

## APPENDICES

### OPEN SPACE AND RESOURCE PROTECTION APPENDIX

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**Example of a Seasonal Conversion Bylaw**

#### References for the 2004 Holland Open Space and Recreation Plan

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# ADA Self-Evaluation for 2004 Holland Open Space and Recreation Plan

## Part 1: Administrative Requirements

An ADA Coordinator has been designated for the Town of Holland (see attached documentation). Affirmative Action policies and Grievance procedures for the Town of Holland have been established (see attached documentation). These policies are posted in the Town Hall. Persons who are unable to read the policies can request that the receptionist read the policies to them.

## Part 2: Program and Site Accessibility

Municipally owned sites in Holland that offer recreational activities were surveyed. These sites include the Holland Elementary School playground and playing fields, the town beach, and Hitchcock Field.

*See archived copy of the 2004 Holland Open Space and Recreation Plan for Program and Site Accessibility section.*

## Part 3: Employment Practices

### Equal Access to Facilities and Activities Grievance Policy

#### **Town of Holland Equal Access to Facilities and Activities Grievance Policy**

Maximum opportunity will be made available to receive citizen comments, complaints, and/or to resolve grievances or inquires.

#### **Step 1**

The Chairs of the Park Commission and Recreation Committee will be available to meet with citizens and employees during the regularly scheduled Park and Recreation meeting. The meeting schedule is posted in Town Hall and can be obtained by calling Town Hall during business hours. If the meeting times are not convenient, then a special meeting will be held to accommodate citizens' schedules. Assistance in writing a grievance is available if desired.

When a complaint, grievance, request for program policy interpretation, or clarification is received either in writing or through a meeting or phone call, every effort will be made to create a record regarding the name, address, and phone numbers of the person making the complaint, grievance, or request for program policy interpretation or clarification. If the person desires to remain anonymous, he or she may.

A complaint, grievance, request for program policy interpretation or clarification will be responded to within ten working days (if the person making the request is identified) in a format that is sensitive to the needs of the recipient (i.e. verbally enlarged type face, etc.)

If the grievance is not resolved at this level, it will be advanced to the next level.

## **Step 2**

Citizens will be informed of the opportunity to meet and speak with the Board of Selectmen, with whom local authority for final grievance resolution lies.

### Town of Holland Affirmative Action Plan

## **Town of Holland Affirmative Action Plan**

### Statement of Policy

The Affirmative Action policy of the Town of Holland is to promote equal employment opportunity, to prohibit discrimination in Holland employment on account of race, color, religion, national origin, sex, age, or handicapped status not related to performance of the job, and to bring about a fair representation and utilization of females and minorities on all levels of Holland employment.

### Dissemination of Policy

The Town of Holland will advise all employees and applicants for employment of this policy and will make known to the public that employment opportunities are available on the basis of individual ability and will encourage all persons who are employed by the Town of Holland to strive for advancement on that basis.

### Personnel Actions

The Town of Holland will take affirmative action to ensure that applicants are recruited and employed and that employees are treated when employed without regard to their race, color, religion, age, sex, national origin, or handicapped status not related to ability to perform the job and such affirmative action shall include all terms and conditions of employment such as hiring, placement, upgrading, demotion, transfer, layoff and termination.

### Grievance Procedure

Any employee that believes that he or she has been adversely affected by an act or decision of the supervisory or managerial personnel of Holland and that such an act or decision was based on race, color, sex, religion, national origin or handicapped condition shall have the right to process a complaint or grievance in accordance with the following procedure:

- An employee who has a grievance regarding his or her employment by Holland may discuss the grievance with his or her supervisor.
- If, following the discussion, the decision of the supervisor regarding the grievance does not satisfy the employee, he or she may discuss it with the Administrator/Coordinator.
- If the decision of the Administrator/Coordinator does not satisfy the employee, he or she may request a hearing with the Council in writing. The decision of the Council regarding the grievance shall be final.
- In thus discussing the grievance, the employee may designate any person of his or her choice to appear with him or her and participate in the discussion. The Council may require the supervisor to participate in the discussion of the grievance when it is brought before the Council.
- Any prospective employee or applicant for employment who is denied employment with Holland and believes that denial was based in whole or in part on the race, religion, sex, age, or physical condition of the applicant may file a written complaint with the Administrator/Coordinator who shall make every effort to resolve the matter impartially and expeditiously. The appeal procedure above is also available to such grievant.

### Example of Lake/Pond Overlay District

The following example of a Lake/Pond Overlay District was excerpted from the Growth Management Report, Holland: Land, Water, People, In Concert, prepared by the Pioneer Valley Planning Commission in June 1995. The bylaw, developed for Holland, Massachusetts, is located in Appendix A of the report.

## APPENDIX A: PROPOSED ZONING AMENDMENTS

### Proposed Lake Protection Overlay District Bylaw

Due to time constraints, the Holland Resources and Development Committee was not able to review this proposed bylaw.

#### 6.5 Lake Protection District

##### 6.51 Purposes

The purposes of the Lake Protection District and the provisions set forth herein are:

- a. To regulate uses of land and buildings and the characteristics of such uses in order to protect and maintain the water resources of the Town of Holland; and
- b. To conserve the recreational, scenic and ecological values of these water resources for the health, welfare, safety, and enjoyment of the people; and
- c. To control erosion and siltation of the Hamilton Reservoir and its tributary streams; and
- d. To encourage shore cover and to encourage well-designed developments

##### 6.52 District Delineation

The location and boundaries of the Lake Protection District are shown on a map entitled, "Lake Protection District, Town of Holland, Massachusetts, 19\_\_," which is on file in the office of the Town Clerk.

##### 6.53 Scope of Authority

The Lake Protection District is an overlay district and shall be superimposed on the other zoning districts established by this Zoning Bylaw. All uses, dimensional requirements, and other provisions of the Town of Holland Zoning Bylaw applicable to such underlying districts shall remain in force and effect, except that where the Lake Protection District imposes greater or additional restrictions and requirements, such additional restrictions or requirements shall prevail.

##### 6.54 Permitted Uses

See Table 1 HOLLAND SCHEDULE OF PRINCIPAL USES

##### 6.55 Lake Protection Standards

- a. All lots having frontage on Hamilton Reservoir shall have a minimum lot width of 150 feet, measured at the reservoir water line, as determined by the level of the dam spillway.
- b. Any construction, except docks, boat ramps or other water dependent structures and uses, shall not occur within 100 feet (measured horizontally) of the high water mark of any lake, pond, stream, brook, nor shall any construction or alteration occur within 100 feet (measured horizontally) of any marsh, swamp, vernal pool, or other wetland as defined by the Massachusetts Wetlands Protection Act without a Special Permit by the Planning Board.

Lake Protection Overlay District Bylaw

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- c. There shall be a 10 foot buffer zone extending from the shore line of Hamilton Reservoir where no more than twenty (20) percent of native vegetation and mature trees shall be removed. Where native vegetation is lacking or has been removed from the buffer zone, planting of appropriate native vegetation shall be required for the buffer zone area.
- d. The minimum setback for sub-surface sewage disposal facilities constructed to serve a new building or an addition to an existing building from the normal high water mark of any lake, pond, stream, brook, marsh, swamp, vernal pool, or other wetland shall be no less than 200 feet.
- e. Agricultural uses shall be permitted only on parcels of five or more acres. Animal feedlots, pastures, storage of manure, shall not be located within 200 feet of the normal high water mark of any lake, pond, stream, brook, marsh, swamp, vernal pool, or other wetland resource area within the Lake Protection District. Drainage from such activities within the Lake Protection District shall be in accordance with agricultural best management practices set forth in the Nonpoint Source Management Manual ("The Megamanual"), June, 1993, written by the Massachusetts Department of Environmental Protection.
- f. Residential Subdivisions defined in M.G.L c. 41, Section 81-L, consisting of 10 or more acres of land, and located in the Lakes Protection District, shall be laid out according to the standards for Open Space Communities contained in Section 6.02 of this Zoning Bylaw, and according to all pertinent the Planning Board Rules and Regulations in effect.

