2.0 DESIGN STANDARDS POLICIES AND PROCESSES

- **General**

This section provides background information on design standard policies and processes. Information is presented on the appropriate design standards relevant to project type. Project types are defined to assist the designer in applying the proper standards to the project. General information is provided concerning design processes, different design strategies such as urban preservation or interstate maintenance, and roadside inventory. Other chapters in this document are broken down into specific design areas such as rural, urban, freeway, intersection, bicycle and pedestrian, transit, etc.

2.1 DESIGN STANDARD POLICIES

- **Policy Background**

In March of 1993 ODOT management approved a proposal to simplify the use and selection of design standards. This proposal brought ODOT to closer alignment with AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 1990"* policy. The decision also involved limiting the design standards to be used, to only three. They are ODOT 4R/New, ODOT 3-R, and AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 1990"*. These three standards are generally retained in the 2001 Highway Design Manual, however, the ODOT 3R standards have been expanded to include separate standards for freeways, urban highways, and rural highways. Additionally, greater clarity and flexibility is provided to the designer for selecting the appropriate standard. The four key elements of the design manual are outlined below:

1. Adopts the 2001 AASHTO policy of Geometric Design (AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"*) as the basis for the ODOT 4R/New Standard for New Construction and Reconstruction on all State Highways. As modifications to the AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"*, this adopted ODOT standard will retain ODOT spirals, superelevation runoffs, specific design speeds, vertical clearances, and specific design recommendations which are within the ranges specified by the AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"*. Additionally, ODOT has adopted a different height of object for calculating stopping sight distance and vertical design controls.

2. Adopts the AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"* Policy on Geometric Design as the ODOT Standard for New Construction and Reconstruction with no modifications on local jurisdiction routes.

3. Continues current ODOT 3-R standards for 3-R type projects on rural state highway routes. and provides separate ODOT 3-R standards for freeways and urban areas.

4. Adopts ODOT 3R Rural standards for rural local jurisdiction preservation projects and either ODOT 3R Urban standards or AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"* standards for urban local jurisdiction preservation projects.

The standards selected for design of all projects are presented in one of the following references:

- *2002 ODOT Highway Design Manual*
- *A Policy on Geometric Design of Highways and Streets – 2001.*
- *A Policy on Design Standards-Interstate System.* (AASHTO 1991)
- *Transportation Research Board(TRB) Special Report #214- Designing Safer Roads*

When the use of the ODOT 4-R/New standard is indicated by the selection matrix (Table 2-1) then specific criteria given in the *2002 ODOT Highway Design Manual* shall govern over any range of values given in AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"* and TRB #214 Guidelines.

- **Standards Background**

The different design standards for ODOT facilities are based upon recommendations from the four documents listed in Section 2.1. The OTC has delegated the responsibility to approve design standards for ODOT transportation facilities to the Director and Deputy Director/Chief Engineer. Subsequently, the Director and Deputy Director/Chief Engineer delegated the responsibility or design standards to the Technical Services Manager.

- **Local Agency Guidelines**

Some projects under ODOT roadway jurisdiction traverse across local agency boundaries. Some local agencies have adopted design standards and guidelines that may differ from the various ODOT design standards. Although the appropriate ODOT design standards are to be applied on ODOT roadway jurisdiction facilities, the designer should be aware of the local agency publications and design practices, which can provide additional guidance, concepts, and strategies for design.

2.1.1 DESIGN STANDARD IDENTIFICATION

• General

Following are brief descriptions of each of the three sources of design standards currently in use by ODOT. These standards give design criteria for both state and local jurisdiction roadways. These standards are dependent on the highway's functional classification (See Appendix A) and the project type.

It is important to note that in addition to the standards described below, considerable reference information is available in other publications. A listing of these references is given in this chapter in Section 2.1.4. and is considered to be supplemental to the design criteria given elsewhere in this manual.

• ODOT 4-R/New Design Standard

Generally these standards are found in the *ODOT Highway Design Manual*, starting in this Chapter and running through the remaining document. The ODOT 4-R/New standards give specific values for use in all areas of design. It is intended that all design values given in the ODOT 4-R/New standards are to be within the values or ranges given in the AASHTO Publication; *"A Policy on Geometric Design of Highways and Streets – 2001"*. That publication is to be referenced, when a particular design detail is not covered in the ODOT 4-R/New standards. ODOT 4-R/New standards have been developed for both Urban and Rural areas of the state and are further defined by freeways, expressways, and arterial standards.

The ODOT 4-R/New standards also contain the following five specific requirements which are not included within "A *Policy on Geometric Design of Highways and Streets – 2001*.

1) Use spirals on all curves with a degree of curve of 1° or sharper, and use ODOT spiral lengths given in the ODOT Highway Design Manual.
2) Superelevation runoffs shall match the ODOT spiral length.
3) ODOT minimum vertical clearance on State system shall be 17 feet.
4) Use ODOT specific design speeds based on traffic volumes and terrain type.
5) Object height for stopping sight distance calculations and vertical curve design shall be 6 inches.

