**Cost Analysis of Public Rights-of-Way Accessibility Guidelines (PROWAG)**

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## Accessible Pedestrian Signals

### Background

Accessible Pedestrian Signals (APS) provide auditory and tactile information about the pedestrian signal phases ("walk" and "don't walk") at signalized pedestrian crossings. This information parallels the visual information provided by conventional signals to sighted pedestrians. This PROWAG provision would require APS to be incorporated in all new and replacement pedestrian signals. There is no requirement to retrofit existing signals. Moreover, there is no underlying requirement to provide pedestrian facilities or pedestrian signals at any given intersection.

### Overview of Compliance Costs

Compliance costs can be thought of as the total lifecycle cost of pedestrian signal installations with this provision in place, less the cost of such projects under current baseline conditions in the absence of this provision, in present value terms over the course of the equipment lifecycle or other reasonable time period. This, in turn, is based on the difference in upfront equipment and installation costs for APS versus those for conventional (visual-only) signals, plus any incremental ongoing operations and maintenance costs for APS compared to conventional signals.

APS installations would result from two main types of roadway projects: (1) replacement of existing pedestrian signals at the end of their useful life, and (2) installation of entirely new pedestrian signals, either at newly built ("greenfield") intersections or at existing intersections where pedestrian signals are being added. This analysis therefore uses a lifecycle model of the current stock of pedestrian signals and assumes that existing, non-APS signals will be replaced with APS equipment as they are retired from service, and that pedestrian signals installed at new locations will be APS.

### Data and Cost Estimates

The project team gathered technical specifications and cost information from the websites of eight APS vendors and conducted follow-up discussions by phone or e-mail with three

[1] The Volpe Center is part of the U.S. Department of Transportation's Research and Innovative Technology Administration. The report was prepared pursuant to Interagency Agreement VXG9 between the U.S. Access Board and the Volpe Center. The authors of the report are Sean Pierce and Lydia Rainville.

of these vendors.[2] For APS models that appear to meet the proposed guidelines, equipment costs average about $600 per pushbutton station, versus about $250 for a non-APS conventional pedestrian signal, for a net cost of $350 per station.

The number of stations that is required will vary according to the layout of the intersection. For a typical four-way intersection, one station may be needed for each of the two crossing directions at all four corners, for a total of eight stations. In some locations, it is possible for a single station to serve the two perpendicular crossings from a corner, such that only four stations are needed. In locations where roadways converge in a T- or Y-shaped junction, four to six stations would be needed, again depending on the layout of crosswalks. Two stations, one for each direction, would suffice for most signalized mid-block crossings. Assuming conservatively that the 8-station scenario is the most representative, net equipment costs are therefore approximately $2,800 per intersection (that is, $350 x 8).

Additional costs for APS installation labor and other equipment, such as stub poles and conduit, vary by location. Based on published cost estimates and interviews with cities such as Naperville, Illinois, and Portland, Oregon, that have already installed various forms of APS, the comprehensive cost of equipping an intersection with APS is in the range of $3,600.[3] These figures generally reflect retrofit situations that are acknowledged to be more expensive than installation of APS as part of new construction, though even in new construction there can be site constraints that impose additional costs.

Signal vendors expressed a belief that equipment costs would decline slightly if order volume increased due to new requirements and/or if the guidelines led to greater standardization in customer requirements. Therefore, these per-intersection incremental cost estimates should be regarded as relatively conservative. (These costs are also a relatively small share of the overall costs of intersection signalization and operation. The costs of adding traffic signals to an intersection, including engineering and design, are estimated at $178,000.[4])

In terms of operating costs, APS draw 3 to 13 watts of power, which is equivalent to about $10 per year in electricity costs (depending on local rates) and comparable to non-accessible signals. NCHRP report 117A *Accessible Pedestrian Signals: A Guide to Best Practices* includes a number of case studies of local governments that indicate

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[2] Website data from Campbell Co., Novax Industries, Polara Engineering, Prisma Teknik, US Traffic Corp., and Wilcox Sales. Follow-up calls with Campbell and Polara; e-mail communication with Prisma Teknik.

[3] A report on the retrofit installation of APS in West Lafayette, Indiana, places the cost at approximately $3,000 in equipment and 8 person-hours of labor per four-way intersection. The report did not provide labor costs, but at an assumed hourly labor rate of $75, the total cost is equivalent to $3,600 per intersection. See R. Jacko, "Blind Pedestrians and Their Ability to Navigate Indiana Intersections – A Review of the Technology Available for Audible Signals," Report for Federal Highway Administration, FHWA/IN/JTRP-2006/12, May 2006.