6.56 Additional Special Permit Criteria for projects located in the Lake Protection District.

- 6.561 In addition to the Special Permit Criteria contained in Section VIII. of this Zoning Bylaw, the Planning Board shall not issue a special permit for a proposed use unless the applicant's plan meets the following criteria:
- a. Chemicals, fuels, pesticides, lubricants, petroleum products or any potentially toxic or hazardous materials may not be stored within 100 feet of high water mark of any lake, pond, stream, brook, nor shall any of these same materials be stored within 100 feet of any marsh, swamp, vernal pool, or other wetland resource area as defined by the Massachusetts Wetlands Protection Act.
  - b. Those businesses using or storing such toxic or hazardous materials shall file a hazardous materials management plan with the Planning Board, Fire Chief, and Board of Health, which shall include:
    - i. Provisions to protect against the discharge of hazardous materials or wastes to the environment due to spillage, accidental damage, corrosion, leakage or vandalism, including spill containment and clean-up procedures.
    - ii. Provisions for indoor, secured storage on impervious floor surfaces of hazardous materials and wastes.
  - c. Meet the stormwater management and erosion control standards specified in sections 6.57 and 6.58 below.
  - d. The petitioner's application materials include, in the Board's opinion, sufficiently detailed, definite and credible information to support positive findings in relation to the standards given in this section.

6.57 Stormwater Runoff

- a. The rate of stormwater runoff from a site shall not be increased during or after construction.
- b. To the extent practical, pollutants such as, but not limited to, sediment, oil and grease shall be removed from the stormwater runoff prior to the discharge of such runoff into the existing storm drainage system or into wetland resource areas listed in the Wetland Protection Act Regulations, 310 CMR 10.00.
- c. In order to meet these standards, a stormwater management plan shall be developed for the site. The plan shall describe stormwater practices that control the volume, timing and rate of flows. A combination of successive Best Management Practices may be used to achieve this standard.
- d. These are preferred stormwater management measures:
  - (i) Infiltration and attenuation of runoff on-site to existing areas with grass, trees, and similar vegetation and by use of open vegetated swales and natural depressions.
  - (ii) Stormwater detention structures for the temporary storage of runoff which are designed so as not to create a permanent pool of water.
  - (iii) Stormwater retention structures for the permanent storage of runoff by means of a permanent pool of water.
- e. Dry wells shall be used only where other methods are not feasible and should not be used at all where there is the potential for contaminated or polluted runoff.

6.58 Erosion Control

Erosion of soil and sedimentation into streams and water bodies shall be minimized by using the following erosion control practices:

- a. Areas exposed or disturbed due to stripping of vegetation, soil removal, or regrading shall be stabilized permanently within six months of occupancy of a structure or of completion of its construction, whichever comes earlier.
- b. During construction, temporary vegetation and/or mulching shall be used to protect exposed areas from erosion. Until a disturbed area is stabilized permanently, sediment in runoff water shall be trapped by using staked hay bales, silt fencing, sedimentation traps, or any combination of these techniques sufficient to prevent sediment from reaching any property line or any stream or water body. These erosion control devices shall be inspected and, if necessary, repaired on a weekly basis, as well as before and after major storms.
- c. All slopes exceeding 15% which result from site grading shall either covered with at least four inches of topsoil and planted with a vegetative cover sufficient to prevent erosion and be properly maintained, or be stabilized by a retaining wall and vegetative cover. Any problem arising from lack of maintenance, disease, or other cause shall be corrected within one growing season.
- d. Dust control shall be used during grading operations if the grading is to occur within 200 feet of an occupied residence or place of business. Dust control methods may consist of grading fine soils on calm days only or of dampening the ground with water.



- e. Permanent erosion control and vegetative measures shall be in accordance with erosion, sedimentation and vegetative practices recommended by the Soil Conservation Service, except that only plants native to New England shall be used for all areas except mown lawn.

6.59 Non-conforming Uses

- a. Any use of a building or land existing at the effective date of this bylaw or amendments thereto and not in conformance with the provisions of this bylaw shall be considered a non-conforming use.
- b. Any non-conforming use may continue and may be maintained or repaired. Any non-conforming use which has been damaged or destroyed by fire or other accidental cause may be rebuilt and used as before, provided such restoration is carried out within two years of the damage or destruction and does not exceed the size of the original non-conforming use, except as allowed by the Zoning Board of Appeals.
- c. A nonconforming use which has been abandoned for two or more years shall not be re-established, and any future use shall conform with this bylaw.

### Example of Seasonal Conversion Bylaw

The following example of a Seasonal Conversion bylaw was excerpted from the Growth Management Report, Holland: Land, Water, People, In Concert, prepared by the Pioneer Valley Planning Commission in June 1995. The bylaw, developed for Holland, Massachusetts, is located in Appendix A of the report.

## Proposed Seasonal Conversion Bylaw

This bylaw was recommended by the Holland Resources and Development Committee.

### 7.6 CONVERSION OF SEASONAL HOMES TO YEAR ROUND RESIDENCES

7.61 The purposes of this section are:

- a. To protect public health, safety, welfare and environment for the people.
- b. To protect surfacc and ground water resources in the Town of Holland from pollution.
- c. To conserve the recreational, scenic, and ecological values of water resources in the Town of Holland for the health, safety and welfare, and enjoyment of the people.
- d. To protect the community from land use and development which is detrimental to the water resources in the Town of Holland.
- e. To insure that the development or conversion of homes for year round use occurs only on those lots which are served by adequate sewage disposal facilities, water supply, drainage, roads and driveways.

7.62 Definitions

- a. Seasonal Dwelling or Camp: A dwelling occupied by a person or persons who, as of the adoption date of this bylaw, keeps personal property in the dwelling which is not exempt from the personal property tax assessment required under M.G.L. c. 59, Section 5, 20<sup>th</sup> clause.
- b. Year Round Dwelling: A dwelling which:
  - 1.) is occupied by a person or persons who, as of the adoption date of this bylaw, has qualified his or her personal property kept in the dwelling for the personal property tax exemption allowed under M.G.L. c. 59, Section 5, 20<sup>th</sup> clause, by virtue of the occupant identifying said dwelling as his or her primary residence, OR
  - 2.) is used for overnight occupancy for twenty-five (25) consecutive days from November 1 through March 31, OR
  - 3.) is occupied by schoolchildren registered to attend public schools which are financially supported by the Town of Holland, OR
  - 4.) is occupied by a person or persons who are registered to vote in the Town of Holland.

Exception: A dwelling in Holland which is used for overnight occupancy for twenty-five (25) consecutive days from November 1 through March 31, may be considered a seasonal dwelling in the event that the dwelling in question is serving as an a temporary residence for a person or family whose primary residence has been damaged or destroyed by fire or other substantial casualty.
- c. Conversion shall mean:

## Seasonal Conversion Bylaw

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Any change from a Seasonal Dwelling or Camp to a Year Round Dwelling, both as defined in Section 7.62 (a.) above.

### 7.63 General Regulations

If a residential structure lawfully existing as a seasonal use at the time of adoption of this bylaw is damaged or destroyed by casualty or fire, the residential use may be continued or rebuilt as a seasonal use, to its pre-existing nonconforming height, footprint and density.

### 7.64 Special Permit for Conversion of a Nonconforming Seasonal Dwelling to a Year Round Dwelling

A conversion of a nonconforming dwelling from a seasonal use to a year round use shall be regulated as an extension of the pre-existing nonconforming seasonal use which requires a special permit in accordance with M.G.L. c. 40A Section 9.

Any person, prior to converting a seasonal dwelling to a year round dwelling, shall obtain a Special Permit for Conversion of a Seasonal Dwelling from the Holland Planning Board. No such Special Permit shall be issued by the Planning Board unless all of the following conditions are met:

- a. The septic sewage disposal system which is proposed to serve the converted dwelling unit has been inspected according to the criteria set forth in 310 CMR 15.302; and,
- b. The septic sewage disposal system which is proposed to serve the converted dwelling unit has in the opinion of the Holland Board of Health, achieved "Maximum Feasible Compliance" as defined in Title V of the Massachusetts Environmental Code (310 CMR 15.404); and,
- c. The septic sewage disposal system which is to serve the dwelling unit proposed for conversion complies with all Board of Health regulations in effect at the time of the proposed conversion; and,
- d. The Holland Planning Board certifies that the dwelling has motor vehicle access to a "street" which meets the standards and requirements for public ways specified in the Subdivision Rules and Regulations of the Planning Board which are in effect at the time of the application for the conversion permit; and,
- e. The lot on which the building or structure stands includes a minimum of two (2) off-street parking spaces; and
- f. The Holland Zoning Board of Appeal finds that the dwelling
  1. complies with all other requirements of this zoning bylaw, and
  2. does not increase the extent to which the existing or pre-existing structure or use fails to conform to the present requirements of this bylaw, and
  3. will not result in a condition more detrimental to the residential character of the neighborhood than the pre-existing use or structure.