The ODOT 4-R/New standard is applicable to projects that are considered either Reconstruction (4R) or New Construction.

Reconstruction (4-R)

These projects upgrade the facility to acceptable geometric standards and as a result, provide a greater roadway width. The improvements may be in the form of additional lanes and/or wider shoulders and produce an improvement in the highway's mobility. Reconstruction projects normally include the following types of work: Projects which alter the original subgrade; those that construct major widenings that result in the addition of a new continuous lane; the addition of passing lanes or climbing lanes; channelization for signals or left turn refuges; structure replacement; and similar projects.

New Construction

New construction projects are projects constructed in a new location, new alignments, major additions such as an interchange, or rebuilding an existing facility with major vertical or horizontal alignment changes.

• AASHTO Design Standards

These standards are contained in the AASHTO Publication *"A Policy on Geometric Design of Highways and Streets – 2001"*. AASHTO standards are specifically for use in the design of new construction and reconstruction projects, when the project is located on routes under local jurisdiction. They are not 3-R standards, as the foreword of the book states. The reader is referred to *TRB Special Report #214*, and related references, for guidance in the design of 3-R jobs. However, for local agency urban preservation type projects utilizing federal funding, the local agency has the choice of using the ODOT 3R standard or AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"*.

AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"* Green Book policy is organized in a system so the roadway's functional classification and volume determines which part of the policy applies to that roadway. The AASHTO policy includes chapters in which general design controls and elements are discussed as they apply to all types of functional classifications and provide a groundwork to understanding basic design concepts. These chapters cover highway functions, design controls and criteria, elements of design, and cross section elements. The policy also gives specific design information for at-grade intersections, grade separations and interchanges.

The remainder of AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"* policy covers design details as they relate to specific functional classifications. AASHTO Green Book policy provides design direction for the following classifications:

- Rural and Urban Freeways
- Rural and Urban Arterials

- Rural & Urban Collector Roads and Streets
- Local Roads and Streets including Special Purpose Roads

It is imperative that any user of AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"* Green Book study and understand the concept of functional classification. The AASHTO's "A Policy On Geometric Design Of Highways And Streets – 2001" gives an explanation of this in Chapter One (Highway Functions). Section 10.6 of this manual outlines additional information dealing with traffic studies and functional class in urban areas and how it relates to design.

Functional Classifications have been established for all state highways by the ODOT Transportation Development Branch. A directory covering these routes is included in Appendix A. The functional classification should also be checked against the functional classification contained in a local TSP. Design specifics cannot be accurately selected from AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"* without the correct functional class being known.

• ODOT 3-R Design Standards

ODOT 3-R Design Standards are found in the *ODOT Highway Design Manual*, Chapters 6, 7, & 8, which contain information dealing with pavement widths, horizontal curvature, superelevation, and other references specific to this type of work. Table 7-3 (Rural 3-R) is essentially the same table used in *TRB Special Report #214*, and found on page 7 of that publication. It is the minimum acceptable standard for rural 3-R projects with federal funding. When ODOT 3-R guidelines refer to AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"* guidelines, this reference is to *TRB Special Report #214*, in the case of general 3-R construction; or *A Policy on Design Standards-Interstate System* (AASHTO 1991) for 3-R work on the freeway system. ODOT 3R standards have been developed for both Urban and Rural areas and are arranged according to functional class. 3-R type projects located on designated expressways are to use the appropriate urban or rural arterial 3-R standard.

Resurfacing, Restoration, and Rehabilitation (3-R)

These are projects that preserve and extend the service life of existing highways and enhance safety, using cost-effective solutions. Improvements include extending pavement life by at least 8 years, safety enhancements, minor widening, improvements in vertical and horizontal alignment, improvement in superelevation, flattening of sideslopes and removal of roadside hazards. The scope is influenced by factors such as: roadside conditions, funding constraints, environmental concerns, changing traffic and land use patterns, surfacing deterioration and crash type and rate. 3-R projects are not constructed with the intent of improving highway mobility, however it is sometimes an automatic incidental benefit as a result of improving the riding surface and improving safety.

This category includes, but is not limited to the following types of work: overlay projects with or without minor widening to shoulders or travel lanes, Latex Modified Concrete (LMC) overlays, widening for curb, guard rail, adding flares, extending tapers and rockfall benches and fallout areas. Also included in this class are projects with site specific vertical or horizontal curve corrections, and left turn channelizations, when included in an overlay project for safety purposes. Scarifying existing surfacing, rebasing and repaving is considered as 3-R if the scope of the job does not require the original subgrade to be altered. All project widening in this category is limited to less than a full lane width except when channelization is incorporated.

2.1.2 PROJECT TYPES

- **General**

The standards used to develop roadway geometric and non-geometric details generally have a major effect on the overall project cost. Factors, which must be taken into consideration when making that selection, are the type of work to be done, and the location and type of roadway.