[4] BNi Public Works Costbook, 2010.

maintenance of equipment has been minimal, e.g. volume adjustment. However, most of these cities have installed APS relatively recently, so there is only a limited history on which to base this information. One municipality that was interviewed noted that the pushbutton poles used with APS can require more frequent maintenance, as their location near the curb increases the frequency with which they are knocked over or damaged by turning vehicles. However, the 2009 MUTCD uses this location requirement as the standard for all pedestrian pushbuttons, so this does not appear to be an APS-specific cost issue. Overall, based on available information, APS do not present any significant increase in operations and maintenance costs compared to conventional signals, and thus no incremental operating costs have been included in the overall cost estimate. As the adoption rates increase and the technology matures, more information about operations and maintenance costs may become available.

Scaling up the per-intersection cost estimates to the national level requires information on the extent of pedestrian signalization. Traffic signals are primarily a state and local responsibility, and there is no consolidated national inventory of traffic signals. The Federal Highway Administration has estimated that there are 300,000 signalized intersections in the U.S.[5], but the share of these intersections that have pedestrian facilities and pedestrian signal indication is unknown. Based on discussions with transportation officials in several fast-growing counties, the share of signalized intersections with pedestrian indication is very roughly estimated at 70% for the current set of signals, but rising to perhaps 90% by the end of the analysis period due to an increasing number of localities that are making pedestrian signals a standard part of their treatment of signalized intersections, even in areas with low pedestrian traffic volumes.

According to vendors and local transportation officials, pedestrian signal equipment has a lifespan of approximately 25 years, though individual components such as pushbuttons and LED lights must be replaced every 5-10 years. In general, it is replacement or upgrade of the whole intersection treatment or system, not basic maintenance such as replacing a LED light, which would "trigger" compliance with the accessibility guidelines. Therefore, the 25-year figure is most appropriate as the replacement lifecycle. With an assumption that 90% of signalized intersections have pedestrian indication (or will have it added), the total number of intersections to be equipped with APS would thus be 10,800 per year, i.e. 300,000 x 0.90 x (1/25). Based on the $3,600 per intersection comprehensive cost figures cited above, the incremental cost of using APS rather than conventional signals for these replacements is approximately **$38.9 million per year**. This figure is somewhat conservative in that it assumes that *all* affected signals would require the upgrade to APS, when in fact a small number of pedestrian signals are already accessible and others are being added each year.

As noted above, the other cost component stems from the installation of APS at new intersections. To help develop a methodology to determine new intersection construction, the project team spoke with 6 local government and state DOT engineers in fast-growing U.S. counties to learn more about new road-building and intersections. Each described a

[5] *Improving Traffic Signal Operations: A Primer*, prepared by the Institute of Transportation Engineers for FHWA, Report No. FHWA-SA-96-007, 1995.

trend of new road and housing development construction that has slowed in recent years due to both capacity constraints and economic conditions. Differences in oversight responsibilities and jurisdiction of traffic signals vary by state, making it difficult to aggregate or compare estimates. However, a rule of thumb that has been used in the transportation engineering community is that there is one signalized intersection per 1,000 population (which accords with the current estimate of 300,000 signals, with the U.S. population at roughly 300 million).[6] The Census Bureau's forecasts of future population show an average rate of growth of about 0.85% per year over the next 40 years.[7] Therefore, if the 1:1000 ratio were to continue to hold in the future, approximately 2,550 signalized intersections would be added each year. Of these, an assumed 90%, or 2,295, would have pedestrian indication. Based on the cost-per-intersection figures cited above, the incremental cost of equipping these intersections with APS rather than conventional pedestrian signals would be **$8.3 million per year**.

Overall, then, total compliance costs would comprise the estimated $38.9 million per year for the ongoing replacement of existing signals at the end of their service lifetimes, plus the $8.3 million per year for APS at new signalized intersections, for a total of **$47.1 million per year** over a 25-year signal replacement cycle. Incremental operations and maintenance costs are believed to be minimal, as noted above.