## HOUSING APPENDIX

**Value of Owner Occupied Housing Units**

**Units in Structure**

**Vacancy Status**

**Household Income**

**Age by Type of Disability for Civilian Non-institutionalized Population Age 5+**

**Monthly Renter Costs**

**Age of Householder by Household Income**

**Number of Single Family Home Sale and Average Length of Time on Market**

**Population Projections by Age Group From MISER**

**Three Alternative Models Used by MISER for Population Projections**

**How the Buildout Analysis of Developable Lands was Created**

**Table H-A: Value for Owner Occupied Housing Units in Holland, 2000, Comparison between the Country, State, and County**

Value	Massachusetts	Percent Total	Hampden County	Percent Total	Holland	Percent Total
Total	1,187,871	100.0%	90,460	100.0%	690	100.0%
Less than \$10,000	507	0.0%	65	0.1%	0	0.0%
\$10,000 to \$14,999	738	0.1%	77	0.1%	4	0.3%
\$15,000 to \$19,999	854	0.1%	80	0.1%	0	0.0%
\$20,000 to \$24,999	1,038	0.1%	87	0.1%	0	0.0%
\$25,000 to \$29,999	827	0.1%	80	0.1%	0	0.0%
\$30,000 to \$34,999	929	0.1%	194	0.2%	2	0.3%
\$35,000 to \$39,999	964	0.1%	155	0.2%	6	0.9%
\$40,000 to \$49,999	2,214	0.2%	531	0.6%	2	0.3%
\$50,000 to \$59,999	4,334	0.4%	1,432	1.6%	7	1.0%
\$60,000 to \$69,999	9,733	0.8%	3,746	4.1%	26	3.8%
\$70,000 to \$79,999	17,244	1.5%	5,789	6.4%	44	6.4%
\$80,000 to \$89,999	31,487	2.7%	9,203	10.2%	57	8.3%
\$90,000 to \$99,999	42,394	3.6%	10,067	11.1%	108	15.7%
\$100,000 to \$124,999	121,055	10.2%	19,708	21.8%	191	27.7%
\$125,000 to \$149,999	156,516	13.7%	15,172	16.8%	102	14.8%
\$150,000 to \$174,999	150,276	12.7%	8,907	9.8%	65	9.4%
\$175,000 to \$199,999	123,266	10.4%	5,361	5.9%	35	5.1%
\$200,000 to \$249,999	167,239	14.1%	5,137	5.7%	22	3.2%
\$250,000 to \$299,999	119,360	10.0%	2,375	2.6%	7	1.0%
\$300,000 to \$399,999	117,119	9.9%	1,509	1.7%	8	1.2%
\$400,000 to \$499,999	53,417	4.5%	485	0.5%	2	0.3%
\$500,000 to \$749,999	42,950	3.6%	208	0.2%	2	0.3%
\$750,000 to \$999,999	13,320	1.1%	45	0.0%	0	0.0%
\$1,000,000 or more	10,090	0.8%	47	0.0%	0	0.0%

*Source: U.S. Census Bureau, Census of Population and Housing, 2000*

**Table H-B: Units in Structure for Holland, Comparison to Country, State, and County, 1990 and 2000**

Units In Structure	United States		Massachusetts		Hampden County		Holland	
	1990	2000	1990	2000	1990	2000	1990	2000
1, detached	60.0%	60.3%	50.4%	52.4%	53.1%	55.1%	96.1%	95.8%
1, attached	5.4%	5.6%	3.7%	3.9%	3.5%	4.4%	0.5%	1.4%
2	4.5%	4.3%	12.5%	11.6%	13.5%	12.9%	1.4%	1.7%
3 or 4	4.9%	4.7%	12.0%	11.4%	8.4%	7.7%	0.7%	0.2%
5 to 9	4.9%	4.7%	6.5%	5.9%	7.5%	6.3%	0.2%	0.2%
10 to 19	4.9%	4.0%	5.2%	4.3%	4.9%	3.4%	0.0%	0.0%
20 to 49	3.9%	3.3%	4.2%	3.9%	3.8%	3.7%	0.0%	0.0%
50 or more	4.4%	5.3%	4.5%	5.4%	3.8%	5.0%	0.0%	0.0%
Mobile home	7.2%	7.8%	1.0%	0.9%	1.5%	1.6%	1.0%	0.8%

Source: U.S. Census Bureau, Census of Population and Housing, 2000

**Table H-C: Vacancy Status for Holland, Comparison to Country, State, and County, 2000**

	United States	Massachusetts	Hampden County	Holland
Total	10,424,540	178,409	10,588	419
For rent	2,614,652	34,174	3,742	4
For sale only	1,204,318	10,861	1,114	19
Rented or sold, not occupied	702,435	9,218	917	7
For seasonal, recreational, or occasional use	3,578,718	93,771	1,735	370
For migrant workers	25,498	194	20	0
Other vacant	2,298,919	30,191	3,060	19

Source: U.S. Census Bureau, Census of Population and Housing, 2000

**Table H-F: Household Income in Holland, 2000, Comparison to the State and the County**

	Massachusetts	Percent Total	Hampden County	Percent Total	Holland	Percent Total
Total	2,444,588	100.0%	175,475	100.0%	900	100.0%
Less than \$10,000	214,700	8.8%	20,917	11.9%	45	5.0%
\$10,000 to \$14,999	137,187	5.6%	13,099	7.5%	36	4.0%
\$15,000 to \$19,999	123,756	5.1%	11,235	6.4%	56	6.2%
\$20,000 to \$24,999	124,452	5.1%	11,421	6.5%	42	4.7%
\$25,000 to \$29,999	125,525	5.1%	11,104	6.3%	29	3.2%
\$30,000 to \$34,999	127,600	5.2%	10,794	6.2%	35	3.9%
\$35,000 to \$39,999	122,456	5.0%	9,649	5.5%	59	6.6%
\$40,000 to \$44,999	120,366	4.9%	9,927	5.7%	50	5.6%
\$45,000 to \$49,999	112,373	4.6%	8,410	4.8%	64	7.1%
\$50,000 to \$59,999	215,885	8.8%	16,105	9.2%	117	13.0%
\$60,000 to \$74,999	275,113	11.3%	19,393	11.1%	154	17.1%
\$75,000 to \$99,999	312,741	12.8%	17,911	10.2%	106	11.8%
\$100,000 to \$124,999	176,926	7.2%	7,564	4.3%	64	7.1%
\$125,000 to \$149,999	90,374	3.7%	3,371	1.9%	20	2.2%
\$150,000 to \$199,999	80,640	3.3%	2,290	1.3%	15	1.7%
\$200,000 or more	84,494	3.5%	2,285	1.3%	8	0.9%

Source: U.S. Census Bureau, Census of Population and Housing, 2000

**Table H-D: Age by Type of Disability for Civilian Non-institutionalized Population Age 5+, 2000, Comparison to the County, State, and County**

	United States	Massachusetts	Hampden County	Holland
Total disabilities tallied	100.0%	100.0%	100.0%	100.0%
Total disabilities tallied for people 5 to 15 years	3.8%	4.0%	5.0%	7.7%
Sensory disability	0.5%	0.4%	0.6%	1.3%
Physical disability	0.5%	0.5%	0.7%	0.6%
Mental disability	2.3%	2.6%	3.0%	5.5%
Self-care disability	0.5%	0.5%	0.7%	0.3%
Total disabilities tallied for people 16 to 64 years	65.0%	64.5%	65.4%	66.1%
Sensory disability	4.6%	4.1%	4.3%	4.7%
Physical disability	12.5%	10.9%	11.9%	14.8%
Mental disability	7.6%	8.1%	9.3%	9.3%
Self-care disability	3.5%	3.3%	3.9%	2.6%
Go-outside-home disability	12.8%	12.5%	12.5%	9.3%
Employment disability	23.9%	25.7%	23.5%	25.5%
Total disabilities tallied for people 65 years and over	31.3%	31.6%	29.5%	26.2%
Sensory disability	5.3%	5.6%	5.1%	5.5%
Physical disability	10.7%	10.6%	9.5%	8.7%
Mental disability	4.0%	3.8%	3.6%	3.1%
Self-care disability	3.6%	3.7%	3.7%	3.5%
Go-outside-home disability	7.6%	8.0%	7.7%	5.5%

