92) and the ABC (Ex. 2-51) stated that a requirement for training records would be unreasonably burdensome. Bristol Steel and the NEA (Exs. 2-12 and 2-43) stated "[w]ritten training records should not be required, and the proposed standard does not require any. Preparation and maintenance of * * * records could easily require 0.05 to 0.2 man hours per employee per year, at a cost of $2.00 to $10.00 per employee, and would not further the objectives of accident prevention." The NCA (Ex. 2-45) simply stated [c]ompliance with training requirements should not include OSHA recordkeeping requirements.

On the other hand, the State of Maryland (Ex. 2-31) stated "[t]raining program should be documented as to attendance and subjects reviewed." In addition, the BCMALU (Ex. 2-46) stated "[t]raining could be marked on an Individuals payroll sheet or whatever, it should be no big bookkeeping problem and the cost is minor compared to the work produced, when you are confident it is safe and reduced Insurance rates."

OSHA has determined, after careful review of these comments, that some record of training is needed to provide assurance that the required training has, in fact, been provided. Given the performance-oriented focus of this rulemaking, the Agency has determined that the generation and review of extensive documentation would impose unnecessary burdens. Accordingly, OSHA will require verification of training through a certification which contains the above-listed information.

The Agency notes that OSHA has also required certification of training in the personal protective equipment standard for general industry, Sec. 1910.132(f)(4); the permit-required confined space standard, Sec. 1910.146(g)(4); the control of hazardous energy (lockout/tagout) standard, Sec. 1910.147(c)(7)(iv); and in the Telecommunications standard, Sec. 1910.268(c). OSHA also notes that the preparation of a certification will not

preclude a citation if the Agency determines that employees have not, in fact, been trained. The Agency believes that this provision will impose a minimal burden, while enabling the employer and OSHA to verify the status of training efforts.

As stated in Sec. 1926.503(c), fall protection training must be repeated when changes in workplace conditions or changes in the types of fall protection systems or equipment to be used render previous training obsolete, and when inadequacies in an affected employee's knowledge or use of fall protection systems or equipment indicate that the employee has not retained the understanding or skill required by paragraph (a). This provision is similar to the proposed provision but has been revised to indicate clearly that employers have an ongoing responsibility to maintain employee proficiency in the use and care of fall protection equipment.

Appendices A to E

The final rule adds five appendices (discussed below), to revised subpart M. The proposed rule contained only three appendices. Appendices D, and E were not proposed, but have been added to give clarification and examples of how to comply with certain requirements. These Appendices are non-mandatory, and neither impose additional requirements nor detract from the requirements contained in this subpart. They are intended to provide useful, explanatory material and information to employers and employees to assist them in compliance with the standards.

Appendix A to Subpart M -- Roof Widths

This appendix is provided to serve as a guide to assist employers in complying with the requirements of Sec. 1926.501(b)(10). This appendix is non-mandatory. The record compiled for the promulgation of existing Sec. 1926.500(g), which requires the guarding of low-pitched roofs during the performance of roofing work, demonstrated that there was confusion as to which dimension of a building should be considered to be the width of a roof. This appendix explains that in all cases buildings are viewed in plan view (i.e., viewed from above, looking down). The width of the roof is then the narrower of the two primary dimensions which define the roof area. Although the Appendix does not show all possible roof configurations, it does give some common arrangements. Final Appendix A is unchanged from the proposed Appendix A. There were no comments on proposed Appendix A.

Appendix B to Subpart M -- Guardrail Systems

As explained in the discussion of Sec. 1926.502(b) governing guardrail systems, this appendix is a non-mandatory set of guidelines provided to assist employers in complying with the requirements of Sec. 1926.502(b) (3), (4) and (5). An employer may use these guidelines as a starting point for designing guardrail systems. However, the guidelines do not provide all the information necessary to build a complete system, and the employer is still responsible for designing and assembling these components in such a way that the completed system will meet the requirements of the standard. Components for which no specific guidelines are given in the appendix (e.g., joints, base connections, components made with other materials, and components with other dimensions) must also be designed and constructed in such a way that the completed system will meet the requirements of Sec. 1926.502(b) (3), (4) and (5). Final Appendix B is unchanged from the proposed Appendix B. There were no comments on proposed Appendix B.

Appendix C to Subpart M -- Personal Fall Arrest Systems

Appendix C is provided to serve as a guide to assist employers in complying with the test requirements of paragraph Sec. 1926.502(d) and Sec. 1926.502(e). Personal fall arrest systems and positioning device systems which have been tested in accordance with the criteria of this non-mandatory appendix will be deemed by OSHA to meet the performance criteria of paragraphs Sec. 1926.502(d)(16) and Sec. 1926.502(e) (3) and (4). Appendix

C also provides additional non-mandatory guidelines for personal fall arrest systems. Final Appendix C differs from the proposed Appendix C in that it provides additional information consistent with the guidelines provided in the appendix for powered platforms.

Appendix D to Subpart M -- Positioning Device Systems

Appendix D is a new appendix which has been added to the final rule to complement Appendix C and provide additional information on testing methods for positioning device systems.Appendix D also contains guidelines for inspecting positioning device systems to assist in complying with the requirements of Sec. 1926.502(e)(5).

Appendix E to Subpart M -- Sample Fall Protection Plans

This is a new Appendix to the final rule and has been added to assist employers who are able to demonstrate that the use of conventional fall protection measures are infeasible or create a greater hazard when constructing leading edges, or erecting precast concrete structures, or when engaged in residential construction work. The plans in Appendix E were developed specifically for a precast concrete worksite and a residential construction site, and can be modified and tailored for use in the other areas where OSHA permits employers to develop a Fall Protection Plans (See Sec. 1926.501(b)(2), (b)(12) and (b)(13).

Discussion of Specific Issues Raised in the Proposed Rule

In the proposed rule, OSHA raised 27 specific issues. The comments and testimony received in response to issues that address specific provisions of the final rule are discussed above with those provisions. The other, more general issues are discussed below, along with the Agency's decisions with respect to those issues.

In Issue #1, OSHA asked for public comment on the extent to which current practices would meet the proposed rule; the feasibility and utility of the proposed rule; and any costs or benefits of the proposed rule not addressed by OSHA. OSHA also asked for any accident reports which indicated that the proposal did not properly address fall hazards.

In response, OSHA received a variety of comments, some which took exception to OSHA's estimate of the number of construction workers who die each year from falls at construction sites. Other comments reflected commenters thoughts and opinions on the practicality and feasibility of the proposed rule. For example, with regard to OSHA's estimate that 45-60 workers are killed on construction jobs each year, one commenter (Ex. 2-36) stated his belief that the actual number killed was higher because, he noted, the National Safety Council's Accident Facts and insurance data which indicated that construction and scaffold falls may approach 1,000 per year. The commenter also included a copy of an article in which a representative of one union of construction workers stated that in one year 41 of their members alone were killed due to falls.

Another commenter, Terry Schmidt, Chairman of the ANSI Z359 Committee (Ex. 2-50) stated, "There is evidence to suggest that OSHA's estimate of 45-60 fatal falls per year in construction is perhaps erroneously very low." The point being made by these commenters is that the number of workers killed in falls each year is higher than that which OSHA estimated at the time of proposal and that a fall protection rule would, therefore, achieve additional benefits in that more lives would be saved.

With regard to OSHA question on costs, the Great Lakes Fabricators & Erectors Association (Ex. 2-19) commented that the regulations, as proposed, provided sufficient protection at reasonable cost levels.

With regard to current practices in the industry and on feasibility and utility of the proposed rule, the National Constructors Association (NCA) (Ex. 2-45), commented that the current level of practice which meets the requirements of the proposed changes is minimal to non-existent. They also stated, "The feasibility is questionable especially with the requirements for floor covering and extending perimeter nets to 15 feet," and noted that costs would increase to provide the proposed safety measures.

The United Union of Roofers, Waterproofers, and Allied Workers(Ex. 2-99) said, "The use of fall protection in the roofing industry is at best minimal."

Bristol Steel and NEA (Ex. 2-12 and 2-43) commented that the proposed standards generally reflected current accepted practices.

OSHA concludes, based on the record and as discussed above, that the final rule will have the effect of significantly reducing the risk of death or injury to workers. OSHA also concludes that the final rule will result in greater compliance than currently exist. Therefore, OSHA has decided promulgation of this final rule is necessary.

In Issue #3, OSHA noted that in some of the existing and proposed provisions, it had used specific numerical limits to define and clarify various duties. As an example, OSHA noted that Sec. 1926.502(a) of the existing rule and Sec. 1926.500(b) of the proposed rule defined the term "hole" by giving a physical measurement. This measurement was then used to determine when certain safety systems must be used to protect against fall hazards. These and other limits were based on existing requirements and national consensus standards, and were used in lieu of more performance-oriented language such as "covers shall be used on all holes which are large enough to constitute a fall hazard," or language which requires a numerical limit but then allows other configurations which give "equivalent" protection. OSHA believes that the use of specific limits in certain provisions is necessary to provide notice to employers as to how they can comply with a provision and how OSHA intends to enforce the provision. OSHA has attempted to restrict the use of such limits in the final rule to situations where it is necessary to specify a single criterion for employee protection, to promote consistency in hazard abatement, and to minimize legal disputes over the intent of the requirement.

Issue #3 requested comment on the appropriateness of using specification language as opposed to a non-mandatory appendix for guidance of employers. OSHA also requested that if the specification language was not appropriate, that commenters state how the provisions should be written to provide the desired flexibility and the required fair notice. If commenters felt the continued use of such limits to be appropriate, they were asked to comment on whether the proposed limits were sufficient to abate the hazards. Commenters were also requested to include appropriate cost and injury data.

In response to this issue, several commenters agreed that OSHA's use of specification language was appropriate (Exs. 2-12, 2-36, 2-46 2-50, 2-56, 2-89, and 2-99). Other commenters (Exs. 2-16, 2-45, 2-47, 2-51, 2-92, 2-103, and 2-140) noted that performance-oriented language with non-mandatory appendices was preferred, though they did not recommend that any particular specification type language be rewritten. ACCSH (Tr. 6/10/87; p. 67), on the other hand, recommended that specification language be used in Subpart M and that the specifications be included in the body of the standard rather than the appendix.

After careful consideration of the record on this issue, OSHA has determined that there are some instances where OSHA regulations must be specific, such as when defining the dimensions of a hole, and that there are other instances where performance language is more appropriate, such as where OSHA can identify the hazard, state the desired results, and leave it up to the employer to choose the appropriate method for eliminating or reducing the hazard. OSHA believes that the final rule is neither too specific nor so performance-oriented that employers will have difficulty in complying with the final rule. OSHA has not made any revisions based solely on the comments received in response to this issue.

Issue #4 -- see Sec. 1926.501(b)(1) Issue #5 -- see Sec. 1926.503 (a) and (b) Issue #6 -- see Sec. 1926.500(a)(1)(ii) Issue #7 -- see Sec. 1926.502(i) (3) and (4) Issue #8 -- see Sec. 1926.501(e) Issue #9 -- see Sec. 1926.502(c)(5) and Sec. 1926.502(e)(5) Issue #10 -- see Sec. 1926.502(f) Issue #11 -- see Sec. 1926.501(b)(10) Issue #12 -- see Sec. 1926.501(b)(7) and (e) Issue #13 -- see (c)(1) of Sec. 1926.501. Issues #14 through #26 -- see Sec. 1926.502(d)

In Issue #27, OSHA noted that Subpart V -- Power Transmission and Distribution provided additional criteria for personal climbing equipment, lineman's body belts, safety straps and lanyards. OSHA also noted that paragraph Sec. 1926.951(b)(4) required lanyards and lifelines to meet the requirements in the existing rule at Sec. 1926.104, Safety belts, lifelines, and lanyards. Public comment was requested on the economic impact, and any other impact, that would result if the reference to Sec. 1926.104 were changed to Sec. 1926.502(d) -- Personal fall arrest systems and Sec. 1926.502(e) -- Positioning device systems.

All the commenters who responded to the questions raised in this issue indicated that there would be no impact, economic or otherwise, as a result of the OSHA contemplated changes, and they agreed that the reference should be changed. (Exs. 2-12, 2-27, 2-43 and 2-50). OSHA agrees with the commenters and has revised the provision in Sec. 1926.951(b)(4) to require lifeline and lanyards to be in compliance with Sec. 1926.502.

Discussion of Issues Raised in the Notice of Hearing

On January 26, 1988, OSHA published a Notice of Hearing in the Federal Register [53 FR 2048]. In that Notice, OSHA raised four new issues specific to the proposed rule on fall protection. Those issues involved steel erection, precast concrete, guardrail systems and safety net systems. The comments received on these issues have already been discussed except Issue M-1 on Steel Erection in which OSHA raised a number of concerns which related to fall protection measures for the employees engaged in steel erection activities. OSHA received considerable data primarily through testimony and post hearing comments concerning the subjects addressed in Issue M-1 and M-2. Comments related to the construction of buildings are not discussed in this final rule since the information was intended for use at a later date as OSHA stated in the hearing notice. OSHA recently established the Steel Erection Negotiated Rulemaking Advisory Committee (SENRAC) to assist the Agency in developing a proposed revision of subpart R -- Steel Erection, which includes fall protection requirements for employees performing steel erection work in buildings (59 FR 24389; May 11, 1994). The comments received in response to Issue #1 and #2 have been made a part of the record of this new rulemaking. Final Subpart M does not set the duty to provide fall protection for workers engaged in steel erection of buildings. The requirements of Sec. 1926.105(a), which is being deleted from part 1926 in this rulemaking, will continue to apply to steel erection of buildings until subpart R is revised. Because the requirements of that section will now apply only to steel erection of buildings, OSHA is redesignating Sec. 1926.105(a) as Sec. 1926.753 of subpart R. This requirement for employees to have fall protection outside (at the perimeter) of buildings, complements the requirements already in subpart R which require fall protection inside the buildings. Together, these requirements will maintain continuity of coverage for these workers until subpart R is revised. Fall protection requirements for activities involving steel erection other than buildings, such as the erection of bridges and tanks are, of course, not currently addressed in subpart R. Therefore, subpart M will set the requirements to have fall protection in these other areas.

In Issue #2 of the notice of hearing, OSHA asked if there were areas or operations, in addition to those already identified in proposed Sec. 1926.501, which had unique fall protection requirements not addressed by the proposed standards. OSHA requested commenters to describe such areas and operations in detail and to discuss the fall protection systems which should be used.

OSHA received many responses to Issue #2. The largest number of commenters mentioned steel erection as an activity that was so unique that it should have separate fall protection requirements. (Exs. 2-16, 2-27, 2-45, 2-47, 2-51, and 2-92). Some commenters suggested that the requirements be placed in a separate subpart of the construction safety and health standards; namely, subpart R -- Steel Erection. Others (Exs. 2-12, 2-36, and 2-43) commented that the proposed standards were adequate for all structural erection operations, and pointed out how the leading edge requirements might apply to structural erection work.

In addition, testimony given at the public hearing supported the need to address fall protection for steel erection separately. OSHA's decision that fall protection for workers engaged in steel erection activities will be the subject of a separate rulemaking effort was discussed in the hearing notice for Subpart M issued on January 26, 1988, [53 FR 2052].

IV. Summary of the Regulatory Impact Analysis

Introduction

Executive Order 12866 and the Regulatory Flexibility Act required OSHA to analyze the costs, benefits, and other consequences and impacts associated with this standard. Consistent with these requirements, OSHA has prepared a regulatory impact analysis for revised subpart M. The following is a summary of this analysis, which is available from OSHA's docket office.

The regulatory impact analysis includes a description of the industries affected by the regulation, the evaluation of the risks addressed, the assessment of the benefits attributable to the revised standard, the determination of the technological feasibility of new requirements, the estimation of the costs of compliance with subpart M requirements, the determination of the economic feasibility of compliance with the standard, and the analysis of the economic and other impacts associated with this rulemaking.

Affected Industries

The requirements of revised subpart M apply to all establishments in the construction industry. As classified by the 1987 Standard Industrial Classification (SIC) manual, the industry can be divided into three broad types of activities: building construction general contractors (SIC 15), heavy construction general and special trade contractors (SIC 16) and construction by other special trade contractors (SIC 17).

The total value of construction work is approximately $500 billion annually. About 75 percent of this amount ($370 billion) involves the construction of buildings, including single family houses ($124 billion). The total value of nonbuilding construction work includes $45 billion for the construction of highways, streets, parking areas, bridges, and tunnels, and another $13 billion for the construction of sewers and water mains.

Construction work includes new construction as well as additions, alterations, reconstruction, maintenance, and repairs. Of the total value of construction work of $500 billion, about $328 billion (66 percent) involves new construction.

Evaluation of Risk and Potential Benefits

Of the 115,000 injuries due to falls that occur in the construction industry annually, 68,000 are addressed by the subpart M standard while the remaining 47,000 are attributable to circumstances addressed by standards other than subpart M. Injuries and fatalities due to falls in construction that are not covered by subpart M include falls that are not associated with subpart M criteria for fall protection systems (Sec. 1926.502) and involve ladders, stairs, scaffolds, vehicles, and skeletal steel erection of buildings. Similarly, of the 158 fatalities due to falls in construction annually, 95 are covered by provisions of the revised subpart M standard.

Revisions to subpart M promulgated through this rulemaking are expected to result in the prevention of 22 fatalities and 15,600 injuries annually in addition to the fatalities and injuries that would be prevented through full compliance with the existing standard. Most of the falls in construction addressed by subpart M could be prevented through compliance with the existing as well as with the revised standards.

In addition to the unquantifiable reductions in pain and suffering, the prevention of injuries will result in estimated savings of over $200 million annually. This estimate includes savings related to wage and productivity losses, medical costs, administrative expenses, and other costs associated with accidents.

Technological Feasibility

Since the requirements of the revised subpart M can be met with existing equipment and methods that are readily available, the standard is considered to be technologically feasible.

Costs

The total estimated costs associated with new requirements included in the revised subpart M standard amount to about $40 million annually. The majority of these costs ($25 million) involve costs associated with providing increased fall protection for employees working on roofs. Other components of the estimated compliance costs involve inspections and tests of personnel safety nets ($5.4 million), and additional training for employees exposed to fall hazards ($6.6 million).

Economic Impacts

Compliance with the requirements of the revised subpart M standard has been determined to be economically feasible and is not expected to produce any significant adverse economic impacts. The costs that are imposed by the regulation should be a minimal burden on construction establishments. The estimated compliance costs represent less than 0.01 percent of total construction revenues and less than 0.5 percent of revenues for each individual construction sector.

Regulatory Flexibility Analysis

Pursuant to the Regulatory Flexibility Act, OSHA has made an assessment of the impact of the revised standard and has concluded that it will not have a significant impact upon a substantial number of small entities. The estimated compliance costs do not involve large capital expenditures, and there is no significant differential effect on small firms relative to that on large firms.

OSHA has included non-mandatory appendices as part of the regulation to help improve compliance with the standard and reduce the potential for misunderstanding. These appendices will also help to minimize impacts on small firms by significantly reducing the effort needed to develop a compliance strategy.

V. Statutory Considerations

A. Introduction

OSHA has described fall hazards, falling object hazards and the measures required to protect affected employees from those hazards in Section I, Background; Section II, Hazards Involved; and Section III, Summary and Explanation of the Final Rule, above. The Agency is providing the following discussion of the statutory mandate for OSHA rulemaking activity to explain the legal basis for its determination that the revised fall protection standard, as promulgated, is reasonably necessary to protect affected employees from significant risks of injury and death.

Section 2(b)(3) of the Occupational Safety and Health Act authorizes "the Secretary of Labor to set mandatory occupational safety and health standards applicable to businesses affecting interstate commerce", and section 5(a)(2) provides that "[e]ach employer shall comply with occupational safety and health standards promulgated under this Act" (emphasis added). Section 3(8) of the OSH Act (29 U.S.C. Sec. 652(8)) provides that "the term `occupational safety and health standard' means a standard which requires conditions, or the adoption or use of one or more practices, means, methods, operations, or processes, reasonably necessary or appropriate to provide safe or healthful employment and places of employment."