**Tabled Intersections**

Background

For drainage, safety, and visibility reasons, streets in hilly urban areas are typically cut-and-filled at crossroads to produce relatively flat ("tabled") intersections. In some cases, this tabling design may encompass the crosswalks, but in other cases, the crosswalks are far enough up- or downhill from the intersection as to experience significant cross-slopes. Cross-slopes present difficulties for pedestrians with mobility impairments.
This provision would require that intersections that are newly constructed (or rebuilt with changes to grading, to the maximum extent feasible) be designed such that the cross-slope on any pedestrian crosswalks would be no more than 2% at controlled intersections, and 5% at other intersections. There is no requirement to re-grade existing intersections for this purpose.

Overview of Compliance Costs

[6] Actual ratios vary according to the level of urbanization and other factors. For example, according to their respective city websites, there is roughly 1 signalized intersection per 705 residents of New York City, 1 per 632 in Cambridge, Mass., and 1 per 614 in Seattle. Ratios are higher in suburban areas, e.g. 1:923 in Naperville, Ill., 1:1055 in Loudon County, Va., and 1:1976 in Gwinnett County, Ga. Although these figures constitute a very limited sample, they suggest that the 1:1000 figure is reasonable as a nationwide rule of thumb.

[7] US Bureau of the Census, National Population Projections, 2008. http://www.census.gov/population/www/projections/summarytables.html

Compliance costs can be thought of as the total costs of intersection construction projects with this provision in place, less the cost of such projects under current baseline conditions, in present value terms over the course of the pavement lifecycle or other reasonable time period. The principal cost element is the additional site preparation and grading/earthwork costs of extending the tabling design to the crosswalks. There is the possibility that some incremental operations and maintenance costs (e.g. for additional drainage equipment) could also be involved.

Previous research by the Access Board places the per-site cost of extending the tabling design to include crosswalks at roughly $60,000, a relatively small share of the overall design, engineering, and construction costs associated with a new intersection. (Road-building costs vary substantially according to site conditions, intersection geometry, and local cost factors, but for comparison purposes, the average cost of a single lane-mile of roadway is estimated at $2.3 million.)[8]

The tabled intersection design is used only in specific circumstances, and many of the existing examples are in highly urbanized areas where future construction of new intersections will be limited, such as downtown San Francisco. Geographic Information Systems (GIS) software generally does not present elevation data in enough detail to identify locations where this provision would be relevant, and no other data source has been identified that would allow the per-site cost to be scaled up to a comprehensive national estimate.

Some locations with many tabled intersections, such as Seattle, already use a 2% cross-slope requirement in their internal design manuals.[9] As such, any incremental compliance costs would be minimal.

**Pedestrian Signalization at Multi-Lane Roundabouts**

Background

Pedestrian-demand signals are traffic control devices that produce a red (stop) signal for vehicles and a "walk" phase for pedestrians when actuated by a pedestrian, usually via a pushbutton. This PROWAG provision would require that roundabouts with pedestrian facilities provide pedestrian-demand signals at each pedestrian crossing that involves more than one lane in each direction. There is no underlying requirement to provide pedestrian facilities at any given roundabout. The provision is technology-neutral, and there are several different approaches that can meet the guidelines, including conventional red-yellow-green signals and more specialized types. It is anticipated that

[8] Washington State Department of Transportation, *Highway Construction Cost Comparison Survey: Final Report*, April 2002. http://www.wsdot.wa.gov/biz/construction/pdf/I-C_Const_Cost.pdf .

[9] See http://www.cityofseattle.net/transportation/rowmanual/manual/4_11.asp. The city of San Francisco is also using a 2.5% cross-slope standard to prioritize improvement, meaning that the *incremental* cost of going to a 2% standard would be limited.

in most locations the signals will only be occasionally activated, and will be structured so as to minimize vehicle delay.

Overview of Compliance Costs

Compliance costs can be thought of as the total present-value lifecycle costs of multilane roundabouts with this provision in place, less the cost of such projects under current baseline conditions, over the pavement or equipment lifecycle, or some other acceptable time period. The installation of pedestrian-demand signals at multi-lane roundabouts has not previously been required by accessibility guidelines and does not represent a widespread industry practice in the U.S., so the baseline for analysis is marked by little to no installation of pedestrian-demand signals, though the use of dedicated pedestrian-demand signals on arterials appears to be growing.

Data and Cost Estimates

The study team gathered information from the Kittelson roundabout database[10] on all roundabouts built between 2005 and 2009. This period was selected as being the most representative of recent levels of roundabout construction. During this five-year period, 435 roundabouts were built, of which 117 were multi-lane. This ratio is consistent with information from informal conversations with state and local entities, who stated that roundabouts recently constructed in their jurisdictions have been predominantly single-lane.