For purposes of determining the appropriate design standard for use in project development, the project types can be divided into 7 categories that match the ODOT project funding types. The type of work determines the design standard to use and typically not the funding type. The funding types are:

1. Modernization *[New Construction / Reconstruction (4R)]*
2. Preservation *[Interstate Maintenance / Resurfacing, Restoration, and Rehabilitation (3R)]*
3. Bridge
4. Safety
5. Operations
6. Maintenance
7. Miscellaneous/Special Programs

- **Modernization**

Modernization projects generally add capacity to the highway system to facilitate existing traffic and/or accommodate projected traffic growth. Modernization projects also include new construction activities such as construction of a new segment of highway on new alignment. Modernization projects must achieve a 20 year service life.

Some examples of modernization projects are:

(a) Addition of High Occupancy Vehicle (HOV) lanes
(b) New alignments and/or new facilities
(c) Highway reconstruction with major alignment improvements or major widening; grade separations
(d) Widening of bridges to add travel lanes
(e) Replacing an existing bridge
(f) New safety rest areas

Modernization projects use the ODOT Urban or Rural standard for the appropriate highway classification since they are generally reconstruction (4-R) or new construction types of activities.

- **Preservation**

Improvements to extend the service life of existing facilities, and rehabilitative work on roadways are preservation types of projects. Preservation projects add useful life to the road without increasing the capacity, and may include:

(a) Pavement overlays (including minor safety and bridge improvements)
(b) Interstate Maintenance (IM) Program (pavement preservation projects on the Interstate system
(c) Re-establishing an existing roadway
(d) Resurfacing projects

Pavement preservation projects on state highways use the ODOT 3R Urban, Rural, or Freeway standard depending upon the highway classification and location. Preservation projects preserve and extend the service life of existing highway by at least 8 years. Preservation projects may include small portions of modernization activities as part of the project such as affecting subgrade, re-basing, adding a turn lane, or minor curve modifications. As long as these elements do not account for over 50% of the project length, the appropriate ODOT 3R standard is to be used, otherwise the project is treated as modernization and the appropriate ODOT 4-R/New standard shall be used.

There are cases where the designer needs to be aware of funding limitations as they relate to preservation type projects and safety features. This information is more fully discussed later in this chapter.

- **Bridge**

  Bridge projects include improvements to rebuild or extend the service life of existing bridges and structures beyond the scope of routine maintenance. Some examples include:

  (a) Deck or railing rehabilitation or replacement
  (b) Major repairs
  (c) Replacement
  (d) Widening
  (e) Overpass Screening
  (f) Tunnels
  (g) Large culverts (over 6 feet)

  The applicable standard for Bridge projects is dependent upon the actual work being performed. An evaluation to determine if a bridge should be widened or replaced is conducted to determine the most cost effective treatment. Bridges that are to remain in place shall use the applicable ODOT 3-R design standards. New bridges or bridges to be replaced shall use the applicable ODOT 4-R design standards. Typically when a bridge is widened, ODOT 4-R design standards are used for bridge widths. The standards outlined are associated with the width of the bridge section, not the specific bridge design standards. The 3-R design standards in sections 6.3 and 7.4 should be reviewed when determining the appropriate bridge width and issues dealing with bridges to remain in place, long bridges, and bridge cross sections.

- **Safety**

  Safety projects address prioritized hazardous highway locations and corridors, including the Interstate system, in order to reduce the number of fatal and serious injury crashes. Projects funded through this program meet strict benefit/cost criteria. Examples of safety projects include:

  (a) Intersection channelization
  (b) Climbing lanes, passing lanes, added lanes, medians, and wider shoulders
  (c) Curve realignments
  (d) Traffic signals, illumination, new guardrail, signing, delineation, and continuous rumble strips
  (e) Railroad crossing improvements (separate funding source)

  In general, safety projects should use the ODOT 4-R/New design standards. However, there are times when 3-R standards are appropriate. Safety projects that provide greater roadway width, add capacity, or improve the level of mobility are to use ODOT 4-R/New design standards. Typical safety projects that use ODOT 4-R/New design standards include climbing lanes,

passing lanes, added lanes, medians, curve realignments, channelization when not part of an overlay project, or major additions such as interchanges. 3-R standards may be appropriate on traffic signal, illumination, signing, delineation, and continuous rumble strip projects that do not include significant additional pavement.

- **Operations**

Operations projects increase the efficiency of the highway system, leading to safer traffic operations and greater system reliability. These types of projects include:

(a) ITS: Intelligent Transportation System (includes ramp metering, incident management, emergency response, traffic management operation centers, and mountain pass and urban traffic cameras)
(b) TDM: Transportation Demand Management (includes rideshare, vanpool, and park and ride programs)
(c) Rockfalls and Slides (chronic rockfall areas and slides; not emergency repair work)
(d) Signals, signs, and other operational improvements

Many of the operational work type projects involve installation of system management equipment and operation improvement items such as ramp meters, response equipment or signs and signals. These installations would all use standard equipment. Operational projects such as rockfall and slide projects and slow moving vehicle turnouts would use 3-R design standards as this type of project is intended for safety enhancements and not an improvement in roadway width or highway mobility.