In two recent cases, reviewing courts have expressed concern that OSHA's interpretation of these provisions of the OSH Act, particularly of section 3(8) as it pertains to safety rulemaking, could lead to overly costly or under-protective safety standards. In International Union, UAW v. OSHA, 938 F.2d 1310 (D.C. Cir. 1991), the District of Columbia Circuit rejected substantive challenges to OSHA's lockout/ tagout standard and denied a request that enforcement of that standard be stayed, but it also expressed concern that OSHA's interpretation of the OSH Act could lead to safety standards that are very costly and only minimally protective. In National Grain § Feed Ass'n v. OSHA, 866 F.2d 717 (5th Cir. 1989),the Fifth Circuit concluded that Congress gave OSHA considerable discretion in structuring the costs and benefits of safety standards but, concerned that the grain dust standard might be under-protective, directed OSHA to consider adding a provision that might further reduce significant risk of fire and explosion.

OSHA rulemakings involve a significant degree of agency expertise and policy-making discretion to which reviewing courts must defer. (See, for example, Building § Constr. Trades Dep't, AFL-CIO v. Brock, 838 F.2d 1258, 1266 (D.C. Cir. 1988); Industrial Union Dep't, AFL-CIO v. American Petroleum Inst., 448 U.S. 607, 655 n. 62 (1980).) At the same time, the Agency's technical expertise and policy making authority must be exercised within discernible limits. The lockout/tagout and grain handling standard decisions sought clarification of the Agency's view of the scope of its expertise and authority. In light of those decisions, the preamble to this safety standard states OSHA's views regarding the limits of its safety rulemaking authority and explains why the Agency is confident that its interpretive views have in the past avoided regulatory extremes and continue to do so in this rule.

Stated briefly, the OSH Act requires that, before promulgating any occupational safety standard, OSHA demonstrate based on substantial evidence in the record as a whole that: (1) the proposed standard will substantially reduce a significant risk of material harm; (2) compliance is technologically feasible in the sense that the protective measures being required already exist, can be brought into existence with available technology, or can be created with technology that can reasonably be developed; (3) compliance is economically feasible in the sense that industry can absorb or pass on the costs without major dislocation or threat of instability; and (4) the standard is cost effective in that it employs the least expensive protective measures capable of reducing or eliminating significant risk. Additionally, proposed safety standards must be compatible with prior Agency action, must be responsive to significant comment in the record, and, to the extent allowed by statute, must be consistent with applicable Executive Orders. These elements limit OSHA's regulatory discretion for safety rulemaking and provide a decision-making framework for developing a rule.

B. Congress Concluded That OSHA Regulations are Necessary To Protect Workers From Occupational Hazards and That Employers Should Be Required To Reduce or Eliminate Significant Workplace Health and Safety Threats

At section 2(a) of the OSH Act (29 U.S.C. 651(a)), Congress announced its determination that occupational injury and illness should be eliminated as much as possible: "The Congress finds that occupational injury and illness arising out of work situations impose a substantial burden upon, and are a hindrance to, interstate commerce in terms of lost production, wage loss, medical expenses, and disability compensation payments." Congress therefore declared "it to be its purpose and policy * * * to assure so far as possible every working man and woman in the Nation safe * * * working conditions [29 U.S.C. 651(b)]."

To that end, Congress instructed the Secretary of Labor to adopt existing federal and consensus standards during the first two years after the OSH Act became effective and, in the event of conflict among any such standards, to "promulgate the standard which assures the greatest protection of the safety or health of the affected employees [29 U.S.C. 655(a)]." Congress also directed the Secretary to set mandatory occupational safety standards [29 U.S.C. 651(b)(3)], based on a rulemaking record and substantial evidence [29 U.S.C. 655(b)(2)], that are "reasonably necessary or appropriate to provide safe * * * employment and places of employment." When promulgating permanent safety or health standards that differ from existing national consensus standards, the Secretary must explain "why the rule as adopted will better effectuate the purposes of this Act than the national consensus standard [29 U.S.C. 655(b)(8)]." Correspondingly, every employer must comply with OSHA standards and, in addition, "furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees [29 U.S.C. 654(a)]."

"Congress understood that the Act would create substantial costs for employers, yet intended to impose such costs when necessary to create a safe and healthful working environment. Congress viewed the costs of health and safety as a cost of doing business * * *. Indeed, Congress thought that the financial costs of health and safety problems in the workplace were as large as or larger than the financial costs of eliminating these problems [American Textile Mfrs. Inst. Inc. v. Donovan, 452 U.S. 490, 519-522 (1981) (ATMI); emphasis was supplied in original]." "[T]he fundamental objective of the Act [is] to prevent occupational deaths and serious injuries [Whirlpool Corp. v. Marshall, 445 U.S. 1, 11 (1980)]." "We know the costs would be put into consumer goods but that is the

price we should pay for the 80 million workers in America [S. Rep. No. 91-1282, 91st Cong., 2d Sess. (1970); H.R. Rep. No. 91-1291, 91st Cong., 2d Sess. (1970), reprinted in Senate Committee on Labor and Public Welfare, Legislative History of the Occupational Safety and Health Act of 1970, (Committee Print 1971) ("Leg. Hist.") at 444 (Senator Yarborough)]." "Of course, it will cost a little more per item to produce a washing machine. Those of us who use washing machines will pay for the increased cost, but it is worth it, to stop the terrible death and injury rate in this country [Id. at 324; see also 510-511, 517]."

[T]he vitality of the Nation's economy will be enhanced by the greater productivity realized through saved lives and useful years of labor.

When one man is injured or disabled by an industrial accident or disease, it is he and his family who suffer the most immediate and personal loss. However, that tragic loss also affects each of us. As a result of occupational accidents and disease, over $1.5 billion in wages is lost each year [1970 dollars], and the annual loss to the gross national product is estimated to be over $8 billion. Vast resources that could be available for productive use are siphoned off to pay workmen's compensation and medical expenses * * *.

Only through a comprehensive approach can we hope to effect a significant reduction in these job death and casualty figures. [Id. at 518-19 (Senator Cranston)] Congress considered uniform enforcement crucial because it would reduce or eliminate the disadvantage that a conscientious employer might experience where inter-industry or intra-industry competition is present. Moreover, "many employers -- particularly smaller ones -- simply cannot make the necessary investment in health and safety, and survive competitively, unless all are compelled to do so [Leg. Hist. at 144, 854, 1188, 1201]."

Thus, the statutory text and legislative history make clear that Congress conclusively determined that OSHA regulation is necessary to protect workers from occupational hazards and that employers should be required to reduce or eliminate significant workplace health and safety threats.

C. As Construed By the Courts and By OSHA,the OSH Act Sets Clear and Reasonable Limits for Agency Rulemaking Action

OSHA has long followed the teaching that section 3(8) of the OSH Act requires that, before it promulgates "any permanent health or safety standard, [it must] make a threshold finding that a place of employment is unsafe -- in the sense that significant risks are present and can be eliminated or lessened by a change in practices [Industrial Union Dep't, AFL-CIO v. American Petroleum Inst., 448 U.S. 607, 642 (1980) (plurality) (Benzene); emphasis was supplied in original]." Thus, the national consensus and existing federal standards that Congress instructed OSHA to adopt summarily within two years of the OSH Act's inception provide reference points concerning the least an OSHA standard should achieve (29 U.S.C. Sec. Sec. 655(a)). As a result, OSHA is precluded from regulating insignificant risks or from issuing standards that do not at least lessen risk in a significant way.

The OSH Act also limits OSHA's discretion to issue overly burdensome rules, as the Agency also has long recognized that "any standard that was not economically or technologically feasible would a fortiori not be `reasonably necessary or appropriate' under the Act. See Industrial Union Dep't v. Hodgson, [499 F.2d 467, 478 (D.C. Cir. 1974)] (`Congress does not appear to have intended to protect employees by putting their employers out of business.') [American Textile Mfrs. Inst. Inc., 452 U.S. at 513 n. 31 (a standard is economically feasible even if it portends `disaster for some marginal firms,' but it is economically infeasible if it `threaten[s] massive dislocation to, or imperil[s] the existence of,' the industry)]."

By stating the test in terms of "threat" and "peril," the Supreme Court made clear in ATMI that economic infeasibility begins short of industry-wide bankruptcy. OSHA itself has placed the line considerably below this level. (See for example, ATMI, 452 U.S. at 527 n. 50; 43 FR 27,360 (June 23, 1978). Proposed 200 ug/m(3) PEL for cotton dust did not raise serious possibility of industry-wide bankruptcy, but impact on weaving sector would be severe, possibly requiring reconstruction of 90 percent of all weave rooms. OSHA concluded that the 200 ug/m(3) level was not feasible for weaving and that 750 ug/m(3) was all that could reasonably be required). See also 54 FR

29,245-246 (July 11, 1989); American Iron § Steel Institute, 939 F.2d at 1003. OSHA raised engineering control level for lead in small nonferrous foundries to avoid the possibility of bankruptcy for about half of small foundries even though the industry as a whole could have survived the loss of small firms.) All OSHA standards must also be cost-effective in the sense that the protective measures being required must be the least expensive measures capable of achieving the desired end (ATMI, at 514 n. 32; Building and Constr. Trades Dep't, AFL-CIO v. Brock, 838 F.2d 1258, 1269 (D.C.Cir. 1988)). OSHA gives additional consideration to financial impact in setting the period of time that should be allowed for compliance, allowing as much as ten years for compliance phase-in. (See United Steelworkers of Am. v. Marshall, 647 F.2d 1189, 1278 (D.C. Cir. 1980), cert. denied, 453 U.S. 913 (1981).) Additionally, OSHA's enforcement policy takes account of financial hardship on an individualized basis. OSHA's Field Operations Manual provides that, based on an employer's economic situation, OSHA may extend the period within which a violation must be corrected after issuance of a citation (CPL. 2.45 B, Chapter III, paragraph E6d(3)(a), Dec. 31, 1990).

To reach the necessary findings and conclusions, OSHA conducts rulemaking in accordance with the requirements of section 6 of the OSH Act. The rulemaking process enables the Agency to determine the qualitative and, if possible, the quantitative nature of the risk with (and without) regulation, the technological feasibility of compliance, the availability of capital to the industry and the extent to which that capital is required for other purposes, the industry's profit history, the industry's ability to absorb costs or pass them on to the consumer, the impact of higher costs on demand, and the impact on competition with substitutes and imports. (See ATMI at 2501-2503; American Iron § Steel Institute generally.) Section 6(f) of the OSH Act further provides that, if the validity of a standard is challenged, OSHA must support its conclusions with "substantial evidence in the record considered as a whole," a standard that courts have determined requires fairly close scrutiny of agency action and the explanation of that action. (See Steelworkers, 647 F.2d at 1206-1207.) OSHA's powers are further circumscribed by the independent Occupational Safety and Health Review Commission, which provides a neutral forum for employer contests of citations issued by OSHA for noncompliance with health and safety standards (29 U.S.C. Sec. Sec. 659-661; noted as an additional constraint in Benzene at 652 n. 59). OSHA must also respond rationally to similarities and differences among industries or industry sectors. (See Building and Constr. Trades Dep't, AFL-CIO v. Brock, 838 F.2d 1258, 1272-73 (D.C. Cir. 1988).) OSHA rulemaking is thus constrained first by the need to demonstrate that the standard will substantially reduce a significant risk of material harm, and then by the requirement that compliance is technologically capable of being done and not so expensive as to threaten economic instability or dislocation for the industry. Within these bounds, further constraints such as the need to find cost-effective measures and to respond rationally to all meaningful comment militate against regulatory extremes.

D. The Revised Fall Protection Standard Complies With the Statutory Criteria Described Above and is not Subject to the Additional Constraints Applicable to Section 6(b)(5) Standards

Standards which regulate hazards that are frequently undetectable because they are subtle or develop slowly or after long latency periods, are frequently referred to as "health" standards. Standards that regulate hazards, such as falls, explosions or electrocutions, that cause immediately noticeable physical harm, are called "safety" standards. (See National Grain § Feed Ass'n v. OSHA (NGFA II), 866 F.2d 717, 731, 733 (5th Cir. 1989). As noted above, section 3(8) provides that all OSHA standards must be "reasonably necessary or appropriate." In addition, section 6(b)(5) requires that OSHA set health standards which limit significant risk "to the extent feasible." OSHA has determined that the revised fall protection standard is a safety standard, because the revised standard addresses hazards, such as falls from elevations and falling objects, that are immediately dangerous to life or health, not the longer term, less obvious hazards subject to section 6(b)(5).

The OSH Act and its legislative history clearly indicate that Congress intended for OSHA to distinguish between safety standards and health standards. For example in section 2(b)(6) of the OSH Act, Congress declared that the goal of assuring safe and healthful working conditions and preserving human resources would be achieved, in part:

* * * by exploring ways to discover latent diseases, establishing causal connections between diseases and work in environmental conditions, and conducting other research relating to health problems, in recognition of the fact that occupational health standards present problems often different from those involved in occupational safety.

The legislative history makes this distinction even clearer:

[The Secretary] should take into account that anyone working in toxic agents and physical agents which might be harmful may be subjected to such conditions for the rest of his working life, so that we can get at something which might not be toxic now, if he works in it a short time, but if he works in it the rest of his life might be very dangerous; and we want to make sure that such things are taken into consideration in establishing standards. [Leg. Hist. at 502-503 (Sen. Dominick), quoted in Benzene at 648-49] Additionally, Representative Daniels distinguished between "insidious `silent killers' such as toxic fumes, bases, acids, and chemicals" and "violent physical injury causing immediate visible physical harm" (Leg. Hist. at 1003), and Representative Udall contrasted insidious hazards like carcinogens with "the more visible and well-known question of industrial accidents and on-the-job injury" (Leg. Hist. at 1004). (See also, for example, S.Rep. No. 1282, 91st Cong., 2d Sess 2-3 (1970), U.S. Code Cong. § Admin. News 1970, pp. 5177, 5179, reprinted in Leg. Hist. at 142-43, discussing 1967 Surgeon General study that found that 65 percent of employees in industrial plants "were potentially exposed to harmful physical agents, such as severe noise or vibration, or to toxic materials"; Leg.Hist at 412; id. at 446; id. at 516; id. at 845; International Union, UAW at 1315.) In reviewing OSHA rulemaking activity, the Supreme Court has held that section 6(b)(5) requires OSHA to set "the most protective standard consistent with feasibility" (Benzene at 643 n.48). As Justice Stevens observed:

The reason that Congress drafted a special section for these substances * * * was because Congress recognized that there were special problems in regulating health risks as opposed to safety risks. In the latter case, the risks are generally immediate and obvious, while in the former, the risks may not be evident until a worker has been exposed for long periods of time to particular substances. [Benzene, at 649 n. 54.]

Challenges to the grain dust and lockout/tagout standards included assertions that grain dust in explosive quantities and uncontrolled energy releases that could expose employees to crushing, cutting, burning or explosion hazards were harmful physical agents so that OSHA was required to apply the criteria of section 6(b)(5) when determining how to protect employees from those hazards. Reviewing courts have uniformly rejected such assertions. For example, the Court in International Union, UAW v. OSHA, 938 F.2d 1310 (D.C. Cir. 1991) rejected the view that section 6(b)(5) provided the statutory criteria for regulation of uncontrolled energy, holding that such a "reading would obliterate a distinction that Congress drew between `health' and `safety' risks." The Court also noted that the language of the OSH Act and the legislative history supported the OSHA position (International Union, UAW at 1314). Additionally, the Court stated: "We accord considerable weight to an agency's construction of a statutory scheme it is entrusted to administer, rejecting it only if unreasonable" (International Union, UAW at 1313, citing Chevron U.S.A., Inc. v. NRDC, 467, U.S. 837, 843 (1984)).

The Court reviewing the grain dust standard also deferred to OSHA's reasonable view that the Agency was not subject to the feasibility mandate of section 6(b)(5) in regulating explosive quantities of grain dust (National Grain § Feed Association v. OSHA (NGFA II), 866 F.2d 717, 733 (5th Cir. 1989)). It therefore applied the criteria of section 3(8), requiring the Agency to establish that the standard is "reasonably necessary or appropriate" to protect section 3(8), requiring the Agency to establish that the standard is "reasonably necessary or appropriate" to protect employee safety.

As explained in Section I, Background, and Section III, Summary and Explanation of the Standard, above, and in Section VI, Summary of the Final Regulatory Impact Analysis and Regulatory Flexibility Analysis, below, OSHA has determined that the failure to protect employees from fall hazards poses significant risks to employees and that the provisions of the final rule are reasonably necessary to protect affected employees from those risks. The Agency estimates that compliance with the revised fall protection standard will cost $70 million annually and will reduce the risk of the identified hazards (preventing 79 fatalities and 56,400 injuries annually). This constitutes a

substantial reduction of significant risk of material harm for the exposed population of approximately 4 million construction employees. The Agency believes that compliance is technologically feasible because the rulemaking record indicates that the measures required by the standard are already in general use throughout the construction industry.

Additionally, OSHA believes that compliance is economically feasible as documented in the Regulatory Impact Analysis.

As detailed in Table 1, below, the standard's costs, benefits, and compliance requirements are consistent with those of other OSHA safety standards, such as the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard.

Table 1

Standard (CFR cite)	Final rule date (FR cite)	No. of deaths prevented annually	No. of injuries prevented annually	Annual cost first five yrs (mill)	Annual cost next five yrs (mill)
Grain handling	12-31-87 (52 FR 49622)	18	394	5.9-33.4	5.9-33.4
HAZWOPER (1910.120)	3-6-89 (54 FR 9311)	32	18,700	153	153
Excavations (Subpt P)	10-31-89 (54 FR 45,954)	74	800	306	306
Process Safety Mgmt (1910.119)	2-24-92 57 FR 6356	330	1,917	880.7	470.8
Permit- Required Confined Spaces (1910.146)	1-14-93 58 FR 4462	54	5,041	202.4	202.4

OSHA assessed employee risk by evaluating exposure to fall hazards throughout the construction industry, except insofar as Sec. 1926.500(a)(2) specified construction activity that is not covered by subpart M. The Summary of the Final Regulatory Impact Analysis and Regulatory Flexibility Analysis, Section IV, above, presents OSHA's estimate of the costs and benefits of the revised fall protection standard in terms of the Standard Industrial Classification (SIC) codes for the industries regulated.

The record indicates clearly that employees in all covered sectors face significant risks related to fall hazards, and that compliance with the revised fall protection standard is reasonably necessary to protect affected employees from that risk.

OSHA has considered and responded to all substantive comments regarding the proposed fall protection standard on their merits in the Section III, Summary and Explanation of the Standard, earlier in this preamble. In particular, OSHA evaluated all suggested changes to the proposed rule in terms of their impact on worker safety, their feasibility, their cost effectiveness, and their consonance with the OSH Act.

VI. References

1. Advisory Committee on Construction Safety and Health, Transcripts of meetings held on November 29-30, 1977; January 10, 1978; February 14, 1978; December 5, 1978; December 16, 1978; June 29-30, 1982.

2. U.S. Department of Labor, Occupational Safety and Health Administration, Preliminary Regulatory Impact and Regulatory Flexibility Assessment of Subpart M -- Fall Protection, Office of Regulatory Analysis, Washington, D.C., March 1984.

3. U.S. Department of Labor, Occupational Safety and Health Administration, Occupational Fatalities Related to Roofs, Ceilings, and Floors as Found in Reports of OSHA Fatality/Catastrophe Investigations, November, 1979.

4. American National Standard ANSI A 10.11-1979, American National Standard for Safety Nets Used During Construction, Repair, and Demolition Operations, American National Standards Institute, New York.

5. American National Standard, ANSI A 10.14-1975, Requirements for Safety Belts, Harnesses, Lanyards, Lifelines, and Droplines for Construction and Industrial Use, American National Standards Institute, New York.

6. U.S. Department of Labor, Bureau of Labor Statistics, Occupational Injuries and Illnesses in 1979: Summary, Washington, D.C., April 1981.