Source: U.S. Census Bureau, Census of Population and Housing, 2000

**Table H-E: Monthly Renter Costs in Holland, 2000**

Price Range	Number of Units	Percent
With cash rent	104	100.0%
Less than \$100	0	0.0%
\$100 to \$149	0	0.0%
\$150 to \$199	0	0.0%
\$200 to \$249	0	0.0%
\$250 to \$299	4	3.9%
\$300 to \$349	2	1.9%
\$350 to \$399	0	0.0%
\$400 to \$449	7	6.7%
\$450 to \$499	12	11.5%
\$500 to \$549	8	7.7%
\$550 to \$599	2	1.9%
\$600 to \$649	12	11.5%
\$650 to \$699	12	11.5%
\$700 to \$749	10	9.6%
\$750 to \$799	4	3.9%
\$800 to \$899	10	9.6%
\$900 to \$999	17	16.4%
\$1,000 to \$1,249	4	3.9%
\$1,250 to \$1,499	0	0.0%
\$1,500 to \$1,999	0	0.0%
\$2,000 or more	0	0.0%
No cash rent	15	N/A

Source: U.S. Census Bureau, Census of Population and Housing, 2000



**Table H-G: Age of Householder by Household Income for Holland for Householders Aged 65 to 74, 2000, Comparison to the State and the County**

	Percent Total		Hampden County	Percent Total		Holland	Percent Total	
	Massachusetts	by Age		by Age	by Age			
Householder 65 to 74 years	269,965	100.0%	20,619	100.0%	81	100.0%		
Less than \$10,000	31,808	11.8%	2,943	14.3%	5	6.2%		
\$10,000 to \$14,999	26,444	9.8%	2,233	10.8%	12	14.8%		
\$15,000 to \$19,999	23,063	8.5%	1,950	9.5%	20	24.7%		
\$20,000 to \$24,999	20,766	7.7%	1,957	9.5%	9	11.1%		
\$25,000 to \$29,999	19,476	7.2%	1,779	8.6%	5	6.2%		
\$30,000 to \$34,999	18,241	6.8%	1,547	7.5%	6	7.4%		
\$35,000 to \$39,999	16,316	6.0%	1,168	5.7%	3	3.7%		
\$40,000 to \$44,999	13,516	5.0%	1,059	5.1%	0	0.0%		
\$45,000 to \$49,999	12,970	4.8%	948	4.6%	2	2.5%		
\$50,000 to \$59,999	19,556	7.2%	1,407	6.8%	7	8.6%		
\$60,000 to \$74,999	21,099	7.8%	1,355	6.6%	7	8.6%		
\$75,000 to \$99,999	20,358	7.5%	1,190	5.8%	4	4.9%		
\$100,000 to \$124,999	10,262	3.8%	524	2.5%	0	0.0%		
\$125,000 to \$149,999	5,598	2.1%	166	0.8%	0	0.0%		
\$150,000 to \$199,999	4,791	1.8%	112	0.5%	1	1.2%		
\$200,000 or more	5,701	2.1%	281	1.4%	0	0.0%		

Source: U.S. Census Bureau, Census of Population and Housing, 2000

**Table H-H: Age of Householder by Household Income for Holland for Householders Aged 75 and Over, 2000, Comparison to the State and the County**

	Percent Total		Hampden County	Percent Total		Holland	Percent Total	
	Massachusetts	by Age		by Age	by Age			
Householder 75 years and over	276,266	100.0%	22,346	100.0%	50	100.0%		
Less than \$10,000	50,797	18.4%	4,163	18.6%	13	26.0%		
\$10,000 to \$14,999	43,861	15.9%	4,033	18.0%	2	4.0%		
\$15,000 to \$19,999	34,464	12.5%	3,022	13.5%	7	14.0%		
\$20,000 to \$24,999	26,711	9.7%	2,304	10.3%	5	10.0%		
\$25,000 to \$29,999	20,597	7.5%	1,842	8.2%	3	6.0%		
\$30,000 to \$34,999	16,906	6.1%	1,492	6.7%	4	8.0%		
\$35,000 to \$39,999	13,335	4.8%	1,021	4.6%	3	6.0%		
\$40,000 to \$44,999	9,965	3.6%	746	3.3%	0	0.0%		
\$45,000 to \$49,999	8,961	3.2%	572	2.6%	0	0.0%		
\$50,000 to \$59,999	13,614	4.9%	1,178	5.3%	7	14.0%		
\$60,000 to \$74,999	12,099	4.4%	927	4.1%	3	6.0%		
\$75,000 to \$99,999	10,948	4.0%	500	2.2%	3	6.0%		
\$100,000 to \$124,999	5,359	1.9%	224	1.0%	0	0.0%		
\$125,000 to \$149,999	2,353	0.9%	73	0.3%	0	0.0%		
\$150,000 to \$199,999	2,485	0.9%	99	0.4%	0	0.0%		
\$200,000 or more	3,811	1.4%	150	0.7%	0	0.0%		

Source: U.S. Census Bureau, Census of Population and Housing, 2000

**Table H-I: Number of Single Family Home Sales and Average Length of Time on Market, 2000-2003**

Price Range	Year					
	2000		2001		2002	
	Number of Listings	Average Number of Days on Market	Number of Listings	Average Number of Days on Market	Number of Listings	Average Number of Days on Market
Under \$10,000	0	N/A	0	N/A	0	N/A
\$10,000 - \$19,999	0	N/A	0	N/A	0	N/A
\$20,000 - \$29,999	0	N/A	3	89	0	N/A
\$30,000 - \$39,999	3	163	1	250	1	2
\$40,000 - \$49,999	3	162	0	N/A	0	N/A
\$50,000 - \$59,999	3	203	2	290	1	3
\$60,000 - \$69,999	5	72	2	110	1	96
\$70,000 - \$79,999	5	57	2	175	2	37
\$80,000 - \$89,999	4	78	5	75	2	95
\$90,000 - \$99,999	4	22	3	45	3	114
\$100,000 - \$119,999	10	122	12	42	3	49
\$120,000 - \$159,999	12	36	15	14	16	8
\$160,000 - \$199,999	7	69	8	94	12	24
\$200,000 - \$249,999	3	42	3	41	11	41
\$250,000 - \$299,999	0	N/A	1	35	1	167
\$300,000 - \$349,999	3	345	0	N/A	2	62
\$350,000 - \$399,999	0	N/A	0	N/A	0	N/A
\$400,000 - \$499,999	0	N/A	0	N/A	0	N/A
\$500,000 - \$599,999	0	N/A	0	N/A	0	N/A
\$600,000 - \$699,999	0	N/A	0	N/A	0	N/A
<b>Total</b>	<b>62</b>	<b>22</b>	<b>57</b>	<b>22</b>	<b>55</b>	<b>13</b>

Source: MLS Property Information Network, 2003

**Table H-J: Population Projections by Age Group**

Age Group	Year			Change from 2000 to 2010
	2000	2005	2010	
0 to 19	754	815	884	130
20 to 44	1,014	1,068	1,160	146
45 to 64	539	694	817	278
65 and over	186	188	228	42

Source: MISER, Population Projections for the Years, 2000, 2005, 2010, released 1999

### Three Alternative Models Used by MISER for Population Projections

The Massachusetts Institute of Social and Economic Research (MISER) developed three models for domestic migration that projected low, middle, and high domestic migration levels. For all three models, it was assumed that the fertility and mortality rates for 1996 to 2010 would follow the trends of 1986 to 1995. The net international migration rate between 1991 and 1995 was applied to all the three models after controlling for the total immigrants of the five-year

period as calculated by the foreign-born population ratio method. However, the three different domestic migration rates were employed to produce low, middle and high-level projection numbers.

The mid-level model is based on the assumption that the average annual domestic migration rates from 1981 to 1995 would be the same as those between 1996 and 2010. To develop the low and high projections, the period of 1981-1995 was divided into three sub-periods (1981-85, 1986-90, and 1991-95) and the average annual domestic migration rates were calculated for these periods. The highest rates for each specific area were chosen for the high-level model and the lowest rates were employed in the low-level model.