- **Maintenance**

Maintenance projects preserve and extend the service life of existing highways and structures typically by less than 8 years. Generally, maintenance activities and projects are subject to ODOT 3-R design standards. Existing widths of lanes and shoulders are almost always maintained. Most maintenance projects are contracted through the district maintenance office. These types of projects include the following:

(a) chip seals
(b) Crack seals
(c) Drainage repairs and enhancements
(d) Rockfall protection
(e) Guardrail replacements and repair
(f) Short term overlays
(g) Channelizations

- **Miscellaneous/Special Programs**

  These are projects funded through special programs such as grants that do not easily fit into other project types. Determining the appropriate standard for these types of projects can be difficult. Generally, these projects should use the appropriate ODOT design standard. There are times when 3-R standards are appropriate. Projects that provide greater roadway width, add capacity, affect curb placement, or improve the level of mobility are to use ODOT 4-R/New design standards. Examples of these special programs include:

  (a) Bike/Ped Grants
  (b) Transportation Enhancement Grants
  (c) CMAQ (Congestion Mitigation/Air Quality)

2.1.3 DESIGN STANDARD SELECTION

The following matrix shows which design standards are applicable for certain projects based on project type, and if the project involves a state route or not. These design standards, when used with an appropriate design speed, are the criteria for whether an exception shall be required for a project.

There are two levels of exceptions for projects. The first level is an exception from the ODOT specific standards for all projects located on a state highway.

The second level of exceptions apply to all projects which are federally funded. This would be either an exception from AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"* design standards in the case of certain New/Reconstruction projects, or an exception to "*A Policy on Design Standards-Interstate System-1991"* for 3-R projects.

See Chapter 13 for further information concerning design exceptions.

Table 2-1
Design Standards Selection Matrix

Project Type	Roadway Jurisdiction				
	State Highways			Local Agency Roads[1]	
	Interstate	Urban State Highways	Rural State Highways	Urban	Rural
Modernization/ Bridge New/Replacement	ODOT 4-R/New Freeway	ODOT 4-R/New Urban	ODOT 4-R/New Rural	AASHTO	
Preservation/ Bridge Rehabilitation	ODOT 3-R Freeway	ODOT 3-R Urban	ODOT 3-R Rural	AASHTO[2]	ODOT 3-R Rural
Safety-Operations-Miscellaneous/ Special Programs	ODOT Freeway[3]	ODOT Urban[3]	ODOT Rural[3]	AASHTO	ODOT 3-R Rural
Maintenance	ODOT 3-R			ODOT 3-R	

[1]For projects on a local jurisdiction route, the local authority may, at its option, use either the appropriate AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"* standard or select a standard of their own choice. This discretion is given by ORS 368.036. (ORS 368.036 applies to counties only, not cities.)
AASHTO standards shall be used for all local agency jurisdiction roadway projects on the National Highway System (NHS).

[2]The local agency has the choice to use AASHTO's *"A Policy On Geometric Design Of Highways And Streets – 2001"* or ODOT 3R Urban design standards.

[3]The appropriate ODOT 3R standard may be used for some projects. Selection is case by case.

2.1.4 ADDITIONAL REFERENCES

• AASHTO References

The following policies are helpful when developing transportation projects, and are currently available by order from AASHTO:

1. *A Policy on Geometric Design of Highways and Streets - 2001*
2. *2002 AASHTO Roadside Design Guide*
3. *A Policy on Design Standards-Interstate System*
4. *Guide for Development of New Bicycle Facilities - 1991*

• Other References (available from other sources):

1. *Federal Aviation Regulations,* Part 77 (D.O.T., F.A.A.)
2. *ODOT Standard Drawings for Design and Construction*
3. *ODOT Policy and Procedure memos*
4. *ODOT Standard Specifications for Highway Construction - 1996*
5. *Manual on Uniform Traffic Control Devices and Oregon Supplementals*
6. *ODOT Traffic Volume Tables*
8. *ODOT Standard Highway Spiral*
9. *Functional Requirements of Highway Safety Features, Participants Notebook* (D.O.T., FHWA, N.H.I.)
10. *Highway Capacity Manual, special report 209, T.R.B. 2000*
11. *The 1999 Oregon Highway Plan*
13 *State of Oregon, Bicycle and Pedestrian Plan, 1995*
14. *TRB Special Report #214, Practices for Resurfacing, Restoration and Rehabilitation*
16. *ODOT Soil and Rock Classification Manual, 1987*
17. *ODOT Bridge Manual*
18. *ODOT Hydraulics Manual*
19. *ODOT Traffic Manual*
20. *ODOT Right of Way Manual*
21. *ODOT Access Management Manual*
22. *ODOT Survey Manual*
23. *ODOT Scoping Manual*

2.2 ODOT 3-R DESIGN PROCESS (FREEWAY, URBAN AND RURAL NON-FREEWAY)

- **General**

The information provided in this section relates to the different design processes associated with 3-R design (freeway, urban and rural non-freeway). Background information is provided for the different standards, strategies discussed, and required design processes outlined. The specific design standards are located in other sections of this manual. This section is intended to provide the designer with an outline of processes to follow once the appropriate project type has been determined.