7. Andrew C. Sulowski, "Selecting Fall Arresting Systems," National Safety News, October 1979.

8. National Bureau of Standards (NBS), NBSIR 76-1146 A Study of Personal Fall-Safety Equipment, Washington, D.C.: NBS, June 1977.

9.International Standards Organization (ISO), Secretariat Association Francaise de Normalisation (AFNOR). Personal Fall Arresting Systems and Components, (ISO/TC 94/SC4 N50E). New York, NY: ANSI, 1983.

10. Noel, Georges; Amphoux, M., et al, Safety Equipment in Construction and Public Works Transportation, (No. 362) Technical Institute for Construction and Public Works. Montreuil, France: 1978.

11. British Standards Institution (BSI). Specification for Industrial Safety Belts, Harnesses and Safety Lanyards, (BS 1397), London, England: BSI, 1979.

12. Hearon, Bernard F. and Brinkley, James W., Fall Arrest and Post-Fall Suspension: Literature Review and Directions for Further Research, (AFAMRL-TR-84-021), Air Force Aerospace Medical Research Laboratory, Wright-Patterson AFB, Dayton, Ohio: 1984.

13. Written comments on OSHA's Proposed Rule on Powered Platforms for Exterior Building Maintenance (50 FR 2890, January 22, 1985), Docket No. S-700A.

14. Yancey, Carino and Sansalone, Perimeter Safety Net Projection Requirements, Center for Building Technology, National Bureau of Standards, Washington, D.C., May 1986 (NBSIR 85-3271).

VII. State Plan Requirements

The 25 States and territories with their own OSHA-approved occupational safety and health plans must revise their existing standards within 6 months of the publication date of the final standard or show OSHA why there is no need for action, e.g., because an existing State standard covering this area is already "at least as effective" as the revised Federal standard. These States and territories are: Alaska, Arizona, California, Connecticut, (State and local government workers only), Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, New York, (State and local government workers only), North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Virgin Islands, Washington and Wyoming.

VIII. Federalism

The Final Rule has been reviewed in accordance with Executive Order 12612 (52 FR 41685; October 30, 1987) regarding Federalism. This Order requires that agencies, to the extent possible, refrain from limiting state policy options, consult with states prior to taking any actions that would restrict state policy options, and take such

actions only when there is clear constitutional authority and the presence of a problem of national scope. The Order provides for preemption of state law only if there is a clear Congressional intent for the agency to do so. Any such preemption is to be limited to the extent possible.

Section 18 of the Occupational Safety and Health Act (OSH Act), expresses Congress' clear intent to preempt state laws relating to issues with respect to which Federal OSHA has promulgated occupational safety or health standards. Under the OSH Act a state can avoid preemption only if it submits, and obtains Federal approval of, a plan for the development of such standards and their enforcement. Occupational safety and health standards developed by such Plan-States must, among other things, be at least as effective in providing safe and healthful employment and places of employment as the Federal standards. Where such standards are applicable to products distributed or used in interstate commerce, they may not unduly burden commerce, must be justified by compelling local conditions, see Section 18(c)(2).

The Federal fall protection standards for construction workers are not unique to any one state or region of the country. Nonetheless, states with occupational safety and health plans approved under Section 18 of the OSH Act will be able to develop their own state standards to deal with any special problems which might be encountered in a particular area. Moreover, because this standard is written in general, performance-oriented terms, there is considerable flexibility for State plans to require, and for affected employers to use, methods of compliance which are appropriate to the working conditions covered by the standard.

In brief, this Final Rule addresses a clear national problem related to occupational safety and health of construction workers. Those states which have elected to participate under Section 18 of the OSH Act are not preempted by this standard, and will be able to address special conditions within the framework of the Federal Act while ensuring that the state standards are at least as effective as that standard.

IX. OMB Review Under the Paperwork Reduction Act

The OMB regulations, 5 CFR part 1320, contain procedures for agencies to follow in obtaining OMB clearance for information collection requirements under the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. The final Fall Protection standard requires employers who use fall protection plans to allow OSHA access to those plans to determine if they are in compliance with Sec.1926.502(k). The collection of information has been approved and the OMB clearance number is 1218-0197.

X. Authority

This document was prepared under the direction of Joseph A. Dear, Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, 200 Constitution Avenue, NW., Washington, DC 20210.

List of Subjects in 29 CFR Parts 1910 and 1926

Construction industry, Construction safety, Excavations, Fall protection, Hoisting safety, Occupational safety and health, Protective equipment, Safety, Tools.

Accordingly, pursuant to sections 4, 6(b) and 8(g) of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657), section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333), Secretary of Labor's Order No. 1-90 (55 FR 35736), and 29 CFR part 1911, 29 CFR parts 1910 and 1926 are amended as set forth below.

Signed at Washington, DC this 29th day of July 1994.

Joseph A. Dear
Assistant Secretary of Labor.

PART 1910-[AMENDED]

Subpart R-[Amended]

1. The authority citation for subpart R of part 1910 continues to read as follows:

Authority: Secs. 4, 6, and 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), or 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable.

2. Paragraph (g)(2)(i) of 1910.269 is revised to read as follows:

1910.269 Electric power generation, transmission, and distribution.

* * * * *

(g) * * * (2) Fall protection. (i) Personal fall arrest equipment shall meet the requirements of subpart M of Part 1926 of this Chapter.

* * * * *

PART 1926 - [AMENDED]

Subpart E - [Amended]

3. The authority citation for subpart E of part 1926 is revised to read as follows:

Authority: Sec. 107, Contract Work Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable.

1926.104 [Removed]

4. Section 1926.104 is removed.

1926.753 [Added]

5. Paragraph (a) of 1926.105 is redesignated as new 1926.753 in subpart R and the section heading "Safety Nets." is added.

1926.105 [Removed and Reserved]

6. Section 1926.105 is removed and reserved.

1926.107 [Amended]

7. Paragraphs (b), (c) and (f) of 1926.107 are removed.

Subpart H - [Amended]

8. The authority citation for subpart H of Part 1926 is revised to read as follows:

Authority: Sec. 107, Contract Work Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), or 1-90 (50 FR 9033), as applicable. Section 1926.250 also issued under 29 CFR Part 1911.

9. Paragraph (b)(2) of 1926.250 is revised to read as follows:

1926.250 General requirements for storage.

* * * * *

(b) * * * (2) Each employee required to work on stored material in silos, hoppers, tanks, and similar storage areas shall be equipped with personal fall arrest equipment meeting the requirements of subpart M of this part.

* * * * *

Subpart N - [Amended]

10. The authority citation for subpart N of Part 1926 continues to read as follows:

Authority: Sec. 107, Contract Work Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable.

11. Paragraphs (c)(2) and (g)(4)(i)(C) of 1926.550 are revised to read as follows:

1926.550 Cranes and derricks.

* * * * *

(c) * * * (2) Each employee required to perform duties on the horizontal boom of hammerhead tower cranes shall be protected against falling by guardrails or by a personal fall arrest system in conformance with subpart M of this part.

* * * * *

(g) * * * (4) * * * (i) * * * (C) The personnel platform itself, except the guardrail system and personal fall arrest system anchorages, shall be capable of supporting, without failure, its own weight and at least five times the maximum intended load. Criteria for guardrail systems and personal fall arrest system anchorages are contained in subpart M of this Part.

* * * * *

Subpart P - [Amended]

12. The authority citation for subpart P of Part 1926 continues to read as follows:

Authority: Sec. 107, Contract Work Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable.

Section 1926.651 also issued under 29 CFR Part 1911.

13. The section heading and paragraph (l) of 1926.651 are revised to read as follows:

1926.651 Specific excavation requirements.

* * * * *

(l) Walkways shall be provided where employees or equipment are required or permitted to cross over excavations. Guardrails which comply with 1926.502(b) shall be provided where walkways are 6 feet (1.8 m) or more above lower levels.

Subpart Q - [Amended]

14. The authority citation for subpart Q of Part 1926 continues to read as follows:

Authority: Sec. 107, Contract Work Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable.

1926.701 [Amended]

15. Paragraph (f)(2) of 1926.701 is removed and the paragraph designation (1) is removed.

16. The authority citation for subpart R of Part 1926 is revised to read as follows:

Authority: Sec. 107, Contract Work Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable.

Subpart V - [Amended]

17. The authority citation for subpart V of Part 1926 is revised to read as follows:

Authority: Sec. 107, Contract Work Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable. Section 1926.951 also issued under 29 CFR Part 1911.

19. Paragraph (b)(4)(i) of 1926.951 is revised to read as follows:

1926.951 Tools and protective equipment.

* * * * *

(b) * * * (4)(i) Lifelines and lanyards shall comply with the provisions of 1926.502.

* * * * *

21. Subpart M of Part 1926 is revised to read as follows:

Subpart M - Fall Protection

1926.500 Scope, application, and definitions applicable to this subpart. 1926.501 Duty to have fall protection. 1926.502 Fall protection systems criteria and practices. 1926.503 Training requirements. Appendix A to Subpart M - Determining Roof Widths Appendix B to Subpart M - Guardrail Systems Appendix C to Subpart M - Personal Fall Arrest Systems Appendix D to Subpart M - Positioning Device Systems Appendix E to Subpart M - Sample Fall Protection Plans

Subpart M - Fall Protection

Authority: Sec. 107, Contract Work Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Sec. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 1-90 (55 FR 9033); and 29 CFR Part 1911.

1926.500 Scope, application, and definitions applicable to this subpart.

(a) Scope and application.

(1) This subpart sets forth requirements and criteria for fall protection in construction workplaces covered under 29 CFR part 1926. Exception: The provisions of this subpart do not apply when employees are making an inspection, investigation, or assessment of workplace conditions prior to the actual start of construction work or after all construction work has been completed.

(2) Section 1926.501 sets forth those workplaces, conditions, operations, and circumstances for which fall protection shall be provided except as follows:

(i) Requirements relating to fall protection for employees working on scaffolds are provided in subpart L of this part.

(ii) Requirements relating to fall protection for employees working on certain cranes and derricks are provided in subpart N of this part.

(iii) Requirements relating to fall protection for employees performing steel erection work in buildings are provided in subpart R of this part.

(iv) Requirements relating to fall protection for employees working on certain types of equipment used in tunneling operations are provided in subpart S of this part.

(v) Requirements relating to fall protection for employees engaged in the construction of electric transmission and distribution lines and equipment are provided in subpart V of this part.

(vi) Requirements relating to fall protection for employees working on stairways and ladders are provided in subpart X of this part.

(3) Section 1926.502 sets forth the requirements for the installation, construction, and proper use of fall protection required by part 1926, except as follows:

(i) Performance requirements for guardrail systems used on scaffolds and performance requirements for falling object protection used on scaffolds are provided in subpart L of this part.

(ii) Performance requirements for stairways, stairrail systems, and handrails are provided in subpart X of this part.

(iii) Additional performance requirements for personal climbing equipment, lineman's body belts, safety straps, and lanyards are provided in Subpart V of this part.

(4) Section 1926.503 sets forth requirements for training in the installation and use of fall protection systems.

(b) Definitions. "Anchorage" means a secure point of attachment for lifelines, lanyards or deceleration devices.

"Body belt (safety belt)" means a strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device.

"Body harness" means straps which may be secured about the employee in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and shoulders with means for attaching it to other components of a personal fall arrest system.

"Buckle" means any device for holding the body belt or body harness closed around the employee's body.

"Connector" means a device which is used to couple (connect) parts of the personal fall arrest system and positioning device systems together. It may be an independent component of the system, such as a carabiner, or it may be an integral component of part of the system (such as a buckle or dee-ring sewn into a body belt or body harness, or a snap-hook spliced or sewn to a lanyard or self-retracting lanyard).

"Controlled access zone (CAZ)" means an area in which certain work (e.g., overhand bricklaying) may take place without the use of guardrail systems, personal fall arrest systems, or safety net systems and access to the zone is controlled.

"Dangerous equipment" means equipment (such as pickling or galvanizing tanks, degreasing units, machinery, electrical equipment, and other units) which, as a result of form or function, may be hazardous to employees who fall onto or into such equipment.

"Deceleration device" means any mechanism, such as a rope grab, rip-stitch lanyard, specially-woven lanyard, tearing or deforming lanyards, automatic self-retracting lifelines/lanyards, etc., which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limit the energy imposed on an employee during fall arrest.

"Deceleration distance" means the additional vertical distance a falling employee travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which the deceleration device begins to operate. It is measured as the distance between the location of an employee's body belt or body harness

attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall, and the location of that attachment point after the employee comes to a full stop.

"Equivalent" means alternative designs, materials, or methods to protect against a hazard which the employer can demonstrate will provide an equal or greater degree of safety for employees than the methods, materials or designs specified in the standard.

"Failure" means load refusal, breakage, or separation of component parts. Load refusal is the point where the ultimate strength is exceeded.

"Free fall" means the act of falling before a personal fall arrest system begins to apply force to arrest the fall.

"Free fall distance" means the vertical displacement of the fall arrest attachment point on the employee's body belt or body harness between onset of the fall and just before the system begins to apply force to arrest the fall. This distance excludes deceleration distance, and lifeline/lanyard elongation, but includes any deceleration device slide distance or self-retracting lifeline/lanyard extension before they operate and fall arrest forces occur.

"Guardrail system" means a barrier erected to prevent employees from falling to lower levels.

"Hole" means a gap or void 2 inches (5.1 cm) or more in its least dimension, in a floor, roof, or other walking/working surface.

"Infeasible" means that it is impossible to perform the construction work using a conventional fall protection system (i.e., guardrail system, safety net system, or personal fall arrest system) or that it is technologically impossible to use any one of these systems to provide fall protection.

"Lanyard" means a flexible line of rope, wire rope, or strap which generally has a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline, or anchorage.

"Leading edge" means the edge of a floor, roof, or formwork for a floor or other walking/working surface (such as the deck) which changes location as additional floor, roof, decking, or formwork sections are placed, formed, or constructed. A leading edge is considered to be an "unprotected side and edge" during periods when it is not actively and continuously under construction.

"Lifeline" means a component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall arrest system to the anchorage.

"Low-slope roof" means a roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

"Lower levels" means those areas or surfaces to which an employee can fall. Such areas or surfaces include, but are not limited to, ground levels, floors, platforms, ramps, runways, excavations, pits, tanks, material, water, equipment, structures, or portions thereof.

"Mechanical equipment" means all motor or human propelled wheeled equipment used for roofing work, except wheelbarrows and mopcarts.

"Opening" means a gap or void 30 inches (76 cm) or more high and 18 inches (48 cm) or more wide, in a wall or partition, through which employees can fall to a lower level.

"Overhand bricklaying and related work" means the process of laying bricks and masonry units such that the surface of the wall to be jointed is on the opposite side of the wall from the mason, requiring the mason to lean over the wall to complete the work. Related work includes mason tending and electrical installation incorporated into the brick wall during the overhand bricklaying process.

"Personal fall arrest system" means a system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, a body belt or body harness and may include a lanyard, deceleration device, lifeline, or suitable combinations of these. As of January 1, 1998, the use of a body belt for fall arrest is prohibited.

"Positioning device system" means a body belt or body harness system rigged to allow an employee to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning.

"Rope grab" means a deceleration device which travels on a lifeline and automatically, by friction, engages the lifeline and locks so as to arrest the fall of an employee. A rope grab usually employs the principle of inertial locking, cam/level locking, or both.

"Roof" means the exterior surface on the top of a building. This does not include floors or formwork which, because a building has not been completed, temporarily become the top surface of a building.

"Roofing work" means the hoisting, storage, application, and removal of roofing materials and equipment, including related insulation, sheet metal, and vapor barrier work, but not including the construction of the roof deck.

"Safety-monitoring system" means a safety system in which a competent person is responsible for recognizing and warning employees of fall hazards.

"Self-retracting lifeline/lanyard" means a deceleration device containing a drum-wound line which can be slowly extracted from, or retracted onto, the drum under slight tension during normal employee movement, and which, after onset of a fall, automatically locks the drum and arrests the fall.

"Snaphook" means a connector comprised of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released, automatically closes to retain the object. Snaphooks are generally one of two types:

(1) The locking type with a self-closing, self-locking keeper which remains closed and locked until unlocked and pressed open for connection or disconnection; or

(2) The non-locking type with a self-closing keeper which remains closed until pressed open for connection or disconnection. As of January 1, 1998, the use of a non-locking snaphook as part of personal fall arrest systems and positioning device systems is prohibited.

"Steep roof" means a roof having a slope greater than 4 in 12 (vertical to horizontal).

"Toeboard" means a low protective barrier that will prevent the fall of materials and equipment to lower levels and provide protection from falls for personnel.

"Unprotected sides and edges" means any side or edge (except at entrances to points of access) of a walking/working surface, e.g., floor, roof, ramp, or runway where there is no wall or guardrail system at least 39 inches (1.0 m) high.

"Walking/working surface" means any surface, whether horizontal or vertical on which an employee walks or works, including, but not limited to, floors, roofs, ramps, bridges, runways, formwork and concrete reinforcing steel but not including ladders, vehicles, or trailers, on which employees must be located in order to perform their job duties.

"Warning line system" means a barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge, and which designates an area in which roofing work may take place without the use of guardrail, body belt, or safety net systems to protect employees in the area.

"Work area" means that portion of a walking/working surface where job duties are being performed.

1926.501 Duty to have fall protection.

(a) General. (1) This section sets forth requirements for employers to provide fall protection systems. All fall protection required by this section shall conform to the criteria set forth in 1926.502 of this subpart.

(2) The employer shall determine if the walking/working surfaces on which its employees are to work have the strength and structural integrity to support employees safely. Employees shall be allowed to work on those surfaces only when the surfaces have the requisite strength and structural integrity.

(b)(1) Unprotected sides and edges. Each employee on a walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet (1.8 m) or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems.

(2) Leading edges.

(i) Each employee who is constructing a leading edge 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, or personal fall arrest systems. Exception: When the employer can demonstrate that it is infeasible or creates a greater hazard to use these systems, the employer shall develop and implement a fall protection plan which meets the requirements of paragraph (k) of 1926.502.

Note: There is a presumption that it is feasible and will not create a greater hazard to implement at least one of the above-listed fall protection systems. Accordingly, the employer has the burden of establishing that it is appropriate to implement a fall protection plan which complies with 1926.502(k) for a particular workplace situation, in lieu of implementing any of those systems.

(ii) Each employee on a walking/working surface 6 feet (1.8 m) or more above a lower level where leading edges are under construction, but who is not engaged in the leading edge work, shall be protected from falling by a guardrail system, safety net system, or personal fall arrest system. If a guardrail system is chosen to provide the fall protection, and a controlled access zone has already been established for leading edge work, the control line may be used in lieu of a guardrail along the edge that parallels the leading edge.

(3) Hoist areas. Each employee in a hoist area shall be protected from falling 6 feet (1.8 m) or more to lower levels by guardrail systems or personal fall arrest systems. If guardrail systems, [or chain, gate, or guardrail] or portions thereof, are removed to facilitate the hoisting operation (e.g., during landing of materials), and an employee must lean through the access opening or out over the edge of the access opening (to receive or guide equipment and materials, for example), that employee shall be protected from fall hazards by a personal fall arrest system.

(4) Holes.

(i) Each employee on walking/working surfaces shall be protected from falling through holes (including skylights) more than 6 feet (1.8 m) above lower levels, by personal fall arrest systems, covers, or guardrail systems erected around such holes.

(ii) Each employee on a walking/working surface shall be protected from tripping in or stepping into or through holes (including skylights) by covers.

(iii) Each employee on a walking/working surface shall be protected from objects falling through holes (including skylights) by covers.

(5) Formwork and reinforcing steel. Each employee on the face of formwork or reinforcing steel shall be protected from falling 6 feet (1.8 m) or more to lower levels by personal fall arrest systems, safety net systems, or positioning device systems.

(6) Ramps, runways, and other walkways. Each employee on ramps, runways, and other walkways shall be protected from falling 6 feet (1.8 m) or more to lower levels by guardrail systems.

(7) Excavations.