### **How the Buildout Analysis of Developable Lands was Created**

- ❖ To determine the number of future buildable residential lots by zoning category a formula was developed to determine the land requirements of a typical lot in each category. The land requirements factor in required frontage multiplied by half the road right-of-way to determine road area. This figure varies from zone to zone. Additionally 10% is subtracted from each zone to cover miscellaneous variables such as odd lot shapes. Commercial and Industrial buildable lots were determined using an effective floor area ratio technique.
- ❖ Buildout is based on available data from Mass GIS, the Town of Holland and the U.S. Census.
- ❖ The buildout scenario addresses only uses by right and not uses allowed by special permit.
- ❖ Residential District is assumed to have 10% two-family, in only the unconstrained area.
- ❖ Garden apartments require a minimum of 2 acres per project. It was assumed that new units would be one- and two-bedroom, with 3,300 feet per unit.
- ❖ Business District is calculated as 34% single family, 33% two-family, and 33% 3-story offices. In constrained area, it is assumed to be 100% single family. Floor area in Business District is calculated using maximum lot coverage of 60%.
- ❖ Rural Business does not have enough remaining square footage for minimum residential or business uses, and is therefore undevelopable.
- ❖ Special Conservancy land is assumed to contain 20% offices and conference centers in its unconstrained regions. The floor area ratio for Business uses in Special Conservancy District is calculated using maximum lot coverage of 20%.
- ❖ Area in floodplain is constrained by 10% from development uses.
- ❖ For all area with over 15% slope, a universal constraint factor of 50% is applied.
- ❖ For all area in wetlands, a constraint factor of 25% is applied.
- ❖ For all area in the river 200-foot protective buffer zone, a constraint factor of 90% is applied.

Source: Executive Office of Environmental Affairs, Developable Lands and Partial Constraints Buildout Map, 2000

## **ECONOMIC DEVELOPMENT APPENDIX**

### **Three Alternative Models Used by MISER for Population Projections**

The Massachusetts Institute of Social and Economic Research (MISER) developed three models for domestic migration that projected low, middle, and high domestic migration levels. For all three models, it was assumed that the fertility and mortality rates for 1996 to 2010 would follow the trends of 1986 to 1995. The net international migration rate between 1991 and 1995 was applied to all the three models after controlling for the total immigrants of the five-year period as calculated by the foreign-born population ratio method. However, the three different domestic migration rates were employed to produce low, middle and high level projection numbers.

The mid-level model is based on the assumption that the average annual domestic migration rates from 1981 to 1995 would be the same as those between 1996 and 2010. To develop the low and high projections, the period of 1981-1995 was divided into three sub-periods (1981-85, 1986-90, and 1991-95) and the average annual domestic migration rates were calculated for these periods. The highest rates for each specific area were chosen for the high-level model and the lowest rates were employed in the low-level model.

**TRANSPORTATION APPENDIX**

**Pavement Condition Data for Surveyed Roads, Town of Holland  
Types of Pavement Deficiencies and Descriptions  
Potential Treatments for Pavement Deficiencies**

**Pavement Condition Data for Surveyed Roads, Town of Holland**

ROAD	D-S*	D-E	F-S	F-E	P-S	P-E	R/W-S	R/W-E	RP-S
Mashapaug (Stafford south)	0	0	0	0	1	1	0	0	0
Stafford (Town Center west)	0	0	0	0	0	0	2	1	2
Brimfield	0	0	0	0	0	0	2	1	0
Old Country	2	1	0	0	0	0	1	1	2
East Brimfield	0	0	0	0	0	0	1	1	2
Sturbridge (Town Center east)	2	1	0	0	0	0	2	1	0
Leno	2	2	0	0	2	1	2	1	0
Union (Maybrook north)	2	1	0	0	0	0	2	1	2

ROAD	RT-S	SH-S	T-S	AC-S	AC-E	BC-S	BC-E	EC-S	EC-E
Mashapaug (Stafford south)	0	0	0	1	1	0	0	2	2
Stafford (Town Center west)	2	0	0	3	2	0	0	2	1
Brimfield	0	0	0	1	1	0	0	0	0
Old Country	2	0	2	0	0	0	0	1	1
East Brimfield	0	0	0	2	2	0	0	2	2
Sturbridge (Town Center east)	0	0	2	3	2	0	0	2	2
Leno	2	0	2	2	2	0	0	1	1
Union (Maybrook north)	0	0	2	0	0	0	0	0	0

ROAD	LC-S	RC-S	TC-S	TC-E	LSDO-S	LSS-S
Mashapaug (Stafford south)	0	0	1	1	0	0
Stafford (Town Center west)	2	0	0	0	0	2
Brimfield	0	0	1	1	0	0
Old Country	0	0	0	0	0	0
East Brimfield	2	0	2	2	0	2
Sturbridge (Town Center east)	2	0	1	1	0	0
Leno	1	0	1	1	0	0
Union (Maybrook north)	2	0	0	0	0	0

\* See following page for code descriptions

**Code Descriptions for Pavement Condition Data for Surveyed Roads tables**

<b>Code</b>	<b>Description</b>
D-S	Delamination - Severity
D-E	Delamination - Extent
F-S	Flushing – Severity
F-E	Flushing – Extent
P-S	Potholes – Severity
P-E	Potholes – Extent
R/W-S	Raveling and Weathering – Severity
R/W-E	Raveling and Weathering - Extent
RP-S	Rippling - Severity
RT-S	Rutting – Severity
SH-S	Shoving – Severity
T-S	Tenting – Severity
AC-S	Alligator Cracking – Severity
AC-E	Alligator Cracking – Extent
BC-S	Block Cracking – Severity
BC-E	Block Cracking – Extent
EC-S	Edge Cracking – Severity
EC-E	Edge Cracking – Extent
LC-S	Longitudinal Cracking - Severity
RC-S	Reflective Cracking - Severity
TC-S	Transverse Cracking - Severity
TC-E	Transverse Cracking - Extent
LSDO-S	Lane/Shoulder Drop Off - Severity
LSS-S	Lane/Shoulder Drop Off - Severity

<b>Code</b>	<b>Description</b>
0	None
1	Light
2	Moderate
3	Heavy

## Types of Pavement Deficiencies and Descriptions

### Surface Deficiencies

#### *Delamination*

Delamination is the loss of a large area of pavement surface. Usually there is a clear separation of the pavement surface and the layer below. Possible causes of delamination are:

- Seepage of water through cracks that breaks the bond between the pavement surface and the layer below.
- Pavement surface is too thin.
- Inadequate cleaning or inadequate tack coat before placement of pavement surface.
- Failure of lower layer.

The severity of the delamination can either be light to moderate or moderate to heavy. Light to moderate severity means that the affected area is less than 30 inches in diameter while moderate to heavy severity is larger. The extent of the delamination can either be light, moderate, or heavy. Light extent of delamination is when less than 20 percent of the surface affected and distress is in localized areas only. Moderate extent of delamination is when 20 to 50 percent of the pavement surface is affected. Heavy extent of delamination is when more than 50 percent of the pavement surface is affected.

#### *Flushing*

Flushing or bleeding is when free bituminous asphalt migrates upwards to the pavement surface. This is most likely to occur in the wheel tracks, especially during hot weather. Flushing results in a reduced coefficient of friction and perhaps a lower skid resistance. Possible causes of flushing are:

- Excessive asphalt in the mix relative to the void space in the mineral aggregate. On hot days the asphalt expands into the air voids. If the air voids are too low, excess asphalt is forced to the surface.
- Paving over excessive tack coat.
- Excessive compaction.

The severity of flushing can be light, moderate, or heavy. Light severity is when faint coloring is noticeable, especially in the wheel tracks. Moderate severity is when distinctive coloring has occurred on the pavement surface with some excess asphalt already free. Heavy severity is when considerable free asphalt gives the pavement surface a wet look, tire marks are evident, and excess asphalt sticks to tires and shoes. The extent of flushing can be light, moderate, or heavy. Light extent of flushing is when less than 20 percent of pavement wheel tracks are affected and distress is in localized areas only. Moderate extent occurs when 20 to 50

percent of the pavement wheel tracks are affected. Heavy extent is when more than 50 percent of the pavement wheel tracks are affected.

### *Potholes*

Potholes are round or irregularly shaped holes extending into layers below the pavement surface which can be unrelated to other surface defects or as a direct result of raveling and weathering, alligator or other forms of cracking, or utilities such as manholes, catchbasins, etc. Possible causes of potholes are:

- Poor quality of materials and/or construction.
- Inadequate drainage.
- Freeze-thaw cycling.
- Poor utility patching.