2.2.1 3-R DESIGN CRITERIA

- **Background**

In 1988, the Oregon Transportation Commission adopted the 3-R Geometric Design Standard and modified it in 1998 for development of 3-R projects. These standards are not applicable to 4-R projects.

The main focus of the 3R design process is to preserve and enhance the highway surface while systematically considering cost effective safety enhancements on a case by case basis.

In 1991 the AASHTO Task Force on Geometric Design, of the AASHTO Highway Subcommittee on Design, prepared a design policy for Interstate freeways. This publication, *A Policy on Design Standards-Interstate System* (AASHTO 1991) gives 3-R and 4-R standards for work on the Interstate system. These standards are to be interpreted as supplemental to ODOT Design Standards. When a project on the freeway system has been identified as 3-R, the "full" design standard (ODOT 4-R/New Design Standard) is to be used for all 3-R freeway construction projects, with the exception of specific details which are given in Section 6.3. The development of a freeway 3-R project should be responsive to the considerations given concerning purpose, applicability, scope, determination, and design process. The freeway 3-R design process has been modified to take into consideration the Interstate Maintenance Preservation Program.

The changes to the 3-R design process in 1998 were in response to a shift in the Department's strategy for pavement preservation and were an attempt to maximize the benefit of money invested in preservation projects towards improving surface condition. This manual reflects that strategy, and builds in additional policy guidance. The 3-R design process now takes into consideration the

Safety Investment Program category of the section of roadway, the Urban Preservation Strategy Policy, and the Interstate Maintenance Strategy Policy. These policy documents were adopted by the Department in 1999 and 2000. Copies of these policies are contained in Appendices B and C.

- **Purpose**

The ODOT 3R standards apply to resurfacing, rehabilitation, and restoration (3-R) projects that preserve and extend the service life of existing highways. While the primary focus of these projects is pavement preservation, consideration of improvement of safety features is an essential design element. All projects utilizing ODOT 3R standards will be developed and accomplished in a manner that considers and includes appropriate safety improvements. Improvements may include minor widening, flattening side slopes, removal of roadside hazards, delineation, etc.

By their purpose and definition, preservation projects emphasize the economic management of the existing highway system in order to protect the investment and get the maximum economic benefit from available funds. Economic considerations are a major factor in determining the priority and scope of preservation projects using 3-R design standards. The scope is influenced by factors such as roadside conditions, cost of correction, environmental concerns, changing traffic and land use patterns, surface deterioration, and crash type and rate. Special emphasis is placed on pavement preservation, recognizing, however, that certain cost-effective improvements for safety and operational purposes may be necessary and desirable.

Major improvements dealing with bridge widening, horizontal and vertical alignments, side slopes and crash reduction at high crash locations, including public road intersections, will normally be funded (depending on their priority and the availability of funds) through the Bridge Management and Safety Investment Programs. The needs should continue to be identified and addressed during project development and it may be most cost effective to include this work with the project. When it is deemed not cost effective to improve design features to current standards or correct a safety deficiency, a design exception must be requested and low-cost safety mitigations as listed in Tables 7-6 and 8-9 shall be considered.

- **Applicability**

The standards apply to geometric design features such as lane and shoulder widths, horizontal curvature and superelevation, vertical curvature and stopping sight distances, bridge width, cross and side slopes, and horizontal and vertical clearances. The standards also discuss other features such as pavement life, traffic control devices, guardrail, and other preservation design features.

The standards do not apply to reconstruction projects (the 4th R) which shall meet new construction standards. However, design features not specifically addressed in these 3-R Standards will generally meet the applicable ODOT 4-R/New standard.

As noted, preservation projects primarily preserve and extend the service life of existing highways and enhance safety through surface improvements. These types of projects generally do not increase the highway mobility of the overall section. Projects may include such items as placement of additional surface material and/or other work necessary to return an existing roadway, including shoulders, bridges, roadside features and appurtenances, to a condition of structural and functional adequacy. Projects utilizing ODOT 3-R design standards may also include reworking or strengthening of base materials and minor upgrading of geometric features and appurtenances for safety purposes.

The Urban Preservation Strategy (Section 2.2.2) provides additional guidance in determining appropriate 3-R work in urban areas. This strategy utilizes all of the guidelines outlined in this section, including the Safety Investment Program tools and processes, and then provides additional guidance in the Urban Preservation Design Features, Table 8.10.

An active project in development provides an opportunity to provide more mitigation of minor roadside features than would normally be done under the Safety Investment Program alone, particularly if a desirable improvement can be made at a minimal cost. The design life of an individual project should be a major factor in the evaluation for determination of appropriate safety investments. Some projects may require small amounts of right of way in order to address the reasonable and desirable geometric and safety needs.