(i) Each employee at the edge of an excavation 6 feet (1.8 m) or more in depth shall be protected from falling by guardrail systems, fences, or barricades when the excavations are not readily seen because of plant growth or other visual barrier;

(ii) Each employee at the edge of a well, pit, shaft, and similar excavation 6 feet (1.8 m) or more in depth shall be protected from falling by guardrail systems, fences, barricades, or covers.

(8) Dangerous equipment.

(i) Each employee less than 6 feet (1.8 m) above dangerous equipment shall be protected from falling into or onto the dangerous equipment by guardrail systems or by equipment guards.

(ii) Each employee 6 feet (1.8 m) or more above dangerous equipment shall be protected from fall hazards by guardrail systems, personal fall arrest systems, or safety net systems.

(9) Overhand bricklaying and related work.

(i) Except as otherwise provided in paragraph (b) of this section, each employee performing overhand bricklaying and related work 6 feet (1.8 m) or more above lower levels, shall be protected from falling by guardrail systems, safety net systems, personal fall arrest systems, or shall work in a controlled access zone.

(ii) Each employee reaching more than 10 inches (25 cm) below the level of the walking/working surface on which they are working, shall be protected from falling by a guardrail system, safety net system, or personal fall arrest system.

Note: Bricklaying operations performed on scaffolds are regulated by subpart L - Scaffolds of this part.

(10) Roofing work on Low-slope roofs. Except as otherwise provided in paragraph (b) of this section, each employee engaged in roofing activities on low-slope roofs, with unprotected sides and edges 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, personal fall arrest systems, or a combination of warning line system and guardrail system, warning line system and safety net system, or warning line system and personal fall arrest system, or warning line system and safety monitoring system. Or, on roofs 50-feet (15.25 m) or less in width (see Appendix A to subpart M of this part), the use of a safety monitoring system alone [i.e. without the warning line system] is permitted.

(11) Steep roofs. Each employee on a steep roof with unprotected sides and edges 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems with toeboards, safety net systems, or personal fall arrest systems.

(12) Precast concrete erection. Each employee engaged in the erection of precast concrete members (including, but not limited to the erection of wall panels, columns, beams, and floor and roof "tees") and related operations such as grouting of precast concrete members, who is 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, or personal fall arrest systems, unless another provision in paragraph (b) of this section provides for an alternative fall protection measure. Exception: When the employer can demonstrate that it is infeasible or creates a greater hazard to use these systems, the employer shall develop and implement a fall protection plan which meets the requirements of paragraph (k) of 1926.502.

Note: There is a presumption that it is feasible and will not create a greater hazard to implement at least one of the above-listed fall protection systems. Accordingly, the employer has the burden of establishing that it is appropriate to implement a fall protection plan which complies with 1926.502(k) for a particular workplace situation, in lieu of implementing any of those systems.

(13) Residential construction. Each employee engaged in residential construction activities 6 feet (1.8 m) or more above lower levels shall be protected by guardrail systems, safety net system, or personal fall arrest system unless another provision in paragraph (b) of this section provides for an alternative fall protection measure.

Exception: When the employer can demonstrate that it is infeasible or creates a greater hazard to use these systems, the employer shall develop and implement a fall protection plan which meets the requirements of paragraph (k) of 1926.502.

Note: There is a presumption that it is feasible and will not create a greater hazard to implement at least one of the above-listed fall protection systems. Accordingly, the employer has the burden of establishing that it is appropriate to implement a fall protection plan which complies with 1926.502(k) for a particular workplace situation, in lieu of implementing any of those systems.

(14) Wall openings. Each employee working on, at, above, or near wall openings (including those with chutes attached) where the outside bottom edge of the wall opening is 6 feet (1.8 m) or more above lower levels and the inside bottom edge of the wall opening is less than 39 inches (1.0 m) above the walking/working surface, shall be protected from falling by the use of a guardrail system, a safety net system, or a personal fall arrest system.

(15) Walking/working surfaces not otherwise addressed. Except as provided in 1926.500(a)(2) or in 1926.501 (b)(1) through (b)(14), each employee on a walking/working surface 6 feet (1.8 m) or more above lower levels shall be protected from falling by a guardrail system, safety net system, or personal fall arrest system.

(c) Protection from falling objects. When an employee is exposed to falling objects, the employer shall have each employee wear a hard hat and shall implement one of the following measures:

(1) Erect toeboards, screens, or guardrail systems to prevent objects from falling from higher levels; or,

(2) Erect a canopy structure and keep potential fall objects far enough from the edge of the higher level so that those objects would not go over the edge if they were accidentally displaced; or,

(3) Barricade the area to which objects could fall, prohibit employees from entering the barricaded area, and keep objects that may fall far enough away from the edge of a higher level so that those objects would not go over the edge if they were accidentally displaced.

1926.502 Fall protection systems criteria and practices.

(a) General.

(1) Fall protection systems required by this part shall comply with the applicable provisions of this section.

(2) Employers shall provide and install all fall protection systems required by this subpart for an employee, and shall comply with all other pertinent requirements of this subpart before that employee begins the work that necessitates the fall protection.

(b) Guardrail systems. Guardrail systems and their use shall comply with the following provisions:

(1) Top edge height of top rails, or equivalent guardrail system members, shall be 42 inches (1.1 m) plus or minus 3 inches (8 cm) above the walking/working level. When conditions warrant, the height of the top edge may exceed the 45-inch height, provided the guardrail system meets all other criteria of this paragraph ( ).

Note: When employees are using stilts, the top edge height of the top rail, or equivalent member, shall be increased an amount equal to the height of the stilts.

(2) Midrails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members shall be installed between the top edge of the guardrail system and the walking/working surface when there is no wall or parapet wall at least 21 inches (53 cm) high.

(i) Midrails, when used, shall be installed at a height midway between the top edge of the guardrail system and the walking/working level.

(ii) Screens and mesh, when used, shall extend from the top rail to the walking/working level and along the entire opening between top rail supports.

(iii) Intermediate members (such as balusters), when used between posts, shall be not more than 19 inches (48 cm) apart.

(iv) Other structural members (such as additional midrails and architectural panels) shall be installed such that there are no openings in the guardrail system that are more than 19 inches (.5 m) wide.

(3) Guardrail systems shall be capable of withstanding, without failure, a force of at least 200 pounds (890 N) applied within 2 inches (5.1 cm) of the top edge, in any outward or downward direction, at any point along the top edge.

(4) When the 200 pound (890 N) test load specified in paragraph (b)(3) of this section is applied in a downward direction, the top edge of the guardrail shall not deflect to a height less than 39 inches (1.0 m) above the walking/working level. Guardrail system components selected and constructed in accordance with the Appendix B to subpart M of this part will be deemed to meet this requirement.

(5) Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members shall be capable of withstanding, without failure, a force of at least 150 pounds (666 N) applied in any downward or outward direction at any point along the midrail or other member.

(6) Guardrail systems shall be so surfaced as to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing.

(7) The ends of all top rails and midrails shall not overhang the terminal posts, except where such overhang does not constitute a projection hazard.

(8) Steel banding and plastic banding shall not be used as top rails or midrails.

(9) Top rails and midrails shall be at least one-quarter inch (0.6 cm) nominal diameter or thickness to prevent cuts and lacerations. If wire rope is used for top rails, it shall be flagged at not more than 6-foot intervals with high-visibility material.

(10) When guardrail systems are used at hoisting areas, a chain, gate or removable guardrail section shall be placed across the access opening between guardrail sections when hoisting operations are not taking place.

(11) When guardrail systems are used at holes, they shall be erected on all unprotected sides or edges of the hole.

(12) When guardrail systems are used around holes used for the passage of materials, the hole shall have not more than two sides provided with removable guardrail sections to allow the passage of materials. When the hole is not in use, it shall be closed over with a cover, or a guardrail system shall be provided along all unprotected sides or edges.

(13) When guardrail systems are used around holes which are used as points of access (such as ladderways), they shall be provided with a gate, or be so offset that a person cannot walk directly into the hole.

(14) Guardrail systems used on ramps and runways shall be erected along each unprotected side or edge.

(15) Manila, plastic or synthetic rope being used for top rails or midrails shall be inspected as frequently as necessary to ensure that it continues to meet the strength requirements of paragraph (b)(3) of this section.

(c) Safety net systems. Safety net systems and their use shall comply with the following provisions:

(1) Safety nets shall be installed as close as practicable under the walking/working surface on which employees are working, but in no case more than 30 feet (9.1 m) below such level. When nets are used on bridges, the potential fall area from the walking/working surface to the net shall be unobstructed.

(2) Safety nets shall extend outward from the outermost projection of the work surface as follows:

Vertical distance from working level to horizontal plane of net	Minimum required horizontal distance of outer edge of net from the edge of the working surface
Up to 5 feet	8 feet
More than 5 feet up to 10 feet	10 feet
More than 10 feet	13 feet

(3) Safety nets shall be installed with sufficient clearance under them to prevent contact with the surface or structures below when subjected to an impact force equal to the drop test specified in paragraph (c)(4) of this section.

(4) Safety nets and their installations shall be capable of absorbing an impact force equal to that produced by the drop test specified in paragraph (c)(4)(i) of this section.

(i) Except as provided in paragraph (c)(4)(ii) of this section, safety nets and safety net installations shall be drop-tested at the jobsite after initial installation and before being used as a fall protection system, whenever relocated, after major repair, and at 6-month intervals if left in one place. The drop-test shall consist of a 400 pound (180 kg) bag of sand 30 x 2 inches (76 x 5 cm) in diameter dropped into the net from the highest walking/working surface at which employees are exposed to fall hazards, but not from less than 42 inches (1.1 m) above that level.

(ii) When the employer can demonstrate that it is unreasonable to perform the drop-test required by paragraph (c)(4)(i) of this section, the employer (or a designated competent person) shall certify that the net and net installation is in compliance with the provisions of paragraphs (c)(3) and (c)(4)(i) of this section by preparing a certification record prior to the net being used as a fall protection system. The certification record must include an identification of the net and net installation for which the certification record is being prepared; the date that it was determined that the identified net and net installation were in compliance with paragraph (c)(3) of this section and the signature of the person making the determination and certification. The most recent certification record for each net and net installation shall be available at the jobsite for inspection.

(5) Defective nets shall not be used. Safety nets shall be inspected at least once a week for wear, damage, and other deterioration. Defective components shall be removed from service. Safety nets shall also be inspected after any occurrence which could affect the integrity of the safety net system.

(6) Materials, scrap pieces, equipment, and tools which have fallen into the safety net shall be removed as soon as possible from the net and at least before the next work shift.

(7) The maximum size of each safety net mesh opening shall not exceed 36 square inches (230 cm) nor be longer than 6 inches (15 cm) on any side, and the opening, measured center-to-center of mesh ropes or webbing, shall not be longer than 6 inches (15 cm). All mesh crossings shall be secured to prevent enlargement of the mesh opening.

(8) Each safety net (or section of it) shall have a border rope for webbing with a minimum breaking strength of 5,000 pounds (22.2 kN).

(9) Connections between safety net panels shall be as strong as integral net components and shall be spaced not more than 6 inches (15 cm) apart.

(d) Personal fall arrest systems. Personal fall arrest systems and their use shall comply with the provisions set forth below. Effective January 1, 1998, body belts are not acceptable as part of a personal fall arrest system. Note: The use of a body belt in a positioning device system is acceptable and is regulated under paragraph (e) of this section.

(1) Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.

(2) Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of the system.

(3) Dee-rings and snaphooks shall have a minimum tensile strength of 5,000 pounds (22.2 kN).

(4) Dee-rings and snaphooks shall be proof-tested to a minimum tensile load of 3,600 pounds (16 kN) without cracking, breaking, or taking permanent deformation.

(5) Snaphooks shall be sized to be compatible with the member to which they are connected to prevent unintentional disengagement of the snaphook by depression of the snaphook keeper by the connected member, or shall be a locking type snaphook designed and used to prevent disengagement of the snaphook by the contact of the snaphook keeper by the connected member. Effective January 1, 1998, only locking type snaphooks shall be used.

(6) Unless the snaphook is a locking type and designed for the following connections, snaphooks shall not be engaged:

(i) directly to webbing, rope or wire rope;

(ii) to each other;

(iii) to a dee-ring to which another snaphook or other connector is attached;

(iv) to a horizontal lifeline; or (v) to any object which is incompatibly shaped or dimensioned in relation to the snaphook such that unintentional disengagement could occur by the connected object being able to depress the snaphook keeper and release itself.

(7) On suspended scaffolds or similar work platforms with horizontal lifelines which may become vertical lifelines, the devices used to connect to a horizontal lifeline shall be capable of locking in both directions on the lifeline.

(8) Horizontal lifelines shall be designed, installed, and used, under the supervision of a qualified person, as part of a complete personal fall arrest system, which maintains a safety factor of at least two.

(9) Lanyards and vertical lifelines shall have a minimum breaking strength of 5,000 pounds (22.2 kN).

(10)(i) Except as provided in paragraph (d)(10)(ii) of this section, when vertical lifelines are used, each employee shall be attached to a separate lifeline.

(ii) During the construction of elevator shafts, two employees may be attached to the same lifeline in the hoistway, provided both employees are working atop a false car that is equipped with guardrails; the strength of the lifeline is 10,000 pounds [5,000 pounds per employee attached] (44.4 kN); and all other criteria specified in this paragraph for lifelines have been met.

(11) Lifelines shall be protected against being cut or abraded. (12) Self-retracting lifelines and lanyards which automatically limit free fall distance to 2 feet (0.61 m) or less shall be capable of sustaining a minimum tensile load of 3,000 pounds (13.3 kN) applied to the device with the lifeline or lanyard in the fully extended position.

(13) Self-retracting lifelines and lanyards which do not limit free fall distance to 2 feet (0.61 m) or less, ripstitch lanyards, and tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,000 pounds (22.2 kN) applied to the device with the lifeline or lanyard in the fully extended position.

(14) Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses shall be made from synthetic fibers.

(15) Anchorages used for attachment of personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 5,000 pounds (22.2 kN) per employee attached, or shall be designed, installed, and used as follows:

(i) as part of a complete personal fall arrest system which maintains a safety factor of at least two; and

(ii) under the supervision of a qualified person.

(16) Personal fall arrest systems, when stopping a fall, shall:

(i) limit maximum arresting force on an employee to 900 pounds (4 kN) when used with a body belt;

(ii) limit maximum arresting force on an employee to 1,800 pounds (8 kN) when used with a body harness;

(iii) be rigged such that an employee can neither free fall more than 6 feet (1.8 m), nor contact any lower level;

(iv) bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet (1.07 m); and, (v) have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet (1.8 m), or the free fall distance permitted by the system, whichever is less.

Note: If the personal fall arrest system meets the criteria and protocols contained in Appendix C to subpart M, and if the system is being used by an employee having a combined person and tool weight of less than 310 pounds (140 kg), the system will be considered to be in compliance with the provisions of paragraph (d)(16) of this section. If the system is used by an employee having a combined tool and body weight of 310 pounds (140 kg) or more, then the employer must appropriately modify the criteria and protocols of the Appendix to provide proper protection for such heavier weights, or the system will not be deemed to be in compliance with the requirements of paragraph (d)(16) of this section.

(17) The attachment point of the body belt shall be located in the center of the wearer's back. The attachment point of the body harness shall be located in the center of the wearer's back near shoulder level, or above the wearer's head.

(18) Body belts, harnesses, and components shall be used only for employee protection (as part of a personal fall arrest system or positioning device system) and not to hoist materials.

(19) Personal fall arrest systems and components subjected to impact loading shall be immediately removed from service and shall not be used again for employee protection until inspected and determined by a competent person to be undamaged and suitable for reuse.

(20) The employer shall provide for prompt rescue of employees in the event of a fall or shall assure that employees are able to rescue themselves.

(21) Personal fall arrest systems shall be inspected prior to each use for wear, damage and other deterioration, and defective components shall be removed from service.

(22) Body belts shall be at least one and five-eighths (1 5/8) inches (4.1 cm) wide.

(23) Personal fall arrest systems shall not be attached to guardrail systems, nor shall they be attached to hoists except as specified in other subparts of this Part.

(24) When a personal fall arrest system is used at hoist areas, it shall be rigged to allow the movement of the employee only as far as the edge of the walking/working surface.

(e) Positioning device systems. Positioning device systems and their use shall conform to the following provisions:

(1) Positioning devices shall be rigged such that an employee cannot free fall more than 2 feet (.9 m).

(2) Positioning devices shall be secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds (13.3 kN), whichever is greater.

(3) Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.

(4) Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of this system.

(5) Connecting assemblies shall have a minimum tensile strength of 5,000 pounds (22.2 kN)

(6) Dee-rings and snaphooks shall be proof-tested to a minimum tensile load of 3,600 pounds (16 kN) without cracking, breaking, or taking permanent deformation.

(7) Snaphooks shall be sized to be compatible with the member to which they are connected to prevent unintentional disengagement of the snaphook by depression of the snaphook keeper by the connected member, or shall be a locking type snaphook designed and used to prevent disengagement of the snaphook by the contact of the snaphook keeper by the connected member. As of January 1, 1998, only locking type snaphooks shall be used.

(8) Unless the snaphook is a locking type and designed for the following connections, snaphooks shall not be engaged:

(i) directly to webbing, rope or wire rope;

(ii) to each other;

(iii) to a dee-ring to which another snaphook or other connector is attached;

(iv) to a horizontal lifeline; or

(v) to any object which is incompatibly shaped or dimensioned in relation to the snaphook such that unintentional disengagement could occur by the connected object being able to depress the snaphook keeper and release itself.

(9) Positioning device systems shall be inspected prior to each use for wear, damage, and other deterioration, and defective components shall be removed from service.

(10) Body belts, harnesses, and components shall be used only for employee protection (as part of a personal fall arrest system or positioning device system) and not to hoist materials.

(f) Warning line systems. Warning line systems [See 1926.501(b)(10)] and their use shall comply with the following provisions:

(1) The warning line shall be erected around all sides of the roof work area.

(i) When mechanical equipment is not being used, the warning line shall be erected not less than 6 feet (1.8 m) from the roof edge.

(ii) When mechanical equipment is being used, the warning line shall be erected not less than 6 feet (1.8 m) from the roof edge which is parallel to the direction of mechanical equipment operation, and not less than 10 feet (3.1 m) from the roof edge which is perpendicular to the direction of mechanical equipment operation.

(iii) Points of access, materials handling areas, storage areas, and hoisting areas shall be connected to the work area by an access path formed by two warning lines.

(iv) When the path to a point of access is not in use, a rope, wire, chain, or other barricade, equivalent in strength and height to the warning line, shall be placed across the path at the point where the path intersects the warning line erected around the work area, or the path shall be offset such that a person cannot walk directly into the work area.

(2) Warning lines shall consist of ropes, wires, or chains, and supporting stanchions erected as follows:

(i) The rope, wire, or chain shall be flagged at not more than 6-foot (1.8 m) intervals with high-visibility material;

(ii) The rope, wire, or chain shall be rigged and supported in such a way that its lowest point (including sag) is no less than 34 inches (.9 m) from the walking/working surface and its highest point is no more than 39 inches (1.0 m) from the walking/working surface;

(iii) After being erected, with the rope, wire, or chain attached, stanchions shall be capable of resisting, without tipping over, a force of at least 16 pounds (71 N) applied horizontally against the stanchion, 30 inches (.8 m) above the walking/working surface, perpendicular to the warning line, and in the direction of the floor, roof, or platform edge;

(iv) The rope, wire, or chain shall have a minimum tensile strength of 500 pounds (2.22 kN), and after being attached to the stanchions, shall be capable of supporting, without breaking, the loads applied to the stanchions as prescribed in paragraph (f)(2)(iii) of this section; and

(v) The line shall be attached at each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in adjacent sections before the stanchion tips over.

(3) No employee shall be allowed in the area between a roof edge and a warning line unless the employee is performing roofing work in that area.

(4) Mechanical equipment on roofs shall be used or stored only in areas where employees are protected by a warning line system, guardrail system, or personal fall arrest system.

(g) Controlled access zones. Controlled access zones [See 1926.501(b)(9) and 1926.502(k)] and their use shall conform to the following provisions.

(1) When used to control access to areas where leading edge and other operations are taking place the controlled access zone shall be defined by a control line or by any other means that restricts access.