The severity of potholes can be light, moderate, or heavy. Potholes that are light in severity are less than 8 inches in width and less than 2.5 inches in depth. Moderately severe potholes are from 8 to 15 inches in width and from 2.5 to 5 inches in depth. Potholes that are heavy in severity are more than 15 inches in width and more than 5 inches in depth. The extent of potholes can be light, moderate, or heavy. Potholes that are light in extent cover less than 20 percent of the pavement surface and the distress is in localized areas only. When the extent of potholes is moderate, 20 to 50 percent of the pavement surface is affected. Heavy extent of potholes is when more than 50 percent of the pavement surface is affected.

### *Raveling and Weathering*

Raveling and weathering is the wearing away of the pavement surface caused by the loss of asphalt binder and dislodged aggregate particles. Raveling can occur over the entire surface, but the wheel tracks are generally the worst areas because of the traffic action. Possible causes of raveling and weathering are:

- The hardening of asphalt due to aging.
- Poor compaction, especially in cold weather paving.
- Insufficient asphalt content.
- Poor adhesion of asphalt binder to aggregate particles due to wet and/or dirty aggregate.
- Traffic action on a weak surface.

The severity of raveling and weathering can be light, moderate, or heavy. Light severity is when the aggregate or binder has started to wear away but it has not progressed significantly. Moderately severe raveling and weathering occurs when the aggregate or binder has worn away, the pavement surface is becoming rough and pitted, and loose particles generally exist. Heavy severity occurs when the aggregate or binder has worn away considerably and the pavement surface is rough and highly pitted. The extent of raveling and weathering can be light, moderate,



or heavy. When the extent of the condition is light, less than 20 percent of the pavement surface is affected and the distress has occurred in localized areas only. Moderate extent occurs when 20 to 50 percent of the pavement surface has been affected. When the extent of raveling or weathering is heavy, more than 50 percent of the surface area has been affected.

## **Surface Deformations**

### *Rippling*

Rippling, corrugations or washboarding, is a series of closely-spaced ridges and valleys (ripples) occurring at fairly regular intervals, usually within 10 feet, along the pavement and perpendicular to the traffic direction. If bumps occur in a series of less than 10 feet, due to any cause, the distress is considered rippling. Possible causes of rippling are:

- Traffic action.
- Unstable pavement mix in the surface or base.
- Excessive tack coat application.
- Improper placement of asphalt mix.

The severity of rippling can be light to moderate or moderate to heavy. When the severity of rippling is light to moderate, rippling will cause some vehicle vibration and discomfort but does not affect the vehicle's handling or safety. When the severity of rippling is moderate to heavy the rippling causes excessive vehicle vibration and discomfort and the speed of the vehicle must be reduced considerably to be driven safely. The extent of the rippling is not applicable.

### *Rutting*

Rutting is longitudinal depressions in the wheel tracks. Pavement uplift may occur along the sides of the rut. In many instances, ruts are noticeable only after a rainfall when the tracks are filled with water. Possible causes of rutting are:

- Poorly-compacted structural layers, including bases and subbases.
- Unstable granular shoulder which cannot provide adequate lateral support.
- Unstable pavement mix in surface or base.
- Insufficient veering support and repeated traffic loading.

The severity of rutting can be light to moderate or moderate to heavy. When the severity of rutting is light to moderate the depth of the rut is less than one inch. Moderate to heavy severity is when the depth of the rut is greater than one inch. The extent of rutting is not applicable.

### *Shoving*

Shoving is the permanent lateral displacement of a localized area of the pavement surface caused by traffic loading. When traffic pushes against the pavement it produces a short, abrupt wave in the pavement surface. Possible causes of shoving are:

- Unstable pavement mix in the surface or base.
- Traffic action such as start and stop at intersections.
- Excessive tack coat application.

The severity of shoving can be light to moderate or moderate to heavy. When the severity of shoving is light to moderate, the shoving causes some vehicle vibration and discomfort but does not affect the vehicle's safety or handling. Moderate to heavy severity of shoving is when the shoving causes excessive vehicle vibration and discomfort and the vehicle's speed must be reduced considerably for safety. The extent of shoving is not applicable.

### *Tenting*

Tenting usually occurs on asphalt surface pavements which have been laid over a Portland Cement Concrete (PCC) slab. This distress is characterized by lifting at transverse construction joints of underlying pavement. Cracks and vertical displacement appear in the asphalt overlay. Possible causes of tenting are:

- Thermal and/or moisture-induced, vertical movement (at the joint) of the PCC slab beneath the asphalt surface.
- The PCC joint fails due to excessive traffic loading or structurally deficient PCC pavement.

The severity of tenting can be light, moderate, or heavy. When the severity of tenting is light, sealed or unsealed cracks have little or no spalling. If unsealed, cracks are less than 0.5 inch in width and 1 inch in height. Tenting has little or no adverse effect on ride quality. If the severity is moderate then the spalled cracks are greater than 0.5 inch in width and between 1 and 1.5 inches in height. Tenting of moderate severity will cause slight vehicle vibration. When the severity of tenting is heavy, extensive spalling and tenting cause excessive vehicle vibration. The extent of tenting is not applicable.

### *Cracking Alligator*

Alligator cracking occurs when interconnecting cracks form a network of multisided, sharp-angled blocks resembling the skin of an alligator. Cracks begin at the bottom of the asphalt layer and propagate to the surface, initially as a series of parallel longitudinal cracks. The cracks often occur in areas subjected to repeated traffic loading, such as wheel paths. Therefore, it is uncommon for alligator cracks to cover the entire roadway area. Possible causes of alligator cracks are insufficient bearing support and repeated traffic loading and/or poor base drainage.

The severity of alligator cracks can be light, moderate, or heavy. Alligator cracks of light severity consist of fine, longitudinal hairline cracks that run parallel to each other with no or only a few interconnecting cracks and the cracks are not spalled. When the severity of alligator cracks are moderate, further development of light cracks into a pattern of cracks that may be lightly spalled occur and distortions are from 0.25 to 0.5 inches. When the severity of alligator cracks is heavy, the cracks are spalled and pieces are well defined, some blocks may be loose or missing, and distortions of 0.5 inches or more occur. The extent of alligator cracks can be light, moderate or heavy. When the extent is light, less than 20 percent of the pavement surface is affected and the distress is in localized areas only. Moderate extent is when 20 to 50 percent of the pavement surface is affected. Heavy extent occurs when more than 50 percent of the pavement surface is affected.

### *Block Cracking*

Block cracking or map cracking is when interconnecting cracks divide the pavement into near-rectangular pieces, giving the appearance of a domination of transverse and longitudinal cracks. Block cracking normally occurs over a large portion of the pavement area and differs from alligator cracking in that it forms larger, more uniformly-shaped peaces that are usually not load-associated. Possible causes of block cracking are the shrinking and hardening of asphalt due to age and daily temperature cycling.

The severity of block cracking can be light, moderate, or heavy. Light severity occurs when clocks are defined by unspalled, well-spaced cracks that are less than 0.25 inches in width. When block cracking is moderately severe, blocks are defined by moderately spalled cracks that are 0.25 to 0.5 inches in width. When the severity of block cracking is heavy, blocks are defined by considerably spalled crack that are greater than 0.5 inches in width. The extent of block cracking can be light, moderate, or heavy. When the extent of block cracking is light, less than 20 percent of the pavement surface is affected and distress is in localized areas only. Moderate extent is when 20 to 50 percent of the surface area is affected. Heavy extent occurs when more than 50 percent of the pavement surface area is affected.

### *Edge Cracking*

Edge cracking is parallel to the pavement adage and is either linear or crescent-shaped. Although usually within 2 feet of the outer edge of the pavement, edge cracking may encroach into the outer wheel track on thin asphalt surfaces. Possible causes of edge cracking are:

- Insufficient bearing support at the pavement edge.
- Inadequate pavement width, forcing traffic to travel close to the pavement edge.
- Poor drainage at the pavement edge.
- Frost action.

The severity of edge cracking can be light, moderate, or heavy. The severity of edge cracking is light when there is cracking with no spalling of pavement edge. Moderate severity occurs when there is cracking with slight spalling of pavement edge. The severity is heavy when

there is cracking with considerable spalling. The pavement edge is cracked and the cracks are interconnected, giving the appearance of alligator cracking. The extent of the cracking can be light, moderate, or heavy. The extent of edge cracking is light when less than 20 percent of the pavement edge is affected and distress is in localized areas only. Moderate extent is when 20 to 50 percent of the pavement edge is affected. When more than 50 percent of the pavement edge is affected, the extent is considered heavy.