When upgrading of geometric features becomes a major factor resulting in substantial capacity improvements (adding through lanes, extensive curve realignments, and modification of original subgrade), the project is "reconstruction" (4th R). The threshold for determining if these features are a major factor is if they are over 50% of the project length. Applicable ODOT 4-R/New standards will apply to reconstruction projects. The project prospectus will identify the applicable standards, ODOT 3-R or ODOT 4-R/New, to be used on individual projects.

- **Project Scoping**

The scope of a preservation or other project utilizing ODOT 3-R standards is determined by many factors. The following shall be considered and discussed as appropriate in the Project Prospectus.

1. Pavement Condition - The existing pavement condition and the scope of needed pavement improvements dictate, to a large extent, those improvements that are feasible, prudent, or practical. Significant geometric upgrading might be appropriate if the pavement improvements are substantial, but may not be appropriate or economical if the needed pavement improvements are relatively minor.

2. Physical Characteristics - The physical characteristics of a highway and its general location often determine those improvements that are necessary, desirable, possible, practical, or cost effective. Topography, climate, adjacent development, existing alignment (horizontal and

vertical), cross-section (lane width, shoulder width, sidewalks, cross slope, side slopes, superelevation, etc.) and similar characteristics along with intersection evaluation should be considered in determining the scope of geometric or safety improvements to be made in conjunction with pavement improvements. Additionally, route continuity is a major determining factor in the overall scope of preservation projects.

3. Traffic Volumes - Traffic data, including the percentage of trucks, is needed for the design of all highway improvements. It is an important consideration both in the determination of the appropriate level of improvement (i.e., reconstruction vs. 3-R) and in the selection of actual design values for the various geometric elements. For projects using ODOT 3-R standards, the need for a formal forecast of future traffic is greatest when the current traffic is approaching the capacity of the highway, and decisions must be made regarding the timing of major improvements such as additional lanes. On the other hand, formal forecasts are not normally necessary on very low volume roads where even high percentage increases in traffic will not significantly impact design decisions.

4. Crash Records - A review of crash records is an integral part of the preservation project development process. Evaluation of crash records often reveals problems requiring special attention. In addition, relative crash rates can be an important factor in establishing both the priority and the scope of these projects. Therefore, traffic crash evaluation shall be made on all projects using ODOT 3-R standards.

5. Potential Impacts of Various Types of Improvements - Quite often, the scope of geometric improvements made by preservation projects is influenced by potential impacts to the surrounding land and development. Typically, social, environmental, and economic impacts severely limit the scope of preservation projects using 3-R design standards, particularly where the existing right of way is narrow and there is considerable adjacent development. The need for additional right of way may determine the upper limit of practical geometric improvements.

6. Speed - Evaluation of design features generally requires the determination of the appropriate design speed based upon the highway type, terrain and adjacent land use or regulatory speed. It is important that the design speed selected for a project realistically reflect the speeds at which vehicles can be expected to operate or are actually operating on the highway. On projects using ODOT 3-R standards, the lesser of determination of the 85^{th} percentile speed or new construction design speed is the preferred method for establishment of the design speed for use in evaluation of geometric improvements. This is particularly true in evaluating roadway widths and horizontal and vertical curvature. However, the project team can use Table 5-1 to assist in equating 85^{th} percentile/posted speed to the general design speed. Note that this table is mainly to be used for urban environments or rural communities.

2.2.2 3-R DESIGN PROCESSES-URBAN AND RURAL NON-FREEWAY

The design process outlined below provides guidelines for developing an urban or rural non-freeway preservation project using 3-R design standards. The Safety Investment Program (SIP) category will dictate which design process a designer shall follow. In addition to the SIP category design process, the Urban Preservation Strategy Design Guidelines are to be applied to urban non-freeway preservation 3-R design projects.

- **Safety Investment Program Category Determination**

The first step in an urban or rural non-freeway preservation project is identifying the Safety Investment Program (SIP) category. The Safety Investment Program rates the safety of segments of state highways based on the number of fatal and serious injury crashes within the last three years, updated annually. The segments are 5 miles in length and are rated based on the following criteria and shown on the Safety Investment Program map:

Category 1	0 Crashes	Light Green
Category 2	1-2 Crashes	Dark Green
Category 3	3-5 Crashes	Orange
Category 4	6-9 Crashes	Magenta
Category 5	10+ Crashes	Purple

Due to the lack of crashes, projects located in SIP Category 1 and 2 sections don't require the level of scrutiny in project development required of higher crash sections of highways. Therefore, **project development for preservation type projects using 3-R design standards in SIP Category 1 and 2 sections has been simplified**. Generally for preservation projects in SIP Category 1 and 2, the Project Team will determine the amount of detail for the roadside inventory. The types of features generally required for roadside inventories on Category 1 and 2 projects are described later in this chapter. Projects located in SIP Category 3, 4, and 5 sections will continue to require full 3R Traffic and Inventory Analysis. For more information on the roadside inventory requirements see Chapter 3.