(i) When control lines are used, they shall be erected not less than 6 feet (1.8 m) nor more than 25 feet (7.7 m) from the unprotected or leading edge, except when erecting precast concrete members.

(ii) When erecting precast concrete members, the control line shall be erected not less than 6 feet (1.8 m) nor more than 60 feet (18 m) or half the length of the member being erected, whichever is less, from the leading edge.

(iii) The control line shall extend along the entire length of the unprotected or leading edge and shall be approximately parallel to the unprotected or leading edge.

(iv) The control line shall be connected on each side to a guardrail system or wall.

(2) When used to control access to areas where overhand bricklaying and related work are taking place:

(i) The controlled access zone shall be defined by a control line erected not less than 10 feet (3.1 m) nor more than 15 feet (4.5 m) from the working edge.

(ii) The control line shall extend for a distance sufficient for the controlled access zone to enclose all employees performing overhand bricklaying and related work at the working edge and shall be approximately parallel to the working edge.

(iii) Additional control lines shall be erected at each end to enclose the controlled access zone.

(iv) Only employees engaged in overhand bricklaying or related work shall be permitted in the controlled access zone.

(3) Control lines shall consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions as follows:

(i) Each line shall be flagged or otherwise clearly marked at not more than 6-foot (1.8 m) intervals with high-visibility material.

(ii) Each line shall be rigged and supported in such a way that its lowest point (including sag) is not less than 39 inches (1 m) from the walking/working surface and its highest point is not more than 45 inches (1.3 m) [50 inches (1.3 m) when overhand bricklaying operations are being performed] from the walking/working surface.

(iii) Each line shall have a minimum breaking strength of 200 pounds (.88 kN).

(4) On floors and roofs where guardrail systems are not in place prior to the beginning of overhand bricklaying operations, controlled access zones shall be enlarged, as necessary, to enclose all points of access, material handling areas, and storage areas.

(5) On floors and roofs where guardrail systems are in place, but need to be removed to allow overhand bricklaying work or leading edge work to take place, only that portion of the guardrail necessary to accomplish that day's work shall be removed.

(h) Safety monitoring systems. Safety monitoring systems [See 1926.501(b)(10) and 1926.502(k)] and their use shall comply with the following provisions:

(1) The employer shall designate a competent person to monitor the safety of other employees and the employer shall ensure that the safety monitor complies with the following requirements:

(i) The safety monitor shall be competent to recognize fall hazards;

(ii) The safety monitor shall warn the employee when it appears that the employee is unaware of a fall hazard or is acting in an unsafe manner;

(iii) The safety monitor shall be on the same walking/working surface and within visual sighting distance of the employee being monitored;

(iv) The safety monitor shall be close enough to communicate orally with the employee; and

(v) The safety monitor shall not have other responsibilities which could take the monitor's attention from the monitoring function.

(2) Mechanical equipment shall not be used or stored in areas where safety monitoring systems are being used to monitor employees engaged in roofing operations on low-slope roofs.

(3) No employee, other than an employee engaged in roofing work [on low-sloped roofs] or an employee covered by a fall protection plan, shall be allowed in an area where an employee is being protected by a safety monitoring system.

(4) Each employee working in a controlled access zone shall be directed to comply promptly with fall hazard warnings from safety monitors.

(i) Covers. Covers for holes in floors, roofs, and other walking/working surfaces shall meet the following requirements:

(1) Covers located in roadways and vehicular aisles shall be capable of supporting, without failure, at least twice the maximum axle load of the largest vehicle expected to cross over the cover.

(2) All other covers shall be capable of supporting, without failure, at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time.

(3) All covers shall be secured when installed so as to prevent accidental displacement by the wind, equipment, or employees.

(4) All covers shall be color coded or they shall be marked with the word "HOLE" or "COVER" to provide warning of the hazard.

Note: This provision does not apply to cast iron manhole covers or steel grates used on streets or roadways.

(j) Protection from falling objects. Falling object protection shall comply with the following provisions:

(1) Toeboards, when used as falling object protection, shall be erected along the edge of the overhead walking/working surface for a distance sufficient to protect employees below.

(2) Toeboards shall be capable of withstanding, without failure, a force of at least 50 pounds (222 N) applied in any downward or outward direction at any point along the toeboard.

(3) Toeboards shall be a minimum of 3 1/2 inches (9 cm) in vertical height from their top edge to the level of the walking/working surface. They shall have not more than 1/4 inch (0.6 cm) clearance above the walking/working surface. They shall be solid or have openings not over 1 inch (2.5 cm) in greatest dimension.

(4) Where tools, equipment, or materials are piled higher than the top edge of a toeboard, paneling or screening shall be erected from the walking/working surface or toeboard to the top of a guardrail system's top rail or midrail, for a distance sufficient to protect employees below.

(5) Guardrail systems, when used as falling object protection, shall have all openings small enough to prevent passage of potential falling objects.

(6) During the performance of overhand bricklaying and related work:

(i) No materials or equipment except masonry and mortar shall be stored within 4 feet (1.2 m) of the working edge.

(ii) Excess mortar, broken or scattered masonry units, and all other materials and debris shall be kept clear from the work area by removal at regular intervals.

(7) During the performance of roofing work:

(i) Materials and equipment shall not be stored within 6 feet (1.8 m) of a roof edge unless guardrails are erected at the edge.

(ii) Materials which are piled, grouped, or stacked near a roof edge shall be stable and self-supporting.

(8) Canopies, when used as falling object protection, shall be strong enough to prevent collapse and to prevent penetration by any objects which may fall onto the canopy.

(k) Fall protection plan. This option is available only to employees engaged in leading edge work, precast concrete erection work, or residential construction work (See 1926.501(b)(2), (b)(12), and (b)(13)) who can demonstrate that it is infeasible or it creates a greater hazard to use conventional fall protection equipment. The fall protection plan must conform to the following provisions.

(1) The fall protection plan shall be prepared by a qualified person and developed specifically for the site where the leading edge work, precast concrete work, or residential construction work is being performed and the plan must be maintained up to date.

(2) Any changes to the fall protection plan shall be approved by a qualified person.

(3) A copy of the fall protection plan with all approved changes shall be maintained at the job site.

(4) The implementation of the fall protection plan shall be under the supervision of a competent person.

(5) The fall protection plan shall document the reasons why the use of conventional fall protection systems (guardrail systems, personal fall arrest systems, or safety nets systems) are infeasible or why their use would create a greater hazard.

(6) The fall protection plan shall include a written discussion of other measures that will be taken to reduce or eliminate the fall hazard for workers who cannot be provided with protection from the conventional fall protection systems. For example, the employer shall discuss the extent to which scaffolds, ladders, or vehicle mounted work platforms can be used to provide a safer working surface and thereby reduce the hazard of falling.

(7) The fall protection plan shall identify each location where conventional fall protection methods cannot be used. These locations shall then be classified as controlled access zones and the employer must comply with the criteria in paragraph (g) of this section.

(8) Where no other alternative measure has been implemented, the employer shall implement a safety monitoring system in conformance with 1926.502(h).

(9) The fall protection plan must include a statement which provides the name or other method of identification for each employee who is designated to work in controlled access zones. No other employees may enter controlled access zones.

(10) In the event an employee falls, or some other related, serious incident occurs, (e.g., a near miss) the employer shall investigate the circumstances of the fall or other incident to determine if the fall protection plan needs to be changed (e.g. new practices, procedures, or training) and shall implement those changes to prevent similar types of falls or incidents.

1926.503 Training requirements.

The following training provisions supplement and clarify the requirements of 1926.21 regarding the hazards addressed in subpart M of this part.

(a) Training Program.

(1) The employer shall provide a training program for each employee who might be exposed to fall hazards. The program shall enable each employee to recognize the hazards of falling and shall train each employee in the procedures to be followed in order to minimize these hazards.

(2) The employer shall assure that each employee has been trained, as necessary, by a competent person qualified in the following areas:

(i) The nature of fall hazards in the work area;

(ii) The correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection systems to be used;

(iii) The use and operation of guardrail systems, personal fall arrest systems, safety net systems, warning line systems, safety monitoring systems, controlled access zones, and other protection to be used;

(iv) The role of each employee in the safety monitoring system when this system is used;

(v) The limitations on the use of mechanical equipment during the performance of roofing work on low-sloped roofs;

(vi) The correct procedures for the handling and storage of equipment and materials and the erection of overhead protection; and

(vii) The role of employees in fall protection plans;

(viii) The standards contained in this subpart.

(b) Certification of training.

(1) The employer shall verify compliance with paragraph (a) of this section by preparing a written certification record. The written certification record shall contain the name or other identity of the employee trained, the date(s) of the training, and the signature of the person who conducted the training or the signature of the employer. If the employer relies on training conducted by another employer or completed prior to the effective date of this section, the certification record shall indicate the date the employer determined the prior training was adequate rather than the date of actual training.

(2) The latest training certification shall be maintained. (c) Retraining. When the employer has reason to believe that any affected employee who has already been trained does not have the understanding and skill required by paragraph (a) of this section, the employer shall retrain each such employee. Circumstances where retraining is required include, but are not limited to, situations where:

(1) Changes in the workplace render previous training obsolete; or

(2) Changes in the types of fall protection systems or equipment to be used render previous training obsolete; or

(3) Inadequacies in an affected employee's knowledge or use of fall protection systems or equipment indicate that the employee has not retained the requisite understanding or skill.

Note: The following appendices to subpart M of this part serve as non-mandatory guidelines to assist employers in complying with the appropriate requirements of subpart M of this part.

Appendix A to Subpart M - Determining Roof Widths Non-mandatory Guidelines for Complying With 1926.501(b)(10)

(1) This Appendix serves as a guideline to assist employers complying with the requirements of 1926.501(b)(10). Section 1910.501(b)(10) allows the use of a safety monitoring system alone as a means of providing fall protection during the performance of roofing operations on low-sloped roofs 50 feet (15.25 m) or less in width. Each example in the appendix shows a roof plan or plans and indicates where each roof or roof area is to be measured to determine its width. Section views or elevation views are shown where appropriate. Some examples show "correct" and "incorrect" subdivisions of irregularly shaped roofs divided into smaller, regularly shaped areas. In all examples, the dimension selected to be the width of an area is the lesser of the two primary dimensions of the area, as viewed from above. Example A shows that on a simple rectangular roof, width is the lesser of the two primary overall dimensions. This is also the case with roofs which are sloped toward or away from the roof center, as shown in Example B.

(2) Many roofs are not simple rectangles. Such roofs may be broken down into subareas as shown in Example C. The process of dividing a roof area can produce many different configurations. Example C gives the general rule of using dividing lines of minimum length to minimize the size and number of the areas which are potentially less than 50 feet (15.25 m) wide. The intent is to minimize the number of roof areas where safety monitoring systems alone are sufficient protection.

(3) Roofs which are comprised of several separate, non-contiguous roof areas, as in Example D, may be considered as a series of individual roofs. Some roofs have penthouses, additional floors, courtyard openings, or similar architectural features; Example E shows how the rule for dividing roofs into subareas is applied to such configurations. Irregular, non-rectangular roofs must be considered on an individual basis, as shown in Example F.

Example A

Rectangular Shaped Roofs

(Refer to paper copy for Example A, Rectangular Shaped Roofs)

Example B

Sloped Rectangular Shaped Roofs

(Refer to paper copy for Example B, Sloped Shaped Roofs)

Example C

Irregularly Shaped Roofs With Rectangular Shaped Sections

(Refer to paper copy for Example C, Irregularly Shaped Roofs With Rectangular Shaped Sections)

Such roofs are to be divided into sub-areas by using dividing lines of minimum length to minimize the size and number of the areas which are potentially less than or equal to 50 feet (15.25 meters) in width, in order to limit the size of roof areas where the safety monitoring system alone can be used [1926.502(b)(10)]. Dotted lines are used in the examples to show the location of dividing lines. W denotes incorrect measurements of width.

Example D

Separate, Non-Contiguous Roof Areas

(Refer to paper copy for Example D, Separate, Non-Contiguous Roof Areas)

Example E

Roofs With Penthouses, Open Courtyards, Additional Floors, etc.

(Refer to paper copy for Example E, Roofs With Penthouses, Open Courtyards, Additional Floors, etc.)

Such roofs are to be divided into sub-areas by using dividing lines of minimum length to minimize the size and number of the areas which are potentially less than or equal to 50 feet (15.25 meters) in width, in order to limit the size of roof areas where the safety monitoring system alone can be used [1926.502(b)(10)]. Dotted lines are used in the examples to show the location of dividing lines. W denotes incorrect measurements of width.

Example F

Irregular, Non-Rectangular Shaped Roofs

(Refer to paper copy for Example F, Irregular, Non-Rectangular Shaped Roofs)

Appendix B to Subpart M - Guardrail Systems Non-Mandatory Guidelines for Complying with 1926.502(b)

The standard requires guardrail systems and components to be designed and built to meet the requirements of 1926.502 (b) (3), (4), and (5). This Appendix serves as a non-mandatory guideline to assist employers in complying with these requirements. An employer may use these guidelines as a starting point for designing guardrail systems. However, the guidelines do not provide all the information necessary to build a complete system, and the employer is still responsible for designing and assembling these components in such a way that the completed system will meet the requirements of 1926.502(b) (3), (4), and (5). Components for which no specific guidelines are given in this Appendix (e.g., joints, base connections, components made with other materials, and components with other dimensions) must also be designed and constructed in such a way that the completed system meets the requirements of 1926.502.

(1) For wood railings: Wood components shall be minimum 1500 lb-ft/in(2) fiber (stress grade) construction grade lumber; the posts shall be at least 2-inch by 4-inch (5 cm x 10 cm) lumber spaced not more than 8 feet (2.4 m) apart on centers; the top rail shall be at least 2-inch by 4-inch (5 cm x 10 cm) lumber, the intermediate rail shall be at least 1-inch by 6-inch (2.5 cm x 15 cm) lumber. All lumber dimensions are nominal sizes as provided by the American Softwood Lumber Standards, dated January 1970.

(2) For pipe railings: posts, top rails, and intermediate railings shall be at least one and one-half inches nominal diameter (schedule 40 pipe) with posts spaced not more than 8 feet (2.4 m) apart on centers.

(3) For structural steel railings: posts, top rails, and intermediate rails shall be at least 2-inch by 2-inch (5 cm x 10 cm) by 3/8-inch (1.1 cm) angles, with posts spaced not more than 8 feet (2.4 m) apart on centers.

Appendix C to Subpart M - Personal Fall Arrest Systems Non-Mandatory Guidelines for Complying With 1926.502(d)

I. Test methods for personal fall arrest systems and positioning device systems - (a) General. This appendix serves as a non-mandatory guideline to assist employers comply with the requirements in 1926.502(d). Paragraphs (b), (c), (d) and (e) of this Appendix describe test procedures which may be used to determine compliance with the requirements in 1926.502 (d)(16). As noted in Appendix D of this subpart, the test methods listed here in Appendix C can also be used to assist employers comply with the requirements in 1926.502(e) (3) and (4) for positioning device systems.

(b) General conditions for all tests in the Appendix to 1926.502(d).

(1) Lifelines, lanyards and deceleration devices should be attached to an anchorage and connected to the body-belt or body harness in the same manner as they would be when used to protect employees.

(2) The anchorage should be rigid, and should not have a deflection greater than 0.04 inches (1 mm) when a force of 2,250 pounds (10 kN) is applied.

(3) The frequency response of the load measuring instrumentation should be 500 Hz.

(4) The test weight used in the strength and force tests should be a rigid, metal, cylindrical or torso-shaped object with a girth of 38 inches plus or minus 4 inches (96 cm plus or minus 10 cm).

(5) The lanyard or lifeline used to create the free fall distance should be supplied with the system, or in its absence, the least elastic lanyard or lifeline available to be used with the system.

(6) The test weight for each test should be hoisted to the required level and should be quickly released without having any appreciable motion imparted to it.

(7) The system's performance should be evaluated taking into account the range of environmental conditions for which it is designed to be used. (8) Following the test, the system need not be capable of further operation.

(c) Strength test.

(1) During the testing of all systems, a test weight of 300 pounds plus or minus 5 pounds (135 kg plus or minus 2.5 kg) should be used. (See paragraph (b)(4) of this section.)

(2) The test consists of dropping the test weight once. A new unused system should be used for each test.

(3) For lanyard systems, the lanyard length should be 6 feet plus or minus 2 inches (1.83 m plus or minus 5 cm) as measured from the fixed anchorage to the attachment on the body belt or body harness.

(4) For rope-grab-type deceleration systems, the length of the lifeline above the centerline of the grabbing mechanism to the lifeline's anchorage point should not exceed 2 feet (0.61 m).

(5) For lanyard systems, for systems with deceleration devices which do not automatically limit free fall distance to 2 feet (0.61 m) or less, and for systems with deceleration devices which have a connection distance in excess of 1 foot (0.3 m) (measured between the centerline of the lifeline and the attachment point to the body belt or harness), the test weight should be rigged to free fall a distance of 7.5 feet (2.3 m) from a point that is 1.5 feet (.46 m) above the anchorage point, to its hanging location (6 feet below the anchorage). The test weight should fall without interference, obstruction, or hitting the floor or ground during the test. In some cases a non-elastic wire lanyard of sufficient length may need to be added to the system (for test purposes) to create the necessary free fall distance.

(6) For deceleration device systems with integral lifelines or lanyards which automatically limit free fall distance to 2 feet (0.61 m) or less, the test weight should be rigged to free fall a distance of 4 feet (1.22 m).

(7) Any weight which detaches from the belt or harness has failed the strength test.

(d) Force test -

(1) General. The test consists of dropping the respective test weight once as specified in paragraph (d)(2)(i) or (d)(3)(i) of this section. A new, unused system should be used for each test.

(2) For lanyard systems.

(i) A test weight of 220 pounds plus or minus 3 pounds (100 kg plus or minus 1.6 kg) should be used. (See paragraph (b)(4) of this appendix).

(ii) Lanyard length should be 6 feet plus or minus two inches (1.83 m plus or minus 5 cm) as measured from the fixed anchorage to the attachment on the body belt or body harness.

(iii) The test weight should fall free from the anchorage level to its hanging location (a total of 6 feet (1.83 m) free fall distance) without interference, obstruction, or hitting the floor or ground during the test.

(3) For all other systems. (i) A test weight of 220 pounds plus or minus 3 pounds (100 kg plus or minus 1.6 kg) should be used. (See paragraph (b)(4) of this appendix) (ii) The free fall distance to be used in the test should be the maximum fall distance physically permitted by the system during normal use conditions, up to a maximum free fall distance for the test weight of 6 feet (1.83 m), except as follows:

(A) For deceleration systems which have a connection link or lanyard, the test weight should free fall a distance equal to the connection distance (measured between the centerline of the lifeline and the attachment point to the body belt or harness).

(B) For deceleration device systems with integral lifelines or lanyards which automatically limit free fall distance to 2 feet (0.61 m) or less, the test weight should free fall a distance equal to that permitted by the system in normal use. (For example, to test a system with a self-retracting lifeline or lanyard, the test weight should be supported and the system allowed to retract the lifeline or lanyard as it would in normal use. The test weight would then be released and the force and deceleration distance measured).

(4) A system fails the force test if the recorded maximum arresting force exceeds 1,260 pounds (5.6 kN) when using a body belt, and/or exceeds 2,520 pounds (11.2 kN) when using a body harness.

(5) The maximum elongation and deceleration distance should be recorded during the force test.

(e) Deceleration device tests. (1) General. The device should be evaluated or tested under the environmental conditions, (such as rain, ice, grease, dirt, type of lifeline, etc.), for which the device is designed.

(2) Rope-grab-type deceleration devices.

(i) Devices should be moved on a lifeline 1,000 times over the same length of line a distance of not less than 1 foot (30.5 cm), and the mechanism should lock each time.

(ii) Unless the device is permanently marked to indicate the type(s) of lifeline which must be used, several types (different diameters and different materials), of lifelines should be used to test the device.

(3) Other self-activating-type deceleration devices. The locking mechanisms of other self-activating-type deceleration devices designed for more than one arrest should lock each of 1,000 times as they would in normal service.