### *Longitudinal Cracking*

Longitudinal cracks follow a course approximately parallel to the centerline of the roadway, situated at or near the center of the wheel tracks or the centerline of the road. Possible causes of longitudinal cracks are:

- Poorly constructed paving lane joint along the pavement surface, which is also known as a seam crack.
- Shrinkage of the pavement surface due to daily temperature cycling or hardening of the asphalt.
- Although longitudinal cracking tends not to be load-related, traffic loading may cause a longitudinal crack to occur. If this is the case, the crack often occurs in the wheel track and may be the initial stage of alligator cracking (see Alligator Cracking).
- Cracking or joints below the pavement surface (see Reflective Cracking).

The severity of longitudinal cracking can be light, moderate, or heavy. When the severity is light, hairline cracks are less than 0.25 inch in width with little or no spalling. Moderate severity occurs when cracks are between 0.25 and 0.5 inches in width with some spalling. Heavy severity is when cracks are greater than 0.5 inches in width with considerable spalling. The extent of longitudinal cracking is not applicable.

### *Reflective Cracking*

Reflective cracking appears in an overlay as a result of a crack or joint in the underlying pavement. This distress is not usually load-related. Possible causes of reflective cracking are either when there is a crack in the underlying pavement or there is a joint existing in the underlying pavement, especially when the pavement below is a rigid, jointed concrete surface.

The severity of reflective cracking can be light, moderate, or heavy. When the cracking is less than 0.0625 of an inch in width with little or no spalling, it is considered to be light in severity. Moderate severity is when the cracking is between 0.0625 and 0.5 of an inch in width with little or moderate spalling. Heavy severity is when the cracking is greater than 0.5 inches in width with considerable spalling. The extent of reflective cracking is not applicable.

## *Transverse Cracking*

Transverse cracks appear approximately at right angles to the centerline and often start at the top of the pavement surface. They are usually not load-related. Possible causes of transverse cracking are:

- Poorly constructed paving lane joint.
- Shrinkage of the surface course due to daily temperature cycling or hardening of asphalt.
- Cracks or joints below the pavement surface (see reflective cracking).

The severity of transverse cracking can be light, moderate, or heavy. Light severity is when hairline cracks are less than 0.0625 of an inch in width with little or no spalling. Moderate severity is when the cracking is between 0.0625 and 0.5 of an inch in width with some spalling. Heavy severity is when the cracking is greater than 0.5 inches in width with considerable spalling. The extent of transverse cracking can be light, moderate, or heavy. Light extent is when there is approximately one transverse crack in every 40-foot length of roadway. Moderate extent is when there is approximately one transverse crack in every 20-foot length of roadway. When there is approximately one transverse crack in every 10-foot length of roadway and may be approaching block cracking, it is heavy extent.

## **Lane/Shoulder Deterioration**

### *Lane/Shoulder Drop-Off*

Lane/shoulder drop-off is when there is a difference in the elevation between the edge of traffic lane and paved or unpaved shoulder. Possible causes of lane/shoulder drop-off are when the shoulder settles due to consolidation or settlement of the underlying granular or subgrade material or pumping of the underlying material or when there is a loss of shoulder materials.

The severity of lane/shoulder drop-off can be light, moderate, or heavy. When the difference in elevation between the traffic lane and the shoulder is less than 2 inches, the severity is considered to be light. Moderate severity is when the difference in elevation between the traffic lane and the shoulder is between 2 and 3 inches. When the difference in elevation between the traffic lane and the shoulder is greater than 3 inches the severity is heavy. The extent of lane/shoulder drop-off is not applicable.

### *Lane/Shoulder Separation*

When the longitudinal joint between the traffic lane and paved shoulder has opened it is considered lane/shoulder separation. Possible causes are:

- Poor construction joint between roadway and shoulder.
- A poorly constructed and backfilled roadway, allowing outward movement and sliding of the shoulder.

- Differential frost action or settlement.

The severity of lane/shoulder separation can be light to moderate or moderate to heavy. When the severity is light to moderate, the opened joint between the shoulder and traffic lane is less than 0.5 inches in width, with little or no spalling. When the severity is moderate to heavy, the opened joint between the shoulder and the traffic lane is greater than 0.5 inches in width with at least some spalling. The extent of lane/shoulder separation is not applicable.

### Potential Treatments of Pavement Deficiencies

#### Potential Treatment for Delamination

<b>Distress Severity</b>	<b>Distress Extent</b>	<b>Low Volume (&lt;2,000 vpd)</b>	<b>Median Volume (2,000-10,000 vpd)</b>	<b>High Volume (&gt;10,000 vpd)</b>
Light to Moderate	Light	No treatment or patch	No treatment or patch	Patch
	Moderate	No treatment or patch	Patch	Patch
	Heavy	No treatment or overlay*	Overlay*	Overlay*
Moderate to Heavy	Light	Patch	Patch	Patch
	Moderate	Patch	Patch or overlay	Overlay*
	Heavy	Overlay*	Overlay*	Overlay*

\*Possibly with milling

#### Potential Treatments for Flushing

<b>Distress Severity</b>	<b>Distress Extent</b>	<b>Low Volume (&lt;2,000 vpd)</b>	<b>Median Volume (2,000-10,000 vpd)</b>	<b>High Volume (&gt;10,000 vpd)</b>
Light	Light	No treatment	No treatment	No treatment
	Moderate	No treatment	No treatment	No treatment or surface treatment
	Heavy	No treatment or surface treatment	No treatment or surface treatment	No treatment or surface treatment
Moderate	Light*	No treatment or surface treatment	No treatment or surface treatment	Surface treatment
	Moderate*	Surface treatment	Surface treatment	Surface treatment
	Heavy*	Surface treatment	Surface treatment	Surface treatment or overlay

Heavy	Light*	Surface treatment	Surface treatment or overlay	Surface treatment or overlay
	Moderate*	Surface treatment	Surface treatment or overlay	Surface treatment or overlay
	Heavy**	Surface treatment	Surface treatment or overlay	Overlay

\* These treatments may be done in conjunction with milling.

\*\* These treatments should be done in conjunction with milling.

### Potential Treatments for Potholes

Distress Severity	Distress Extent	Low Volume (<2,000 vpd)	Median Volume (2,000-10,000 vpd)	High Volume (>10,000 vpd)
Light	Light	No treatment or patch	Patch	Patch
	Moderate	Patch	Patch	Patch
	Heavy	Patch or overlay	Patch or overlay	Patch or overlay
Moderate	Light	Patch	Patch	Patch
	Moderate	Patch or overlay	Patch or overlay	Patch or overlay
	Heavy	Overlay	Overlay	Overlay or reconstruction
Heavy	Light	Patch*	Patch*	Patch*
	Moderate	Patch* or overlay	Overlay	Overlay
	Heavy	Overlay	Overlay	Overlay or reconstruction

\* Possibility of full-depth type

### Potential Treatments for Raveling and Weathering

Distress Severity	Distress Extent	Low Volume (<2,000 vpd)	Median Volume (2,000-10,000 vpd)	High Volume (>10,000 vpd)
Light	Light	No treatment	No treatment	No treatment or surface treatment
	Moderate	No treatment	No treatment or surface treatment	No treatment or surface treatment
	Heavy	No treatment	Surface treatment	Surface treatment
Moderate	Light	No treatment	No treatment or surface treatment	Surface treatment
	Moderate	No treatment or surface treatment	No treatment or surface treatment	Surface treatment or overlay*
	Heavy	No treatment or surface treatment	Surface treatment or overlay*	Surface treatment or overlay*
Heavy	Light	No treatment or surface treatment	Surface treatment	Surface treatment
	Moderate	Surface treatment	Surface treatment or overlay*	Surface treatment or overlay*
	Heavy	Surface treatment	Surface treatment	Overlay*

or overlay\*

\* Possibly with milling

**Potential Treatments for Rippling**

<b>Distress Severity</b>	<b>Low Volume (&lt;2,000 vpd)</b>	<b>Median Volume (2,000-10,000 vpd)</b>	<b>High Volume (&gt;10,000 vpd)</b>
Light to Moderate	No treatment or mill smooth	No treatment or mill smooth	Mill smooth or overlay*
Moderate to Heavy	Mill smooth or overlay*	Overlay*	Overlay* or reconstruction