- **Crash/Traffic Analysis**

Regardless of the SIP Category, every preservation project using 3-R design standards needs to have a full crash analysis completed. Crash listings should be pulled for the last five years and analyzed by the Region Traffic Engineer (or equivalent). The intent of this review is to look for trends, locations with a high number of non-fatal/injury crashes, and other situations, which may, in the judgement of the Region Traffic Engineer, justify further investigation. This review, when coupled with the on-site visit, may identify some low cost mitigation measures that could generate a significant reduction in crashes or their potential. Therefore, this review may also identify the need

for larger scale solutions that may need to be programmed into the project, or identify a future safety funded project.
There may be cases when a SPIS (Safety Priority Index System) site is located within the project limits. Full analysis is needed of these locations to determine the appropriate solution to the problem creating the crashes. Funding for SPIS solutions will come from the Safety Investment Program but a decision to include the work in the preservation project or leave it as a stand alone project must be made by the Project Team.

A cursory level Traffic analysis should also be completed. Determining the existing traffic volumes and approximate mix of traffic is an important consideration in the project design. Transportation Planning and Analysis or Region Traffic can often provide future year Average Daily Traffic (ADT's) for highway segments. This information is also very useful in scoping a preservation project. A detailed traffic analysis of design hour volumes, turning movements, and vehicle composition is generally not necessary, at this time, for any SIP Category.

- **Project Scoping**

As previously noted, the Project Team determines the level of scoping effort. For SIP Category 1 and 2 projects, Scoping Teams should consist of the critical few individuals required to give quality input for the decisions required. This may include the Project Leader, Roadway Designer, Bridge Liaison (as needed), Region Right of Way Liaison, Region Environmentalist, District Maintenance staff, Construction Project Manager or Assistant Project Manager, Region Traffic (as needed), Pavement Design Representative, and Utility Liaison. The ODOT Scoping Manual should be used to assist in project scoping and determination of appropriate personnel.

To assist in the analysis and scoping trip, Roadside Inventory Items 3, 4, and 5, (see Section 3.3.2) should be completed by the Roadway Designer prior to the site visit. They can then be reviewed on site by the team and compared with the crash history. Major improvements dealing with deficiencies identified in items Roadside Inventory Items 3, 4, and 5 (Section 3.3.2) will rarely be incorporated on this category of project. These projects will incorporate more low-cost mitigation to address these items, as the crash history will probably not generate the good benefit/cost ratio required for the more substantial improvements.

The scoping team should determine the level of effort that will be required by the survey crew. Very definite parameters should be set as to which roadside obstacles need to be inventoried. The intent of the inventory for SIP Category 1 and 2 projects is not to survey every fixed object or culvert throughout the project. Only those objects near the roadway that constitute a substantial hazard should be inventoried. Continuous runs of utility poles or trees at the R/W line generally don't need to be inventoried. However, if there is a location with a number of run-off-the-road crashes (i.e. on the outside of a curve), then the effort and the area covered in the inventory should be increased.

Other than roadside features, the field work on SIP Category 1 and 2 projects should be limited to the amount needed for quantity calculations, in particular leveling for crown and super correction. By their nature, urban projects may require some additional work but every effort should be made to limit the survey work to the minimum needed for the particular project.
Project scoping on SIP Category 3, 4, and 5 projects is more detailed. The scoping team should include at a minimum the Project Leader, Senior Roadway Designer and/or the Technical Services Resource Manager (TSRM), Area Maintenance Manager, Region Traffic Engineer, and an Environmental Section representative. Other disciplines may be required as well, such as Bridge, Geo/Hydro, Pavements, Right of way, and Region Access Management Engineer.

The intent of the Scoping Team is to identify the parameters of the project, clearly identify the problem, and identify a range of solutions. These may include some low cost mitigation measures or safety enhancements if funding is available.

During scoping, the need for exceptions from design standards, or for new traffic control devices, should be identified. Design exception requests shall be submitted as early as possible in the project development process. This will minimize the need for redesign should the exception request be denied. For further information on design exceptions, see Chapter 13.

- **Roadside Inventory**

Section 3.3.1 provides information on roadside inventory for SIP Category 3, 4, and 5 projects while Section 3.3.2 provides roadside inventory information for SIP Category 1 and 2 projects.

- **Urban Preservation Strategy**

Due to the number of features that come into play in urban projects, further guidance is required to scope and develop projects appropriately and consistently statewide in an effort to ensure the entire pavement system can be adequately maintained with available preservation funds. To this end, in addition to the SIP Design Process, urban preservation projects using 3-R design standards must also be processed through the Urban Preservation Strategy.

The Urban Preservation Strategy focuses on preserving the life and safety of the pavement system “curb to curb”. The Strategy utilizes all of the guidelines outline in this chapter (including the SIP tools and processes) and then provides additional guidance as shown in Table 8-10, “Urban Preservation Design Features.” Section 8.8.2 outlines the Urban Preservation Strategy.

While the same process is applicable and relevant for rural preservation projects, this strategy is not generally applied to them, due to the differing roadside features.

For more information on the Urban Preservation Strategy, see Appendix B.