II. Additional non-mandatory guidelines for personal fall arrest systems. The following information constitutes additional guidelines for use in complying with requirements for a personal fall arrest system.

(a) Selection and use considerations. (1) The kind of personal fall arrest system selected should match the particular work situation, and any possible free fall distance should be kept to a minimum. Consideration should be given to the particular work environment. For example, the presence of acids, dirt, moisture, oil, grease, etc., and their effect on the system, should be evaluated. Hot or cold environments may also have an adverse effect on the system. Wire rope should not be used where an electrical hazard is anticipated. As required by the standard, the employer must plan to have means available to promptly rescue an employee should a fall occur, since the suspended employee may not be able to reach a work level independently.

(2) Where lanyards, connectors, and lifelines are subject to damage by work operations such as welding, chemical cleaning, and sandblasting, the component should be protected, or other securing systems should be used. The employer should fully evaluate the work conditions and environment (including seasonal weather changes) before selecting the appropriate personal fall protection system. Once in use, the system's effectiveness should be monitored. In some cases, a program for cleaning and maintenance of the system may be necessary.

(b) Testing considerations. Before purchasing or putting into use a personal fall arrest system, an employer should obtain from the supplier information about the system based on its performance during testing so that the employer can know if the system meets this standard. Testing should be done using recognized test methods. This Appendix contains test methods recognized for evaluating the performance of fall arrest systems. Not all systems may need to be individually tested; the performance of some systems may be based on data and calculations derived from testing of similar systems, provided that enough information is available to demonstrate similarity of function and design.

(c) Component compatibility considerations. Ideally, a personal fall arrest system is designed, tested, and supplied as a complete system. However, it is common practice for lanyards, connectors, lifelines, deceleration devices, body belts and body harnesses to be interchanged since some components wear out before others. The employer and employee should realize that not all components are interchangeable. For instance, a lanyard should not be connected between a body belt (or harness) and a deceleration device of the self-retracting type since this can result in additional free fall for which the system was not designed. Any substitution or change to a personal fall arrest system should be fully evaluated or tested by a competent person to determine that it meets the standard, before the modified system is put in use.

(d) Employee training considerations. Thorough employee training in the selection and use of personal fall arrest systems is imperative. Employees must be trained in the safe use of the system. This should include the following: application limits; proper anchoring and tie-off techniques; estimation of free fall distance, including determination of deceleration distance, and total fall distance to prevent striking a lower level; methods of use; and inspection and storage of the system. Careless or improper use of the equipment can result in serious injury or death. Employers and employees should become familiar with the material in this Appendix, as well as manufacturer's recommendations, before a system is used. Of uppermost importance is the reduction in strength caused by certain tie-offs (such as using knots, tying around sharp edges, etc.) and maximum permitted free fall distance. Also, to be stressed are the importance of inspections prior to use, the limitations of the equipment, and unique conditions at the worksite which may be important in determining the type of system to use.

(e) Instruction considerations. Employers should obtain comprehensive instructions from the supplier as to the system's proper use and application, including, where applicable:

(1) The force measured during the sample force test;

(2) The maximum elongation measured for lanyards during the force test;

(3) The deceleration distance measured for deceleration devices during the force test;

(4) Caution statements on critical use limitations;

(5) Application limits;

(6) Proper hook-up, anchoring and tie-off techniques, including the proper dee-ring or other attachment point to use on the body belt and harness for fall arrest;

(7) Proper climbing techniques;

(8) Methods of inspection, use, cleaning, and storage; and

(9) Specific lifelines which may be used. This information should be provided to employees during training. (f) Rescue considerations. As required by 1926.502(d)(20), when personal fall arrest systems are used, the employer must assure that employees can be promptly rescued or can rescue themselves should a fall occur. The availability of rescue personnel, ladders or other rescue equipment should be evaluated. In some situations, equipment which allows employees to rescue themselves after the fall has been arrested may be desirable, such as devices which have descent capability.

(g) Inspection considerations. As required by 1926.502(d)(21), personal fall arrest systems must be regularly inspected. Any component with any significant defect, such as cuts, tears, abrasions, mold, or undue stretching; alterations or additions which might affect its efficiency; damage due to deterioration; contact with fire, acids, or other corrosives; distorted hooks or faulty hook springs; tongues unfitted to the shoulder of buckles; loose or damaged mountings; non-functioning parts; or wearing or internal deterioration in the ropes must be withdrawn from service immediately, and should be tagged or marked as unusable, or destroyed.

(h) Tie-off considerations. (1) One of the most important aspects of personal fall protection systems is fully planning the system before it is put into use. Probably the most overlooked component is planning for suitable anchorage points. Such planning should ideally be done before the structure or building is constructed so that anchorage points can be incorporated during construction for use later for window cleaning or other building maintenance. If properly planned, these anchorage points may be used during construction, as well as afterwards.

(i) Properly planned anchorages should be used if they are available. In some cases, anchorages must be installed immediately prior to use. In such cases, a registered professional engineer with experience in designing fall protection systems, or another qualified person with appropriate education and experience should design an anchor point to be installed.

(ii) In other cases, the Agency recognizes that there will be a need to devise an anchor point from existing structures. Examples of what might be appropriate anchor points are steel members or I-beams if an acceptable strap is available for the connection (do not use a lanyard with a snaphook clipped onto itself); large eye-bolts made of an appropriate grade steel; guardrails or railings if they have been designed for use as an anchor point; or masonry or wood members only if the attachment point is substantial and precautions have been taken to assure that bolts or other connectors will not pull through. A qualified person should be used to evaluate the suitable of these "make shift" anchorages with a focus on proper strength.

(2) Employers and employees should at all times be aware that the strength of a personal fall arrest system is based on its being attached to an anchoring system which does not reduce the strength of the system (such as a properly dimensioned eye-bolt/snap-hook anchorage). Therefore, if a means of attachment is used that will reduce the strength of the system, that component should be replaced by a stronger one, but one that will also maintain the appropriate maximum arrest force characteristics.

(3) Tie-off using a knot in a rope lanyard or lifeline (at any location) can reduce the lifeline or lanyard strength by 50 percent or more. Therefore, a stronger lanyard or lifeline should be used to compensate for the weakening effect of the knot, or the lanyard length should be reduced (or the tie-off location raised) to minimize free fall distance, or the lanyard or lifeline should be replaced by one which has an appropriately incorporated connector to eliminate the need for a knot.

(4) Tie-off of a rope lanyard or lifeline around an "H" or "I" beam or similar support can reduce its strength as much as 70 percent due to the cutting action of the beam edges. Therefore, use should be made of a webbing lanyard or wire core lifeline around the beam; or the lanyard or lifeline should be protected from the edge; or free fall distance should be greatly minimized.

(5) Tie-off where the line passes over or around rough or sharp surfaces reduces strength drastically. Such a tie-off should be avoided or an alternative tie-off rigging should be used. Such alternatives may include use of a snap-hook/dee ring connection, wire rope tie-off, an effective padding of the surfaces, or an abrasion-resistance strap around or over the problem surface.

(6) Horizontal lifelines may, depending on their geometry and angle of sag, be subjected to greater loads than the impact load imposed by an attached component. When the angle of horizontal lifeline sag is less than 30 degrees, the impact force imparted to the lifeline by an attached lanyard is greatly amplified. For example, with a sag angle of 15 degrees, the force amplification is about 2:1 and at 5 degrees sag, it is about 6:1. Depending on the angle of sag, and the line's elasticity, the strength of the horizontal lifeline and the anchorages to which it is attached should be increased a number of times over that of the lanyard. Extreme care should be taken in considering a horizontal lifeline for multiple tie-offs. The reason for this is that in multiple tie-offs to a horizontal lifeline, if one employee falls, the movement of the falling employee and the horizontal lifeline during arrest of the fall may cause other employees to fall also. Horizontal lifeline and anchorage strength should be increased for each additional employee to be tied off. For these and other reasons, the design of systems using horizontal lifelines must only be done by qualified persons. Testing of installed lifelines and anchors prior to use is recommended.

(7) The strength of an eye-bolt is rated along the axis of the bolt and its strength is greatly reduced if the force is applied at an angle to this axis (in the direction of shear). Also, care should be exercised in selecting the proper diameter of the eye to avoid accidental disengagement of snap-hooks not designed to be compatible for the connection.

(8) Due to the significant reduction in the strength of the lifeline/lanyard (in some cases, as much as a 70 percent reduction), the sliding hitch knot (prusik) should not be used for lifeline/lanyard connections except in emergency situations where no other available system is practical. The "one-and-one" sliding hitch knot should never be used because it is unreliable in stopping a fall. The "two-and-two," or "three-and-three" knot (preferable) may be used in emergency situations; however, care should be taken to limit free fall distance to a minimum because of reduced lifeline/lanyard strength.

(i) Vertical lifeline considerations. As required by the standard, each employee must have a separate lifeline [except employees engaged in constructing elevator shafts who are permitted to have two employees on one lifeline] when the lifeline is vertical. The reason for this is that in multiple tie-offs to a single lifeline, if one employee falls, the movement of the lifeline during the arrest of the fall may pull other employees' lanyards, causing them to fall as well.

(j) Snap-hook considerations. (1) Although not required by this standard for all connections until January 1, 1998, locking snaphooks designed for connection to suitable objects (of sufficient strength) are highly recommended in lieu of the nonlocking type. Locking snaphooks incorporate a positive locking mechanism in addition to the spring loaded keeper, which will not allow the keeper to open under moderate pressure without someone first releasing the mechanism. Such a feature, properly designed, effectively prevents roll-out from occurring.

(2) As required by 1926.502(d)(6), the following connections must be avoided (unless properly designed locking snaphooks are used) because they are conditions which can result in roll-out when a nonlocking snaphook is used:

(i) Direct connection of a snaphook to a horizontal lifeline.

(ii) Two (or more) snaphooks connected to one dee-ring.

(iii) Two snaphooks connected to each other.

(iv) A snaphook connected back on its integral lanyard.

(v) A snaphook connected to a webbing loop or webbing lanyard.

(vi) Improper dimensions of the dee-ring, rebar, or other connection point in relation to the snaphook dimensions which would allow the snaphook keeper to be depressed by a turning motion of the snaphook.

(k) Free fall considerations. The employer and employee should at all times be aware that a system's maximum arresting force is evaluated under normal use conditions established by the manufacturer, and in no case using a free fall distance in excess of 6 feet (1.8 m). A few extra feet of free fall can significantly increase the arresting force on the employee, possibly to the point of causing injury. Because of this, the free fall distance should be kept at a minimum, and, as required by the standard, in no case greater than 6 feet (1.8 m). To help assure this, the tie-off attachment point to the lifeline or anchor should be located at or above the connection point of the fall arrest equipment to belt or harness. (Since otherwise additional free fall distance is added to the length of the connecting means (i.e. lanyard)). Attaching to the working surface will often result in a free fall greater than 6 feet (1.8 m). For instance, if a 6 foot (1.8 m) lanyard is used, the total free fall distance will be the distance from the working level to the body belt (or harness) attachment point plus the 6 feet (1.8 m) of lanyard length. Another important consideration is that the arresting force which the fall system must withstand also goes up with greater distances of free fall, possibly exceeding the strength of the system.

(l) Elongation and deceleration distance considerations. Other factors involved in a proper tie-off are elongation and deceleration distance. During the arresting of a fall, a lanyard will experience a length of stretching or elongation, whereas activation of a deceleration device will result in a certain stopping distance. These distances should be available with the lanyard or device's instructions and must be added to the free fall distance to arrive at the total fall distance before an employee is fully stopped. The additional stopping distance may be very significant if the lanyard or deceleration device is attached near or at the end of a long lifeline, which may itself add considerable distance due to its own elongation. As required by the standard, sufficient distance to allow for all of these factors must also be maintained between the employee and obstructions below, to prevent an injury due to impact before the system fully arrests the fall. In addition, a minimum of 12 feet (3.7 m) of lifeline should be allowed below the securing point of a rope grab type deceleration device, and the end terminated to prevent the device from sliding off the lifeline. Alternatively, the lifeline should extend to the ground or the next working level below. These measures are suggested to prevent the worker from inadvertently moving past the end of the lifeline and having the rope grab become disengaged from the lifeline.

(m) Obstruction considerations. The location of the tie-off should also consider the hazard of obstructions in the potential fall path of the employee. Tie-offs which minimize the possibilities of exaggerated swinging should be considered. In addition, when a body belt is used, the employee's body will go through a horizontal position to a jack-knifed position during the arrest of all falls. Thus, obstructions which might interfere with this motion should be avoided or a severe injury could occur.

(n) Other considerations. Because of the design of some personal fall arrest systems, additional considerations may be required for proper tie-off. For example, heavy deceleration devices of the self-retracting type should be secured overhead in order to avoid the weight of the device having to be supported by the employee. Also, if self-retracting equipment is connected to a horizontal lifeline, the sag in the lifeline should be minimized to prevent the device from sliding down the lifeline to a position which creates a swing hazard during fall arrest. In all cases, manufacturer's instructions should be followed.

Appendix D to Subpart M - Positioning Device Systems

Non-Mandatory Guidelines for Complying With 1926.502(e)

I. Testing Methods For Positioning Device Systems. This appendix serves as a non-mandatory guideline to assist employers comply with the requirements for positioning device systems in 1926.502(e). Paragraphs (b), (c), (d) and (e) of Appendix C of subpart M relating to 1926.502(d) - Personal Fall Arrest Systems - set forth test procedures which may be used, along with the procedures listed below, to determine compliance with the requirements for positioning device systems in 1926.502(e)(3) and (4) of Subpart M.

(a) General.

(1) Single strap positioning devices shall have one end attached to a fixed anchorage and the other end connected to a body belt or harness in the same manner as they would be used to protect employees. Double strap positioning devices, similar to window cleaner's belts, shall have one end of the strap attached to a fixed anchorage and the other end shall hang free. The body belt or harness shall be attached to the strap in the same manner as it would be used to protect employees. The two strap ends shall be adjusted to their maximum span.

(2) The fixed anchorage shall be rigid, and shall not have a deflection greater than .04 inches (1 mm) when a force of 2,250 pounds (10 kN) is applied.

(3) During the testing of all systems, a test weight of 250 pounds plus or minus 3 pounds (113 kg plus or minus 1.6 kg) shall be used. The weight shall be a rigid object with a girth of 38 inches plus or minus 4 inches (96 cm plus or minus 10 cm).

(4) Each test shall consist of dropping the specified weight one time without failure of the system being tested. A new system shall be used for each test.

(5) The test weight for each test shall be hoisted exactly 4 feet (1.2 m above its "at rest" position), and shall be dropped so as to permit a vertical free fall of 4 feet (1.2 m).

(6) The test is failed whenever any breakage or slippage occurs which permits the weight to fall free of the system.

(7) Following the test, the system need not be capable of further operation; however, all such incapacities shall be readily apparent.

II. Inspection Considerations. As required in 1926.502 (e)(5), positioning device systems must be regularly inspected. Any component with any significant defect, such as cuts, tears, abrasions, mold, or undue stretching; alterations or additions which might affect its efficiency; damage due to deterioration; contact with fire, acids, or other corrosives; distorted hooks or faulty hook springs; tongues unfitted to the shoulder of buckles; loose or damaged mountings; non-functioning parts; or wearing or internal deterioration in the ropes must be withdrawn from service immediately, and should be tagged or marked as unusable, or destroyed.

Appendix E to Subpart M - Sample Fall Protection Plan

Non-Mandatory Guidelines for Complying With 1926.502(k)

Employers engaged in leading edge work, precast concrete construction work and residential construction work who can demonstrate that it is infeasible or creates a greater hazard to use conventional fall protection systems must develop and follow a fall protection plan. Below are sample fall protection plans developed for precast concrete construction and residential work that could be tailored to be site specific for other precast concrete or residential jobsite. This sample plan can be modified to be used for other work involving leading edge work. The sample plan outlines the elements that must be addressed in any fall protection plan. The reasons outlined in this sample fall protection plan are for illustrative purposes only and are not necessarily a valid, acceptable rationale (unless the conditions at the job site are the same as those covered by these sample plans) for not using conventional fall protection systems for a particular precast concrete or residential construction worksite. However, the sample plans provide guidance to employers on the type of information that is required to be discussed in fall protection plans.

Sample Fall Protection Plans

Fall Protection Plan For Precast/Prestress Concrete Structures

This Fall Protection Plan is specific for the following project:

Location of Job _____
Erecting Company _____
Date Plan Prepared or Modified _____
Plan Prepared By _____
Plan Approved By _____
Plan Supervised By _____

The following Fall Protection Plan is a sample program prepared for the prevention of injuries associated with falls. A Fall Protection Plan must be developed and evaluated on a site by site basis. It is recommended that erectors discuss the written Fall Protection Plan with their OSHA Area Office prior to going on a jobsite.

I. Statement of Company Policy

(Company Name) is dedicated to the protection of its employees from on-the-job injuries. All employees of (Company Name) have the responsibility to work safely on the job. The purpose of this plan is: (a) To supplement our standard safety policy by providing safety standards specifically designed to cover fall protection on this job and; (b) to ensure that each employee is trained and made aware of the safety provisions which are to be implemented by this plan prior to the start of erection.

This Fall Protection Plan addresses the use of other than conventional fall protection at a number of areas on the project, as well as identifying specific activities that require non-conventional means of fall protection. These areas include:

a. Connecting activity (point of erection). b. Leading edge work. c. Unprotected sides or edge. d. Grouting. This plan is designed to enable employers and employees to recognize the fall hazards on this job and to establish the procedures that are to be followed in order to prevent falls to lower levels or through holes and openings in walking/working surfaces. Each employee will be trained in these procedures and strictly adhere to them except when doing so would expose the employee to a greater hazard. If, in the employee's opinion, this is the case, the employee is to notify the foreman of the concern and the concern addressed before proceeding.

Safety policy and procedure on any one project cannot be administered, implemented, monitored and enforced by any one individual. The total objective of a safe, accident free work environment can only be accomplished by a dedicated, concerted effort by every individual involved with the project from management down to the last employee. Each employee must understand their value to the company; the costs of accidents, both monetary, physical, and emotional; the objective of the safety policy and procedures; the safety rules that apply to the safety policy and procedures; and what their individual role is in administering, implementing, monitoring, and compliance of their safety policy and procedures. This allows for a more personal approach to compliance through planning, training, understanding and cooperative effort, rather than by strict enforcement. If for any reason an unsafe act persists, strict enforcement will be implemented.

It is the responsibility of (name of competent person) to implement this Fall Protection Plan. (Name of Competent Person) is responsible for continual observational safety checks of their work operations and to enforce the safety policy and procedures. The foreman also is responsible to correct any unsafe acts or conditions immediately. It is the responsibility of the employee to understand and adhere to the procedures of this plan and to follow the instructions of the foreman. It is also the responsibility of the employee to bring to management's attention any unsafe or hazardous conditions or acts that may cause injury to either themselves or any other employees. Any changes to this Fall Protection Plan must be approved by (name of Qualified Person).

II. Fall Protection Systems to Be Used on This Project

Where conventional fall protection is infeasible or creates a greater hazard at the leading edge and during initial connecting activity, we plan to do this work using a safety monitoring system and expose only a minimum number of employees for the time necessary to actually accomplish the job. The maximum number of workers to be monitored by one safety monitor is six (6). We are designating the following trained employees as designated erectors and they are permitted to enter the controlled access zones and work without the use of conventional fall protection.

Safety monitor: Designated erector: Designated erector: Designated erector: Designated erector: Designated erector: Designated erector:

The safety monitor shall be identified by wearing an orange hard hat. The designated erectors will be identified by one of the following methods:

1. They will wear a blue colored arm band, or 2. They will wear a blue colored hard hat, or 3. They will wear a blue colored vest.

Only individuals with the appropriate experience, skills, and training will be authorized as designated erectors. All employees that will be working as designated erectors under the safety monitoring system shall have been trained and instructed in the following areas:

1. Recognition of the fall hazards in the work area (at the leading edge and when making initial connections-point of erection).