\* Possibly with milling

**Potential Treatments for Rutting**

<b>Distress Severity</b>	<b>Low Volume (&lt;2,000 vpd)</b>	<b>Median Volume (2,000-10,000 vpd)</b>	<b>High Volume (&gt;10,000 vpd)</b>
Light to Moderate	No treatment or mill smooth	No treatment, mill smooth, or fill ruts	Mill smooth, fill ruts, or overlay*
Moderate to Heavy	Mill smooth, fill ruts, or overlay*	Fill ruts or overlay*	Overlay*

\* Possibly with milling

**Potential Treatments for Shoving**

<b>Distress Severity</b>	<b>Low Volume (&lt;2,000 vpd)</b>	<b>Median Volume (2,000-10,000 vpd)</b>	<b>High Volume (&gt;10,000 vpd)</b>
Light to Moderate	No treatment or mill smooth	No treatment or mill smooth	Mill smooth or overlay*
Moderate to Heavy	Mill smooth or overlay*	Overlay*	Overlay* or reconstruction

\* Possibly with milling

**Potential Treatments for Tenting**

<b>Distress Severity</b>	<b>Low Volume (&lt;2,000 vpd)</b>	<b>Median Volume (2,000-10,000 vpd)</b>	<b>High Volume (&gt;10,000 vpd)</b>
Light	No treatment	No treatment, rout and rill, or mill smooth	Rout and fill or mill smooth
Moderate	No treatment, rout and rill, or mill smooth	Rout and fill, mill smooth, or saw cut and seal	Rout and fill, mill smooth, or saw cut and seal
Heavy	Saw cut and seal	Saw cut and seal	Saw cut and seal



**Potential Treatments for Alligator Cracks**

<b>Distress Severity</b>	<b>Distress Extent</b>	<b>Low Volume (&lt;2,000 vpd)</b>	<b>Median Volume (2,000-10,000 vpd)</b>	<b>High Volume (&gt;10,000 vpd)</b>
Light	Light	No treatment	No treatment or crack seal	No treatment or crack seal
	Moderate	No treatment or crack seal	No treatment or crack seal	No treatment or crack seal
	Heavy	No treatment or crack seal	No treatment or crack seal	Crack seal
Moderate	Light	No treatment or crack seal	No treatment or crack seal	Crack seal
	Moderate	No treatment or crack seal	Crack seal	Crack seal or surface treatment
	Heavy	Patch* or surface treatment	Patch* or surface treatment	Surface treatment or overlay
Heavy	Light	Patch* or crack seal	Patch* or crack seal	Patch* or crack seal
	Moderate	Patch* or surface treatment	Patch* or surface treatment	Surface treatment or overlay
	Heavy	Overlay or reconstruction	Overlay or reconstruction	Overlay or reconstruction

**Potential Treatments for Block Cracking**

<b>Distress Severity</b>	<b>Distress Extent</b>	<b>Low Volume (&lt;2,000 vpd)</b>	<b>Median Volume (2,000-10,000 vpd)</b>	<b>High Volume (&gt;10,000 vpd)</b>
Light	Light	No treatment	No treatment	No treatment or crack seal
	Moderate	No treatment	No treatment or crack seal	No treatment or crack seal
	Heavy	No treatment, crack seal, or surface treatment	Crack seal or surface treatment	Crack seal or surface treatment
Moderate	Light	No treatment or crack seal	Crack seal or rout and fill	Crack seal or rout and fill
	Moderate	Crack seal or rout and fill	Crack seal or surface treatment	Crack seal or surface treatment
	Heavy	Crack seal or surface treatment	Crack seal or surface treatment	Surface treatment or overlay*
Heavy	Light	Crack seal or rout and fill	Crack seal or rout and fill	Rout and fill or surface treatment
	Moderate	Surface treatment or overlay*	Surface treatment or overlay*	Overlay*
	Heavy	Overlay*	Overlay*	Overlay* or

reconstruction

\* Possibly with milling and stress absorbing membrane interlayer (SAMI)

**Possible Treatments for Edge Cracking\***

<b>Distress Severity</b>	<b>Distress Extent</b>	<b>Low Volume (&lt;2,000 vpd)</b>	<b>Median Volume (2,000-10,000 vpd)</b>	<b>High Volume (&gt;10,000 vpd)</b>
Light	Light	No treatment	No treatment	No treatment
	Moderate	No treatment	No treatment	No treatment or crack seal
	Heavy	No treatment	No treatment or crack seal	No treatment or crack seal
Moderate	Light	No treatment or crack seal	No treatment or crack seal	Crack seal or rout and fill
	Moderate	Crack seal	Crack seal or rout and fill	Crack seal or rout and fill
	Heavy	Crack seal or rout and fill	Crack seal or rout and fill	Rout and fill or Patch**
Heavy	Light	Patch**	Patch** or overlay	Patch** or overlay
	Moderate	Patch** or overlay	Patch** or overlay	Overlay
	Heavy	Patch** or overlay	Overlay	Overlay or reconstruction

\* It should be noted that improvements to shoulder drainage and removal or replacement of frost-susceptible soil are common treatments, in addition to those listed above.

\*\* Possibly of full-depth type.

**Potential Treatments for Longitudinal Cracking**

<b>Distress Severity</b>	<b>Low Volume (&lt;2,000 vpd)</b>	<b>Median Volume (2,000-10,000 vpd)</b>	<b>High Volume (&gt;10,000 vpd)</b>
Light	No treatment or crack seal	No treatment or crack seal	No treatment or crack seal
Moderate	Crack seal or rout and fill	Crack seal or rout and fill	Crack seal or rout and fill
Heavy	Crack seal or rout and fill	Rout and fill	Rout and fill or overlay*

\* Possibly with milling.

**Potential Treatments for Reflective Cracking**

<b>Distress Severity</b>	<b>Low Volume (&lt;2,000 vpd)</b>	<b>Median Volume (2,000-10,000 vpd)</b>	<b>High Volume (&gt;10,000 vpd)</b>
Light	No treatment or crack seal	No treatment or crack seal	No treatment or crack seal
Moderate	Crack seal or rout and fill	Crack seal or rout and fill	Rout and fill
Heavy	Rout and fill or Patch*	Rout and fill, patch*, or overlay*	Rout and fill, patch*, or overlay*

\* Possibly with stress absorbing membrane interlayer (SAMI) in conjunction with saw cut and seal treatment.

**Potential Treatments for Transverse Cracking**

<b>Distress Severity</b>	<b>Distress Extent</b>	<b>Low Volume (&lt;2,000 vpd)</b>	<b>Median Volume (2,000-10,000 vpd)</b>	<b>High Volume (&gt;10,000 vpd)</b>
Light	Light	No treatment	No treatment	No treatment or crack seal
	Moderate	No treatment	No treatment or crack seal	No treatment or crack seal
	Heavy	No treatment or crack seal	No treatment or crack seal	Crack seal or rout and fill
Moderate	Light	No treatment or crack seal	No treatment or crack seal	Crack seal or rout and fill
	Moderate	Crack seal or rout and fill	Crack seal or rout and fill	Crack seal or rout and fill
	Heavy	Crack seal or rout and fill	Crack seal or rout and fill	Rout and fill
Heavy	Light	Crack seal or rout and fill	Rout and fill	Rout and fill
	Moderate	Rout and fill	Rout and fill	Rout and fill or overlay*
	Heavy	Rout and fill	Rout and fill or overlay*	Rout and fill or overlay*

\* Possibly with milling

**Potential Treatments for Lane/Shoulder Drop-Off**

<b>Distress Severity</b>	<b>Low Volume (&lt;2,000 vpd)</b>	<b>Median Volume (2,000-10,000 vpd)</b>	<b>High Volume (&gt;10,000 vpd)</b>
Light	No treatment or mill pavement	No treatment or mill pavement	Mill pavement or overlay shoulder
Moderate	Mill pavement or overlay shoulder	Overlay shoulder	Overlay shoulder

Heavy                      Overlay shoulder    Overlay shoulder    Overlay shoulder

**Potential Treatments for Lane/Shoulder Separation**

<b>Distress Severity</b>	<b>Low Volume (&lt;2,000 vpd)</b>	<b>Median Volume (2,000-10,000 vpd)</b>	<b>High Volume (&gt;10,000 vpd)</b>
Light to Moderate	No treatment	No treatment or rout and fill	No treatment or rout and fill
Moderate to Heavy	Rout and fill	Rout and fill	Rout and fill