2.2.3 3-R DESIGN PROCESS-FREEWAY

The design process for Freeway 3-R projects requires a full roadside inventory similar to SIP Category 3, 4, and 5 rural, non-freeway 3-R projects (see Chapter 3-Survey for Roadside Inventory). In addition to the roadside inventory, the Interstate Maintenance Design Features have been added to the Freeway 3-R design process.

The Interstate Maintenance Design Features shown in Section 6.3 provide additional guidance in determining appropriate 3-R work on freeways. The Interstate Maintenance program utilizes all of the guidelines outlined in Section 2.2.1 (Purpose, Applicability, Project scoping) and then provides additional guidance as shown in the Interstate Maintenance Design Features Table located in Section 6.3. The "have to" list is the recommended minimum treatment for the listed project elements. The "like to" list includes treatments for elements which should be considered when economically feasible (i.e. minimum cost, or funds available from sources other than the Preservation Program). Items covered in Interstate Maintenance Design Features include:

- Guardrail
- Concrete Barrier
- Interchange Ramp Surfacing
- Roadside Obstacles
- Bridges
- Delineators
- Fencing
- Signing, Illumination, and Signal Loops
- Attenuators
- Rumble Strips
- Pavement Life
- Striping
- Drainage

2.3 EMERGENCY RELIEF PROGRAM-BETTERMENTS

- **General**

The Emergency Relief (ER) program is intended to assist the States and local agencies in repairing disaster damaged highway facilities and returning them to their predisaster condition. In-kind restoration is the predominate type of repair. The purpose of this section is to define betterments, explain the Federal Highway Administration (FHWA) policy on betterments, give examples of betterments and provide guidance on the submittal of betterment requests for FHWA approval.

2.3.1 DEFINITION

A betterment is defined as (1) an additional feature or upgrading, or (2) a change in capacity, function or character of the facility from its predisaster condition. Betterment requests during the last several years have been limited to the first category, with no proposals to change the capacity, function or character of a facility.

2.3.2 POLICY

FHWA policy permits the approval of ER funding for upgrading or additional features to protect the highway from future disaster damage. To receive such approval, it must be shown that the ER expenditure is cost-effective in terms of reducing probable future recurring repair costs to the ER program. It is also FHWA policy that betterments to correct pre-existing conditions, particularly at landslides, will be subjected to a stricture test and it will be considerably more difficult to justify the expenditure of ER funds at such sites.

In general, betterments that change the capacity, function or character of a facility are not eligible for ER funding. Examples of this category of betterment include:

- Adding lanes
- Upgrading surfaces, such as from gravel to paved
- Improving access control
- Adding grade separation
- Changing from rural to urban cross-section

One exception is that under special circumstances, ER funding can be used for a replacement bridge that can accommodate traffic volumes over the design life of the bridge, thus potentially allowing ER funding for added lane(s) on the structure.

2.3.3 EXAMPLES OF BETTERMENTS

The following are examples of upgrading or additional features that are considered betterments. Specific FHWA approval is required before ER funds can be used for the following:

- Stabilizing slide areas (e.g., internal dewatering systems, retaining structures, etc.)
- Stabilizing slopes
- Raising roadway grades
- Relocating roadways to higher ground or away from slide prone areas
- Installing riprap
- Lengthening or raising bridges to increase waterway openings
- Deepening channels
- Increasing the size or number of drainage structures
- Replacing culverts with bridges
- Installing seismic retrofits on bridges
- Adding scour protection at bridges
- Adding spur dikes

There will be cases where one of the above features can be added with only a relatively minor expenditure of ER funds. These may include, for example, short and low height retaining structures, small areas of rock inlays for slope stabilization or installation of small amounts of riprap incidental to other repair work. The decision whether this work will be considered a betterment will be decided on a case-by-case basis.

The following are examples of upgrading or additional features that are not considered betterments:

- Replacement of older features or facilities with new ones,
- Incorporation of current design standards, and
- Additional features resulting from the environmental process required as a condition of permit approval.

2.3.4 APPROVAL REQUESTS

To request approval of a betterment, it will be necessary to provide detailed justification. It is important that the request contain information regarding conditions at the site prior to the disaster (including a brief summary of previous problems) and the current conditions at the site. The "do nothing" alternative must be discussed and it is expected that most proposals would include at least two "build" alternatives. Estimated costs for each alternative are needed. The appropriate ODOT unit must review and endorse betterment requests prepared by consultants.

The same basic rules will apply to betterment requests on local agency facilities. These proposals must be reviewed and endorsed by the appropriate ODOT unit and the request to use ER funds for such betterments must be made by ODOT in order to be considered.

As previously noted, if ER funds are to be approved, the betterment must be economically justified based on an analysis of the cost of the betterment versus projected savings in costs to the ER program should future disasters occur. This cost/benefit analysis must focus solely on benefits resulting from estimated savings in future recurring repair costs under the ER program. The analysis cannot include other factors typically included in highway benefit/cost evaluations such as traffic delay costs, added user costs, motorist safety, economic impacts, etc.

If FHWA is unable to provide ER funding for a betterment, ODOT or the local agency has the option to include the work in either the ER repair project or a separate project, and fund it with other Federal-aid, State or local funds.