2. Avoidance of fall hazards using established work practices which have been made known to the employees.

3. Recognition of unsafe practices or working conditions that could lead to a fall, such as windy conditions.

4. The function, use, and operation of safety monitoring systems, guardrail systems, body belt/harness systems, control zones and other protection to be used.

5. The correct procedure for erecting, maintaining, disassembling and inspecting the system(s) to be used.

6. Knowledge of construction sequence or the erection plan. A conference will take place prior to starting work involving all members of the erection crew, crane crew and supervisors of any other concerned contractors. This conference will be conducted by the precast concrete erection supervisor in charge of the project. During the pre-work conference, erection procedures and sequences pertinent to this job will be thoroughly discussed and safety practices to be used throughout the project will be specified. Further, all personnel will be informed that the controlled access zones are off limits to all personnel other than those designated erectors specifically trained to work in that area.

Safety Monitoring System

A safety monitoring system means a fall protection system in which a competent person is responsible for recognizing and warning employees of fall hazards. The duties of the safety monitor are to:

1. Warn by voice when approaching the open edge in an unsafe manner.

2. Warn by voice if there is a dangerous situation developing which cannot be seen by another person involved with product placement, such as a member getting out of control.

3. Make the designated erectors aware they are in a dangerous area.

4. Be competent in recognizing fall hazards.

5. Warn employees when they appear to be unaware of a fall hazard or are acting in an unsafe manner.

6. Be on the same walking/working surface as the monitored employees and within visual sighting distance of the monitored employees.

7. Be close enough to communicate orally with the employees.

8. Not allow other responsibilities to encumber monitoring. If the safety monitor becomes too encumbered with other responsibilities, the monitor shall (1) stop the erection process; and (2) turn over other responsibilities to a designated erector; or (3) turn over the safety monitoring function to another designated, competent person. The safety monitoring system shall not be used when the wind is strong enough to cause loads with large surface areas to swing out of radius, or result in loss of control of the load, or when weather conditions cause the walking-working surfaces to become icy or slippery.

Control Zone System

A controlled access zone means an area designated and clearly marked, in which leading edge work may take place without the use of guardrail, safety net or personal fall arrest systems to protect the employees in the area. Control zone systems shall comply with the following provisions:

1. When used to control access to areas where leading edge and other operations are taking place the controlled access zone shall be defined by a control line or by any other means that restricts access.

When control lines are used, they shall be erected not less than 6 feet (l.8 m) nor more than 60 feet (18 m) or half the length of the member being erected, whichever is less, from the leading edge.

2. The control line shall extend along the entire length of the unprotected or leading edge and shall be approximately parallel to the unprotected or leading edge.

3. The control line shall be connected on each side to a guardrail system or wall.

4. Control lines shall consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions as follows:

5. Each line shall be flagged or otherwise clearly marked at not more than 6-foot (1.8 m) intervals with high-visibility material.

6. Each line shall be rigged and supported in such a way that its lowest point (including sag) is not less than 39 inches (1 m) from the walking/working surface and its highest point is not more than 45 inches (1.3 m) from the walking/working surface.

7. Each line shall have a minimum breaking strength of 200 pounds (.88 kN).

Holes

All openings greater than 12 in. x 12 in. will have perimeter guarding or covering. All predetermined holes will have the plywood covers made in the precasters' yard and shipped with the member to the jobsite. Prior to cutting holes on the job, proper protection for the hole must be provided to protect the workers. Perimeter guarding or covers will not be removed without the approval of the erection foreman.

Precast concrete column erection through the existing deck requires that many holes be provided through this deck. These are to be covered and protected. Except for the opening being currently used to erect a column, all opening protection is to be left undisturbed. The opening being uncovered to erect a column will become part of the point of erection and will be addressed as part of this Fall Protection Plan. This uncovering is to be done at the erection foreman's direction and will only occur immediately prior to "feeding" the column through the opening. Once the end of the column is through the slab opening, there will no longer exist a fall hazard at this location.

III. Implementation of Fall Protection Plan

The structure being erected is a multistory total precast concrete building consisting of columns, beams, wall panels and hollow core slabs and double tee floor and roof members.

The following is a list of the products and erection situations on this job:

Columns

For columns 10 ft to 36 ft long, employees disconnecting crane hooks from columns will work from a ladder and wear a body belt/harness with lanyard and be tied off when both hands are needed to disconnect. For tying off, a vertical lifeline will be connected to the lifting eye at the top of the column, prior to lifting, to be used with a manually operated or mobile rope grab. For columns too high for the use of a ladder, 36 ft and higher, an added cable will be used to reduce the height of the disconnecting point so that a ladder can be used. This cable will be left in place until a point in erection that it can be removed safely. In some cases, columns will be unhooked from the crane by using an erection tube or shackle with a pull pin which is released from the ground after the column is stabilized.

The column will be adequately connected and/or braced to safely support the weight of a ladder with an employee on it.

Inverted Tee Beams

Employees erecting inverted tee beams, at a height of 6 to 40 ft, will erect the beam, make initial connections, and final alignment from a ladder. If the employee needs to reach over the side of the beam to bar or make an adjustment to the alignment of the beam, they will mount the beam and be tied off to the lifting device in the beam after ensuring the load has been stabilized on its bearing. To disconnect the crane from the beam an employee will stand a ladder against the beam. Because the use of ladders is not practical at heights above 40 ft, beams will be initially placed with the use of tag lines and their final alignment made by a person on a manlift or similar employee positioning systems.

Spandrel Beams

Spandrel beams at the exterior of the building will be aligned as closely as possible with the use of tag lines with the final placement of the spandrel beam made from a ladder at the open end of the structure. A ladder will be used to make the initial connections and a ladder will be used to disconnect the crane. The other end of the beam will be placed by the designated erector from the double tee deck under the observation of the safety monitor.

The beams will be adequately connected and/or braced to safely support the weight of a ladder with an employee on it.

Floor and Roof Members

During installation of the precast concrete floor and/or roof members, the work deck continuously increases in area as more and more units are being erected and positioned. Thus, the unprotected floor/roof perimeter is constantly modified with the leading edge changing location as each member is installed. The fall protection for workers at the leading edge shall be assured by properly constructed and maintained control zone lines not more than 60 ft away from the leading edge supplemented by a safety monitoring system to ensure the safety of all designated erectors working within the area defined by the control zone lines.

The hollow core slabs erected on the masonry portion of the building will be erected and grouted using the safety monitoring system. Grout will be placed in the space between the end of the slab and face shell of the concrete masonry by dumping from a wheelbarrow. The grout in the keyways between the slabs will be dumped from a wheelbarrow and then spread with long handled tools, allowing the worker to stand erect facing toward the unprotected edge and back from any work deck edge.

Whenever possible, the designated erectors will approach the incoming member at the leading edge only after it is below waist height so that the member itself provides protection against falls.

Except for the situations described below, when the arriving floor or roof member is within 2 to 3 inches of its final position, the designated erectors can then proceed to their position of erection at each end of the member under the control of the safety monitor. Crane hooks will be unhooked from double tee members by designated erectors under the direction and supervision of the safety monitor.

Designated erectors, while waiting for the next floor or roof member, will be constantly under the control of the safety monitor for fall protection and are directed to stay a minimum of six (6) ft from the edge. In the event a designated erector must move from one end of a member, which has just been placed at the leading edge, they must first move away from the leading edge a minimum of six (6) ft and then progress to the other end while maintaining the minimum distance of six (6) ft at all times.

Erection of double tees, where conditions require bearing of one end into a closed pocket and the other end on a beam ledge, restricting the tee legs from going directly into the pockets, require special considerations. The tee legs that are to bear in the closed pocket must hang lower than those at the beam bearing. The double tee will be "two-lined" in order to elevate one end higher than the other to allow for the low end to be ducked into the closed pocket using the following procedure.

The double tee will be rigged with a standard four-way spreader off of the main load line. An additional choker will be attached to the married point of the two-legged spreader at the end of the tee that is to be elevated. The double tee will be hoisted with the main load line and swung into a position as close as possible to the tee's final bearing elevation. When the tee is in this position and stabilized, the whip line load block will be lowered to just above the tee deck. At this time, two erectors will walk out on the suspended tee deck at midspan of the tee member and pull the load block to the end of the tee to be elevated and attach the additional choker to the load block. The possibility of entanglement with the crane lines and other obstacles during this two lining process while raising and lowering the crane block on that second line could be hazardous to an encumbered employee. Therefore, the designated erectors will not tie off during any part of this process. While the designated erectors are on the double tee, the safety monitoring system will be used. After attaching the choker, the two erectors then step back on the previously erected tee deck and signal the crane operator to hoist the load with the whip line to the elevation that will allow for enough clearance to let the low end tee legs slide into the pockets when the main load line is lowered. The erector, who is handling the lowered end of the tee at the closed pocket bearing, will step out on the suspended tee. An erection bar will then be placed between the end of the tee leg and the inside face of the pocketed spandrel member. The tee is barred away from the pocketed member to reduce the friction and lateral force against the pocketed member. As the tee is being lowered, the other erector remains on the tee which was previously erected to handle the other end. At this point the tee is slowly lowered by the crane to a point where the tee legs can freely slide into the pockets. The erector working the lowered end of the tee must keep pressure on the bar between the tee and the face of the pocketed spandrel member to very gradually let the tee legs slide into the pocket to its proper bearing dimension. The tee is then slowly lowered into its final erected position.

The designated erector should be allowed onto the suspended double tee, otherwise there is no control over the horizontal movement of the double tee and this movement could knock the spandrel off of its bearing or the column out of plumb. The control necessary to prevent hitting the spandrel can only be done safely from the top of the double tee being erected.

Loadbearing Wall Panels: The erection of the loadbearing wall panels on the elevated decks requires the use of a safety monitor and a controlled access zone that is a minimum of 25 ft and a maximum of 1/2 the length of the wall panels away from the unprotected edge, so that designated erectors can move freely and unencumbered when receiving the panels. Bracing, if required for stability, will be installed by ladder. After the braces are secured, the crane will be disconnected from the wall by using a ladder. The wall to wall connections will also be performed from a ladder.

Non-Loadbearing Panels (Cladding): The locating of survey lines, panel layout and other installation prerequisites (prewelding, etc.) for non-loadbearing panels (cladding) will not commence until floor perimeter and floor openings have been protected. In some areas, it is necessary because of panel configuration to remove the perimeter protection as the cladding is being installed. Removal of perimeter protection will be performed on a bay to bay basis, just ahead of cladding erection to minimize temporarily unprotected floor edges. Those workers within 6 ft of the edge, receiving and positioning the cladding when the perimeter protection is removed shall be tied off.

Detailing

Employees exposed to falls of six (6) feet or more to lower levels, who are not actively engaged in leading edge work or connecting activity, such as welding, bolting, cutting, bracing, guying, patching, painting or other operations, and who are working less than six (6) ft from an unprotected edge will be tied off at all times or guardrails will be installed. Employees engaged in these activities but who are more than six (6) ft from an unprotected edge as defined by the control zone lines, do not require fall protection but a warning line or control lines must be erected to remind employees they are approaching an area where fall protection is required.

IV. Conventional Fall Protection Considered for the Point of Erection or Leading Edge Erection Operations

A. Personal Fall Arrest Systems

In this particular erection sequence and procedure, personal fall arrest systems requiring body belt/harness systems, lifelines and lanyards will not reduce possible hazards to workers and will create offsetting hazards during their usage at the leading edge of precast/prestressed concrete construction.

Leading edge erection and initial connections are conducted by employees who are specifically trained to do this type of work and are trained to recognize the fall hazards. The nature of such work normally exposes the employee to the fall hazard for a short period of time and installation of fall protection systems for a short duration is not feasible because it exposes the installers of the system to the same fall hazard, but for a longer period of time.

1. It is necessary that the employee be able to move freely without encumbrance in order to guide the sections of precast concrete into their final position without having lifelines attached which will restrict the employee's ability to move about at the point of erection.

2. A typical procedure requires 2 or more workers to maneuver around each other as a concrete member is positioned to fit into the structure. If they are each attached to a lifeline, part of their attention must be diverted from their main task of positioning a member weighing several tons to the task of avoiding entanglements of their lifelines or avoiding tripping over lanyards. Therefore, if these workers are attached to lanyards, more fall potential would result than from not using such a device.

In this specific erection sequence and procedure, retractable lifelines do not solve the problem of two workers becoming tangled. In fact, such a tangle could prevent the lifeline from retracting as the worker moved, thus potentially exposing the worker to a fall greater than 6 ft. Also, a worker crossing over the lifeline of another worker can create a hazard because the movement of one person can unbalance the other. In the event of a fall by one person there is a likelihood that the other person will be caused to fall as well. In addition, if contamination such as grout (during hollow core grouting) enters the retractable housing it can cause excessive wear and damage to the device and could clog the retracting mechanism as the lanyard is dragged across the deck. Obstructing the cable orifice can defeat the device's shock absorbing function, produce cable slack and damage, and adversely affect cable extraction and retraction.

3. Employees tied to a lifeline can be trapped and crushed by moving structural members if the employee becomes restrained by the lanyard or retractable lifeline and cannot get out of the path of the moving load. The sudden movement of a precast concrete member being raised by a crane can be caused by a number of factors.

When this happens, a connector may immediately have to move a considerable distance to avoid injury. If a tied off body belt/harness is being used, the connector could be trapped. Therefore, there is a greater risk of injury if the connector is tied to the structure for this specific erection sequence and procedure.

When necessary to move away from a retractable device, the worker cannot move at a rate greater than the device locking speed typically 3.5 to 4.5 ft/sec. When moving toward the device it is necessary to move at a rate which does not permit cable slack to build up. This slack may cause cable retraction acceleration and cause a worker to lose their balance by applying a higher than normal jerking force on the body when the cable suddenly becomes taut after building up momentum. This slack can also cause damage to the internal spring-loaded drum, uneven coiling of cable on the drum, and possible cable damage.

The factors causing sudden movements for this location include:

(a) Cranes

(1) Operator error.
(2) Site conditions (soft or unstable ground).
(3) Mechanical failure.
(4) Structural failure.
(5) Rigging failure.
(6) Crane signal/radio communication failure.

(b) Weather Conditions

(1) Wind (strong wind/sudden gusting) - particularly a problem with the large surface areas of precast concrete members.
(2) Snow/rain (visibility).
(3) Fog (visibility).
(4) Cold - causing slowed reactions or mechanical problems.
(c) Structure/Product Conditions.
(1) Lifting Eye failure.
(2) Bearing failure or slippage.
(3) Structure shifting.
(4) Bracing failure.
(5) Product failure.
(d) Human Error.
(1) Incorrect tag line procedure.
(2) Tag line hang-up.
(3) Incorrect or misunderstood crane signals.
(4) Misjudged elevation of member.
(5) Misjudged speed of member.
(6) Misjudged angle of member.

4. Anchorages or special attachment points could be cast into the precast concrete members if sufficient preplanning and consideration of erectors' position is done before the members are cast. Any hole or other attachment must be approved by the engineer who designed the member. It is possible that some design restrictions will not allow a member to be weakened by an additional hole; however, it is anticipated that such situations would be the exception, not the rule. Attachment points, other than on the deck surface, will require removal and/or patching. In order to remove and/or patch these points, requires the employee to be exposed to an additional fall hazard at an unprotected perimeter. The fact that attachment points could be available anywhere on

the structure does not eliminate the hazards of using these points for tying off as discussed above. A logical point for tying off on double tees would be using the lifting loops, except that they must be cut off to eliminate a tripping hazard at an appropriate time.

5. Providing attachment at a point above the walking/working surface would also create fall exposures for employees installing their devices. Final positioning of a precast concrete member requires it to be moved in such a way that it must pass through the area that would be occupied by the lifeline and the lanyards attached to the point above. Resulting entanglements of lifelines and lanyards on a moving member could pull employees from the work surface. Also, the structure is being created and, in most cases, there is no structure above the members being placed.

(a) Temporary structural supports, installed to provide attaching points for lifelines limit the space which is essential for orderly positioning, alignment and placement of the precast concrete members. To keep the lanyards a reasonable and manageable length, lifeline supports would necessarily need to be in proximity to the positioning process. A sudden shift of the precast concrete member being positioned because of wind pressure or crane movement could make it strike the temporary supporting structure, moving it suddenly and causing tied off employees to fall.

(b) The time in manhours which would be expended in placing and maintaining temporary structural supports for lifeline attaching points could exceed the expended manhours involved in placing the precast concrete members. No protection could be provided for the employees erecting the temporary structural supports and these supports would have to be moved for each successive step in the construction process, thus greatly increasing the employee's exposure to the fall hazard.

(c) The use of a cable strung horizontally between two columns to provide tie off lines for erecting or walking a beam for connecting work is not feasible and creates a greater hazard on this multi-story building for the following reasons:

(1) If a connector is to use such a line, it must be installed between the two columns. To perform this installation requires an erector to have more fall exposure time attaching the cable to the columns than would be spent to make the beam to column connection itself.

(2) If such a line is to be installed so that an erector can walk along a beam, it must be overhead or below him. For example, if a connector must walk along a 24 in. wide beam, the presence of a line next to the connector at waist level, attached directly to the columns, would prevent the connector from centering their weight over the beam and balancing themselves. Installing the line above the connector might be possible on the first level of a two-story column; however, the column may extend only a few feet above the floor level at the second level or be flush with the floor level. Attaching the line to the side of the beam could be a solution; however, it would require the connector to attach the lanyard below foot level which would most likely extend a fall farther than 6 ft.

(3) When lines are strung over every beam, it becomes more and more difficult for the crane operator to lower a precast concrete member into position without the member becoming fouled. Should the member become entangled, it could easily dislodge the line from a column. If a worker is tied to it at the time, a fall could be caused.

6. The ANSI A10.14-1991 American National Standard for Construction and Demolition Operations - Requirements for Safety Belts, Harnesses, Lanyards and Lifelines for Construction and Demolition Use, states that the anchor point of a lanyard or deceleration device should, if possible, be located above the wearer's belt or harness attachment. ANSI A10.14 also states that a suitable anchorage point is one which is located as high as possible to prevent contact with an obstruction below should the worker fall. Most manufacturers also warn in the user's handbook that the safety block/retractable lifeline must be positioned above the D-ring (above the work space of the intended user) and OSHA recommends that fall arrest and restraint equipment be used in accordance with the manufacturer's instructions.

Attachment of a retractable device to a horizontal cable near floor level or using the inserts in the floor or roof members may result in increased free fall due to the dorsal D-ring of the full-body harness riding higher than the attachment point of the snaphook to the cable or insert (e.g., 6 foot tall worker with a dorsal D-ring at 5 feet above the floor or surface, reduces the working length to only one foot, by placing the anchorage five feet away from the fall hazard). In addition, impact loads may exceed maximum fall arrest forces (MAF) because the fall arrest D-ring would be 4 to 5 feet higher than the safety block/retractable lifeline anchored to the walking-working surface; and the potential for swing hazards is increased.

Manufacturers also require that workers not work at a level where the point of snaphook attachment to the body harness is above the device because this will increase the free fall distance and the deceleration distance and will cause higher forces on the body in the event of an accidental fall.

Manufacturers recommend an anchorage for the retractable lifeline which is immovably fixed in space and is independent of the user's support systems. A moveable anchorage is one which can be moved around (such as equipment or wheeled vehicles) or which can deflect substantially under shock loading (such as a horizontal cable or very flexible beam). In the case of a very flexible anchorage, a shock load applied to the anchorage during fall arrest can cause oscillation of the flexible anchorage such that the retractable brake mechanism may undergo one or more cycles of locking/unlocking/locking (ratchet effect) until the anchorage deflection is dampened. Therefore, use of a moveable anchorage involves critical engineering and safety factors and should only be considered after fixed anchorage has been determined to be not feasible.

Horizontal cables used as an anchorage present an additional hazard due to amplification of the horizontal component of maximum arrest force (of a fall) transmitted to the points where the horizontal cable is attached to the structure. This amplification is due to the angle of sag of a horizontal cable and is most severe for small angles of sag. For a cable sag angle of 2 degrees the horizontal force on the points of cable attachment can be amplified by a factor of 15.