The five-year total of 117 multi-lane roundabouts is equivalent to 23 per year. In addition, a small number of roundabouts were listed in the database as having an "unknown" number of lanes, and these roundabouts were re-allocated to the single- and multi-lane categories in proportion to the overall totals. A further adjustment is needed to account for multi-lane roundabouts that have no sidewalks or other pedestrian facilities, since the signalization guidelines would not apply in those cases. To estimate this adjustment, a 20% sample of the relevant set of multi-lane roundabouts were manually spot-checked using satellite imagery. Approximately 5 percent of the roundabouts checked did not have pedestrian facilities. The combined effect of the two adjustment factors is to raise the annual total from 23 multi-lane roundabouts per year to 27.

The Access Board's previous analysis of signalization costs produced an estimate of $90,000 to $230,000 per roundabout. (This is roughly consistent with information from the RS Means Cost Workbook which lists costs from $178,000 for the signalization of an intersection to $320,000 for 4 "mid-block" pedestrian crossings.) Using the $90,000 figure, the total costs are therefore **$2.4 million** per year (27 x $90,000). Using the higher $230,000 unit cost, the total is **$6.2 million** per year.

Compliance with the proposed guidelines can also be achieved using pedestrian under- or over-passes and similar approaches that separate pedestrians from conflicting vehicle

[10] See http://roundabout.kittelson.com/ . The database is the best known source of information on roundabout construction but is not necessarily comprehensive.

movements. However, this approach is not required by the guidelines and generally presents significant additional expense, though it may be the preferred option in cases where there are heavy pedestrian flows or other local factors. Underpass costs are generally in the range of $0.5 to $4.0 million.[11]

### Detectable Warnings

Background

Detectable Warnings (DWs) are distinctive sections of raised material that are used at curb ramps and other locations to provide a tactile indication underfoot and contrast to the surrounding paving material. DWs alert pedestrians with visual impairments to the transition between the pedestrian way and the vehicular way.

PROWAG would require DWs at all new and re-built curb ramps, pedestrian crossing islands, and similar settings such as raised crosswalks.

Overview of Compliance Costs

Compliance costs can be thought of as the total cost of sidewalk-related construction projects in the United States with this provision in place, less the cost of such projects under current baseline conditions, in present value terms over the course of a pavement lifecycle or other reasonable time period.

In this case, the magnitude of the costs depends on the current baseline conditions. State and local government agencies must comply with Title II of the ADA. State and local government agencies that receive federal financial assistance must also comply with Section 504 of the Rehabilitation Act. State and local government agencies currently have a choice of accessibility standards to use under regulations implementing these laws. Under the DOJ ADA Title II regulations, State and local government agencies can currently use the 1991 DOJ Standards [which are based on the 1991 ADAG], 2010 DOJ Standards [which are based on the 2004 ADAAG], or UFAS.[12] Under the USDOT Section 504 regulations, State and local government agencies can currently use the 2004 ADAAG, as modified by USDOT, or UFAS.[13]

The 1991 DOJ Standards and 2004 ADAAG, as modified by USDOT, require DWs at curb ramps. The technical provisions for DWs in the 2004 ADAAG, as modified by USDOT, are consistent with PROWAG and require DWs to extend 24 inches minimum

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[11] NCHRP Report 17-18(3). http://safety.transportation.org/htmlguides/peds/, Strategy 9.1 A5.

[12] 28 CFR §35.151 (c). The DOJ ADA Title II regulations eliminate the 1991 DOJ Standards and UFAS as options effective March 15, 2012.

[13] 49 CFR §27.3 (b) and 49 CFR Part 37, Appendix A. USDOT adopted the 2004 ADAAG as an accessibility standard in 2006 and added a requirement for detectable warnings at curb ramps (section 406.8) to the standard. USDOT is expected to amend its Section 504 regulations to eliminate UFAS as an option.

at curb ramps. State and local government agencies that use the 2004 ADAAG, as modified by USDOT, for sidewalk construction projects would not incur any additional costs for DWs under PROWAG. The technical provisions for DWs in the 1991 DOJ Standard require DWs to extend the full depth of the curb ramp. State and local government agencies that use the 1991 DOJ Standard for sidewalk construction projects would have reduced costs for DWs under PROWAG.

UFAS and the 2010 DOJ Standards do not require DWs at curb ramps. State and local government agencies that use UFAS or the 2010 DOJ Standards for sidewalk construction projects would incur additional costs for DWs under PROWAG.