It is also necessary to install the retractable device vertically overhead to minimize swing falls. If an object is in the worker's swing path (or that of the cable) hazardous situations exist: (1) due to the swing, horizontal speed of the user may be high enough to cause injury when an obstacle in the swing fall path is struck by either the user or the cable; (2) the total vertical fall distance of the user may be much greater than if the user had fallen only vertically without a swing fall path.

With retractable lines, overconfidence may cause the worker to engage in inappropriate behavior, such as approaching the perimeter of a floor or roof at a distance appreciably greater than the shortest distance between the anchorage point and the leading edge. Though the retractable lifeline may arrest a worker's fall before he or she has fallen a few feet, the lifeline may drag along the edge of the floor or beam and swing the worker like a pendulum until the line has moved to a position where the distance between the anchorage point and floor edge is the shortest distance between those two points. Accompanying this pendulum swing is a lowering of the worker, with the attendant danger that he or she may violently impact the floor or some obstruction below.

The risk of a cable breaking is increased if a lifeline is dragged sideways across the rough surface or edge of a concrete member at the same moment that the lifeline is being subjected to a maximum impact loading during a fall. The typical 3/16 in. cable in a retractable lifeline has a breaking strength of from 3000 to 3700 lbs.

7. The competent person, who can take into account the specialized operations being performed on this project, should determine when and where a designated erector cannot use a personal fall arrest system.

B. Safety Net Systems

The nature of this particular precast concrete erection worksite precludes the safe use of safety nets where point of erection or leading edge work must take place.

1. To install safety nets in the interior high bay of the single story portion of the building poses rigging attachment problems. Structural members do not exist to which supporting devices for nets can be attached in the area where protection is required. As the erection operation advances, the location of point of erection or leading edge work changes constantly as each member is attached to the structure. Due to this constant change it is not feasible to set net sections and build separate structures to support the nets.

2. The nature of the erection process for the precast concrete members is such that an installed net would protect workers as they position and secure only one structural member. After each member is stabilized the net would have to be moved to a new location (this could mean a move of 8 to 10 ft or the possibility of a move to a different level or area of the structure) to protect workers placing the next piece in the construction sequence. The result would be the installation and dismantling of safety nets repeatedly throughout the normal work day. As the time necessary to install a net, test, and remove it is significantly greater than the time necessary to position and secure a precast concrete member, the exposure time for the worker installing the safety net would be far longer than for the workers whom the net is intended to protect. The time exposure repeats itself each time the nets and supporting hardware must be moved laterally or upward to provide protection at the point of erection or leading edge.

3. Strict interpretation of 1926.502(c) requires that operations shall not be undertaken until the net is in place and has been tested. With the point of erection constantly changing, the time necessary to install and test a safety net significantly exceeds the time necessary to position and secure the concrete member.

4. Use of safety nets on exposed perimeter wall openings and opensided floors, causes attachment points to be left in architectural concrete which must be patched and filled with matching material after the net supporting hardware is removed. In order to patch these openings, additional numbers of employees must be suspended by swing stages, boatswain chairs or other devices, thereby increasing the amount of fall exposure time to employees.

5. Installed safety nets pose an additional hazard at the perimeter of the erected structure where limited space is available in which members can be turned after being lifted from the ground by the crane. There would be a high probability that the member being lifted could become entangled in net hardware, cables, etc.

6. The use of safety nets where structural wall panels are being erected would prevent movement of panels to point of installation. To be effective, nets would necessarily have to provide protection across the area where structural supporting wall panels would be set and plumbed before roof units could be placed.

7. Use of a tower crane for the erection of the high rise portion of the structure poses a particular hazard in that the crane operator cannot see or judge the proximity of the load in relation to the structure or nets. If the signaler is looking through nets and supporting structural devices while giving instructions to the crane operator, it is not possible to judge precise relationships between the load and the structure itself or to nets and supporting structural devices. This could cause the load to become entangled in the net or hit the structure causing potential damage.

C. Guardrail Systems

On this particular worksite, guardrails, barricades, ropes, cables or other perimeter guarding devices or methods on the erection floor will pose problems to safe erection procedures. Typically, a floor or roof is erected by placing 4 to 10 ft wide structural members next to one another and welding or grouting them together. The perimeter of a floor and roof changes each time a new member is placed into position. It is unreasonable and virtually impossible to erect guardrails and toe boards at the ever changing leading edge of a floor or roof.

1. To position a member safely it is necessary to remove all obstructions extending above the floor level near the point of erection. Such a procedure allows workers to swing a new member across the erected surface as necessary to position it properly without worrying about knocking material off of this surface.

Hollow core slab erection on the masonry wall requires installation of the perimeter protection where the masonry wall has to be constructed. This means the guardrail is installed then subsequently removed to continue the masonry construction. The erector will be exposed to a fall hazard for a longer period of time while installing and removing perimeter protection than while erecting the slabs.

In hollow core work, as in other precast concrete erection, others are not typically on the work deck until the precast concrete erection is complete. The deck is not complete until the leveling, aligning, and grouting of the joints is done. It is normal practice to keep others off the deck until at least the next day after the installation is complete to allow the grout to harden.

2. There is no permanent boundary until all structural members have been placed in the floor or roof. At the leading edge, workers are operating at the temporary edge of the structure as they work to position the next member in the sequence. Compliance with the standard would require a guardrail and toe board be installed along this edge. However, the presence of such a device would prevent a new member from being swung over the erected surface low enough to allow workers to control it safely during the positioning process. Further, these employees would have to work through the guardrail to align the new member and connect it to the structure. The guardrail would not protect an employee who must lean through it to do the necessary work, rather it would hinder the employee to such a degree that a greater hazard is created than if the guardrail were absent.

3. Guardrail requirements pose a hazard at the leading edge of installed floor or roof sections by creating the possibility of employees being caught between guardrails and suspended loads. The lack of a clear work area in which to guide the suspended load into position for placement and welding of members into the existing structure creates still further hazards.

4. Where erection processes require precast concrete stairways or openings to be installed as an integral part of the overall erection process, it must also be recognized that guardrails or handrails must not project above the surface of the erection floor. Such guardrails should be terminated at the level of the erection floor to avoid placing hazardous obstacles in the path of a member being positioned.

V. Other Fall Protection Measures Considered for This Job

The following is a list and explanation of other fall protection measures available and an explanation of limitations for use on this particular jobsite. If during the course of erecting the building the employee sees an area that could be erected more safely by the use of these fall protection measures, the foreman should be notified.

A. Scaffolds are not used because:

1. The leading edge of the building is constantly changing and the scaffolding would have to be moved at very frequent intervals. Employees erecting and dismantling the scaffolding would be exposed to fall hazards for a greater length of time than they would by merely erecting the precast concrete member.

2. A scaffold tower could interfere with the safe swinging of a load by the crane.

3. Power lines, terrain and site do not allow for the safe use of scaffolding.

B. Vehicle mounted platforms are not used because:

1. A vehicle mounted platform will not reach areas on the deck that are erected over other levels.

2. The leading edge of the building is usually over a lower level of the building and this lower level will not support the weight of a vehicle mounted platform.

3. A vehicle mounted platform could interfere with the safe swinging of a load by the crane, either by the crane swinging the load over or into the equipment.

4. Power lines and surrounding site work do not allow for the safe use of a vehicle mounted platform.

C. Crane suspended personnel platforms are not used because:

1. A second crane close enough to suspend any employee in the working and erecting area could interfere with the safe swinging of a load by the crane hoisting the product to be erected.

2. Power lines and surrounding site work do not allow for the safe use of a second crane on the job.

VI. Enforcement

Constant awareness of and respect for fall hazards, and compliance with all safety rules are considered conditions of employment. The jobsite Superintendent, as well as individuals in the Safety and Personnel Department, reserve the right to issue disciplinary warnings to employees, up to and including termination, for failure to follow the guidelines of this program.

VII. Accident Investigations

All accidents that result in injury to workers, regardless of their nature, shall be investigated and reported. It is an integral part of any safety program that documentation take place as soon as possible so that the cause and means of prevention can be identified to prevent a reoccurrence.

In the event that an employee falls or there is some other related, serious incident occurring, this plan shall be reviewed to determine if additional practices, procedures, or training need to be implemented to prevent similar types of falls or incidents from occurring.

VIII. Changes to Plan

Any changes to the plan will be approved by (name of the qualified person). This plan shall be reviewed by a qualified person as the job progresses to determine if additional practices, procedures or training needs to be implemented by the competent person to improve or provide additional fall protection. Workers shall be notified and trained, if necessary, in the new procedures. A copy of this plan and all approved changes shall be maintained at the jobsite.

Sample Fall Protection Plan for Residential Construction (Insert Company Name)

This Fall Protection Plan Is Specific For The Following Project:

Location of Job _____
Date Plan Prepared or Modified _____
Plan Prepared By _____
Plan Approved By _____
Plan Supervised By _____

The following Fall Protection Plan is a sample program prepared for the prevention of injuries associated with falls. A Fall Protection Plan must be developed and evaluated on a site by site basis. It is recommended that builders discuss the written Fall Protection Plan with their OSHA Area Office prior to going on a jobsite.

I. Statement of Company Policy

(Your company name here) is dedicated to the protection of its employees from on-the-job injuries. All employees of (Your company name here) have the responsibility to work safely on the job. The purpose of the plan is to supplement our existing safety and health program and to ensure that every employee who works for (Your company name here) recognizes workplace fall hazards and takes the appropriate measures to address those hazards.

This Fall Protection Plan addresses the use of conventional fall protection at a number of areas on the project, as well as identifies specific activities that require non-conventional means of fall protection. During the construction of residential buildings under 48 feet in height, it is sometimes infeasible or it creates a greater hazard to use

conventional fall protection systems at specific areas or for specific tasks. The areas or tasks may include, but are not limited to:

a. Setting and bracing of roof trusses and rafters;

b. Installation of floor sheathing and joists;

c. Roof sheathing operations; and

d. Erecting exterior walls. In these cases, conventional fall protection systems may not be the safest choice for builders. This plan is designed to enable employers and employees to recognize the fall hazards associated with this job and to establish the safest procedures that are to be followed in order to prevent falls to lower levels or through holes and openings in walking/working surfaces.

Each employee will be trained in these procedures and will strictly adhere to them except when doing so would expose the employee to a greater hazard. If, in the employee's opinion, this is the case, the employee is to notify the competent person of their concern and have the concern addressed before proceeding.

It is the responsibility of (name of competent person) to implement this Fall Protection Plan. Continual observational safety checks of work operations and the enforcement of the safety policy and procedures shall be regularly enforced. The crew supervisor or foreman (insert name) is responsible for correcting any unsafe practices or conditions immediately.

It is the responsibility of the employer to ensure that all employees understand and adhere to the procedures of this plan and to follow the instructions of the crew supervisor. It is also the responsibility of the employee to bring to management's attention any unsafe or hazardous conditions or practices that may cause injury to either themselves or any other employees. Any changes to the Fall Protection Plan must be approved by (name of qualified person).

II. Fall Protection Systems To Be Used on This Job

Installation of roof trusses/rafters, exterior wall erection, roof sheathing, floor sheathing and joist/truss activities will be conducted by employees who are specifically trained to do this type of work and are trained to recognize the fall hazards. The nature of such work normally exposes the employee to the fall hazard for a short period of time. This Plan details how (Your company name here) will minimize these hazards.

Controlled Access Zones

When using the Plan to implement the fall protection options available, workers must be protected through limited access to high hazard locations. Before any non-conventional fall protection systems are used as part of the work plan, a controlled access zone (CAZ) shall be clearly defined by the competent person as an area where a recognized hazard exists. The demarcation of the CAZ shall be communicated by the competent person in a recognized manner, either through signs, wires, tapes, ropes or chains.

(Your company name here) shall take the following steps to ensure that the CAZ is clearly marked or controlled by the competent person:

***** All access to the CAZ must be restricted to authorized entrants;

***** All workers who are permitted in the CAZ shall be listed in the appropriate sections of the Plan (or be visibly identifiable by the competent person) prior to implementation;

***** The competent person shall ensure that all protective elements of the CAZ be implemented prior to the beginning of work.

Installation Procedures for Roof Truss and Rafter Erection

During the erection and bracing of roof trusses/rafters, conventional fall protection may present a greater hazard to workers. On this job, safety nets, guardrails and personal fall arrest systems will not provide adequate fall protection because the nets will cause the walls to collapse, while there are no suitable attachment or anchorage points for guardrails or personal fall arrest systems.

On this job, requiring workers to use a ladder for the entire installation process will cause a greater hazard because the worker must stand on the ladder with his back or side to the front of the ladder. While erecting the truss or rafter the worker will need both hands to maneuver the truss and therefore cannot hold onto the ladder. In addition, ladders cannot be adequately protected from movement while trusses are being maneuvered into place. Many workers may experience additional fatigue because of the increase in overhead work with heavy materials, which can also lead to a greater hazard.

Exterior scaffolds cannot be utilized on this job because the ground, after recent backfilling, cannot support the scaffolding. In most cases, the erection and dismantling of the scaffold would expose workers to a greater fall hazard than erection of the trusses/rafters.

On all walls eight feet or less, workers will install interior scaffolds along the interior wall below the location where the trusses/rafters will be erected. "Sawhorse" scaffolds constructed of 46 inch sawhorses and 2x10 planks will often allow workers to be elevated high enough to allow for the erection of trusses and rafters without working on the top plate of the wall.

In structures that have walls higher than eight feet and where the use of scaffolds and ladders would create a greater hazard, safe working procedures will be utilized when working on the top plate and will be monitored by the crew supervisor. During all stages of truss/rafter erection the stability of the trusses/rafters will be ensured at all times.

(Your company name here) shall take the following steps to protect workers who are exposed to fall hazards while working from the top plate installing trusses/rafters:

***** Only the following trained workers will be allowed to work on the top plate during roof truss or rafter installation:

_____

_____

_____

***** Workers shall have no other duties to perform during truss/rafter erection procedures;

***** All trusses/rafters will be adequately braced before any worker can use the truss/rafter as a support;

***** Workers will remain on the top plate using the previously stabilized truss/rafter as a support while other trusses/rafters are being erected;

***** Workers will leave the area of the secured trusses only when it is necessary to secure another truss/rafter;

***** The first two trusses/rafters will be set from ladders leaning on side walls at points where the walls can support the weight of the ladder; and

***** A worker will climb onto the interior top plate via a ladder to secure the peaks of the first two trusses/rafters being set.

The workers responsible for detaching trusses from cranes and/or securing trusses at the peaks traditionally are positioned at the peak of the trusses/rafters. There are also situations where workers securing rafters to ridge beams will be positioned on top of the ridge beam.

(Your company name here) shall take the following steps to protect workers who are exposed to fall hazards while securing trusses/rafters at the peak of the trusses/ridge beam:

* Only the following trained workers will be allowed to work at the peak during roof truss or rafter installation:

_____

_____

_____

* Once truss or rafter installation begins, workers not involved in that activity shall not stand or walk below or adjacent to the roof opening or exterior walls in any area where they could be struck by falling objects;

* Workers shall have no other duties than securing/bracing the trusses/ridge beam;

* Workers positioned at the peaks or in the webs of trusses or on top of the ridge beam shall work from a stable position, either by sitting on a "ridge seat" or other equivalent surface that provides additional stability or by positioning themselves in previously stabilized trusses/rafters and leaning into and reaching through the trusses/rafters;

* Workers shall not remain on or in the peak/ridge any longer than necessary to safely complete the task.

Roof Sheathing Operations

Workers typically install roof sheathing after all trusses/rafters and any permanent truss bracing is in place. Roof structures are unstable until some sheathing is installed, so workers installing roof sheathing cannot be protected from fall hazards by conventional fall protection systems until it is determined that the roofing system can be used as an anchorage point. At that point, employees shall be protected by a personal fall arrest system.

Trusses/rafters are subject to collapse if a worker falls while attached to a single truss with a belt/harness. Nets could also cause collapse, and there is no place to attach guardrails.

All workers will ensure that they have secure footing before they attempt to walk on the sheathing, including cleaning shoes/boots of mud or other slip hazards.

To minimize the time workers must be exposed to a fall hazard, materials will be staged to allow for the quickest installation of sheathing.

(Your company name here) shall take the following steps to protect workers who are exposed to fall hazards while installing roof sheathing:

* Once roof sheathing installation begins, workers not involved in that activity shall not stand or walk below or adjacent to the roof opening or exterior walls in any area where they could be struck by falling objects;

* The competent person shall determine the limits of this area, which shall be clearly communicated to workers prior to placement of the first piece of roof sheathing;

* The competent person may order work on the roof to be suspended for brief periods as necessary to allow other workers to pass through such areas when this would not create a greater hazard;

* Only qualified workers shall install roof sheathing;

* The bottom row of roof sheathing may be installed by workers standing in truss webs;

* After the bottom row of roof sheathing is installed, a slide guard extending the width of the roof shall be securely attached to the roof. Slide guards are to be constructed of no less than nominal 4" height capable of limiting the uncontrolled slide of workers. Workers should install the slide guard while standing in truss webs and leaning over the sheathing;

* Additional rows of roof sheathing may be installed by workers positioned on previously installed rows of sheathing. A slide guard can be used to assist workers in retaining their footing during successive sheathing operations; and

* Additional slide guards shall be securely attached to the roof at intervals not to exceed 13 feet as successive rows of sheathing are installed. For roofs with pitches in excess of 9-in-12, slide guards will be installed at four-foot intervals.

* When wet weather (rain, snow, or sleet) are present, roof sheathing operations shall be suspended unless safe footing can be assured for those workers installing sheathing.

* When strong winds (above 40 miles per hour) are present, roof sheathing operations are to be suspended unless wind breakers are erected.

Installation of Floor Joists and Sheathing

During the installation of floor sheathing/joists (leading edge construction), the following steps shall be taken to protect workers:

* Only the following trained workers will be allowed to install floor joists or sheathing:

_____

_____

_____

* Materials for the operations shall be conveniently staged to allow for easy access to workers;

* The first floor joists or trusses will be rolled into position and secured either from the ground, ladders or sawhorse scaffolds;

* Each successive floor joist or truss will be rolled into place and secured from a platform created from a sheet of plywood laid over the previously secured floor joists or trusses;

* Except for the first row of sheathing which will be installed from ladders or the ground, workers shall work from the established deck; and

* Any workers not assisting in the leading edge construction while leading edges still exist (e.g. cutting the decking for the installers) shall not be permitted within six feet of the leading edge under construction.

Erection of Exterior Walls

During the construction and erection of exterior walls, employers shall take the following steps to protect workers:

* Only the following trained workers will be allowed to erect exterior walls:

_____

_____

_____

* A painted line six feet from the perimeter will be clearly marked prior to any wall erection activities to warn of the approaching unprotected edge;

* Materials for operations shall be conveniently staged to minimize fall hazards; and

* Workers constructing exterior walls shall complete as much cutting of materials and other preparation as possible away from the edge of the deck.

III. Enforcement

Constant awareness of and respect for fall hazards, and compliance with all safety rules are considered conditions of employment. The crew supervisor or foreman, as well as individuals in the Safety and Personnel Department, reserve the right to issue disciplinary warnings to employees, up to and including termination, for failure to follow the guidelines of this program.

IV. Accident Investigations

All accidents that result in injury to workers, regardless of their nature, shall be investigated and reported. It is an integral part of any safety program that documentation take place as soon as possible so that the cause and means of prevention can be identified to prevent a reoccurrence.

In the event that an employee falls or there is some other related, serious incident occurring, this plan shall be reviewed to determine if additional practices, procedures, or training need to be implemented to prevent similar types of falls or incidents from occurring.

V. Changes to Plan

Any changes to the plan will be approved by (name of the qualified person). This plan shall be reviewed by a qualified person as the job progresses to determine if additional practices, procedures or training needs to be implemented by the competent person to improve or provide additional fall protection. Workers shall be notified and trained, if necessary, in the new procedures. A copy of this plan and all approved changes shall be maintained at the jobsite.

[FR Doc. 94-19000 Filed 8-4-94 8:45 am]