All the State DOTs and District of Columbia DOT receive federal financial assistance from USDOT and must comply with the USDOT Section 504 regulations. Local government agencies that receive federal financial assistance either directly from USDOT or indirectly through State DOTs must also comply with the USDOT Section 504 regulations. The USDOT Section 504 regulations cover all sidewalk construction projects, including state or locally funded projects. A review of the State DOT and the District of Columbia DOT websites (Attachment A) shows that as of November 2010 they all install detectable warnings at curb ramps, and use the technical provisions for DWs in the 2004 ADAAG, as modified by USDOT. Limited interviews with local government officials indicate that they install DWs at curb ramps. Anecdotally, DWs can now be seen in new sidewalk projects in communities across the country. The NPRM should seek additional information on the extent to which local government agencies are installing DWs at curb ramps.

<u>Data and Cost Estimates</u>

Detectable warnings are made from a number of different materials, and the mix of products in use varies by jurisdiction. Metal panels, for example, are often used in areas with severe winters due to the wear and tear associated with snow clearance and de-icing chemicals.[14] The type of material selected affects not only the upfront costs of materials and installation, but also the lifecycle cost including eventual replacement.

Some basic data collection was conducted to understand the unit costs of DW products currently in use. A standard DW of eight square feet (i.e., curb ramp width of 4 feet minimum and detectable warning extending 2 feet minimum) was used for comparison. Based on discussions with city public works departments and price quotes from vendors, unit costs for materials appear to be consistent with those found in earlier Access Board research. These costs range from around $30 per square foot for stainless steel or cast iron, to $15 to $25 for polymer/composite material, $6-$10 per square foot for concrete

[14] Information on preferred and approved products for several cities and states is available in: National Cooperative Highway Research Program (NHCRP), Report 670, *Recommended Procedures for Testing and Evaluating Detectable Warning Systems*, 2010.

pavers, and $16 per square foot for brick pavers.[15] Again, upfront costs need to be considered in conjunction with installation and replacement costs. To give a sense of installation costs, a standard polymer DW is estimated to require 0.5 person-hours of labor.

There is no comprehensive national database for curb ramps, and the number of locations is difficult to estimate on a national scale due to the sheer number jurisdictions involved. An inventory conducted by the city of San Francisco provides one point of reference: the city has approximately 7,200 intersections with an overall total of around 40,000 potential curb ramp locations, about one-fourth of which currently have "safe and useable" ramps already in place.[16] Since San Francisco's population is roughly 815,000, that implies an average of 8.8 intersections (or 49 curb ramp locations) per 1,000 population. However, simply scaling this estimate up to the national level could be problematic because intersections with pedestrian facilities are much more numerous in urban areas like San Francisco than in the suburban and rural areas where many Americans live. A more sophisticated estimate could be generated by using GIS software and aerial photography to analyze a random sample of road intersections around the country, possibly grouped by community size and land-use type.

Overall, because the use of DWs has already become mainstream practice for public-sector transportation projects in all 50 states, any incremental compliance costs would appear to be minimal.

[15] Sources: Stainless steel and cast iron: City of Cambridge, Mass. (based on recent projects); polymer/composite: vendor price quotes (Home Depot and ADA Solutions, Inc.); concrete pavers: vendor price quotes (Tile Tech Pavers); brick pavers: Salt Lake City Corporation.

[16] City and County of San Francisco, Department of Public Works, *Americans with Disabilities Act Transition Plan for Curb Ramps and Sidewalks*, 2007-2008.

## Attachment A
## State DOT Curb Ramp Standard Drawings with Detectable Warning Details

| State | State DOT Standard Drawings with Detectable Warning Details<br>Websites Last Visited 11/4/10 Unless Noted Otherwise |
|---|---|
| AL | SW-618 Wheelchair Ramp at Pedestrian Crosswalks and Details of Sidewalks<br>http://alletting.dot.state.al.us/Docs/Standard_Drawings/English/STDUS10_0700.pdf |
| AK | I-21.01 Parallel Curb Ramp<br>http://www.dot.state.ak.us/stwddes/dcsprecon/assets/pdf/stddwgs/eng/i2101.pdf<br>I-22.01 Perpendicular Curb Ramp<br>http://www.dot.state.ak.us/stwddes/dcsprecon/assets/pdf/stddwgs/eng/i2201.pdf |
| AZ | C-05.30 Sidewalk Ramp (7 sheets)<br>http://www.azdot.gov/highways/Roadway_Engineering/Roadway_Design//Construction_Standards/Drawings_Current/PDF/2007ConstructionStandardDrawings.pdf |
| AR | 65-WR-1 Wheelchair Ramps New Construction and Alterations<br>http://www.arkansashighways.com/roadway_design_division/usunits/65--WR-1.pdf<br>66-WR-2 Wheelchair Ramps Alterations Only<br>http://www.arkansashighways.com/roadway_design_division/usunits/66--WR-2.pdf |
| CA | RSP A88A Curb Ramp Details<br>http://www.dot.ca.gov/hq/esc/oe/project_plans/highway_plans/stdplans_dual_02/viewable_pdf/rspa88a.pdf<br>RSP A88B Curb Ramp and Island Passageway Details<br>http://www.dot.ca.gov/hq/esc/oe/project_plans/highway_plans/stdplans_dual_02/viewable_pdf/rspa88b.pdf |
| CO | M-608-1 Curb Ramps (4 sheets)<br>http://www.coloradodot.info/business/designsupport/standard-plans/2006-m-standards/2006-m-standards-pdfs/42-curb-ramps/curb-ramps-m-608-1-all.pdf |
| CT | HW-921-02 Sidewalk Ramps<br>http://www.ct.gov/dot/lib/dot/documents/deng/standards/ctdot_highway_std.pdf |
| DE | C-2 Curb Ramp Type 1<br>http://www.deldot.gov/information/pubs_forms/const_details/2008/pdf/SD_c02-1.pdf<br>C-2 Curb Ramp Types 2,3, and 4<br>http://deldot.gov/information/pubs_forms/const_details/2008/pdf/SD_c02-2.pdf?011509 |
| DC | 609.05 – 609.09 Wheelchair-Bicycle Ramps<br>http://www.dc.gov/DC/DDOT/Projects+and+Planning/Standards+and+Guidelines/Standard+Drawings+-+April+2009/Standard+Drawings+-+April+2009+-+Series+600+-+Part+1 |
| FL | 304 Public Sidewalk Curb Ramps<br>http://www.dot.state.fl.us/rddesign/rd/rtds/10/304.pdf |
| GA | A-3 Concrete Sidewalk Details Curb Cut (Wheelchair) Ramps<br>A-4 Detectable Warning Surface Truncated Dome Size, Spacing and Alignment Requirements<br>http://tomcat2.dot.state.ga.us/stds_dtls/edtls.jsp?Preview=no |
| HI | R12-06-06 Curb Ramp and Detectable Warning Details (9 sheets)<br>http://www.state.hi.us/dot/administration/ada/curbrampdetails-r12-06-06.pdf |
| ID | H-2-B Urban Approaches Handicapped/Bicycle Types A5 & A6<br>http://www.itd.idaho.gov/design/StandardDrawings/English/h2b_0507.pdf |
| IL | 424001-05 Curb Ramps for Sidewalks<br>http://dot.state.il.us/desenv/hwystds/rev211/Web%20PDFs/211-424001-05_CurbRampsForSidewalk.pdf |
| IN | 604-SWCR-01 – 604-SWCR-12 Curb Ramps<br>http://www.state.in.us/dot/div/contracts/standards/drawings/sep09/m/sep600.htm |
| IA | MI-220 Pedestrian Curb Ramps (7 sheets)<br>http://www.iowadot.gov/design/SRP/IndividualStandards/emi220.pdf |
| KS | RD725 Sidewalk & Steps<br>http://kart.ksdot.org/StandardDrawings/_us_published_pdfs/rd725.pdf<br>RD725A Auxiliary Details for Sidewalk & Steps<br>http://kart.ksdot.org/StandardDrawings/_us_published_pdfs/rd725a.pdf |
| KY | RPM-160-03 Typical Installations for Sidewalk Ramps<br>http://www.kytc.state.ky.us/design/standard/pdf2008/ROADWAY-SERIES2008.PDF#rpm160-03 |

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|---|---|
| | RPM-170-06 Sidewalk Ramps<br>http://www.kytc.state.ky.us/design/standard/pdf2008/ROADWAY-SERIES2008.PDF#rpm170-06<br>RGX-040 Truncated Domes<br>http://www.kytc.state.ky.us/design/standard/pdf2008/ROADWAY-SERIES2008.PDF#rgx040-00 |
| LA | PED-01 Public Sidewalk Curb Ramps (4 sheets)<br>http://www.dotd.la.gov/highways/standardplans/DirListing.aspx?txtPath=/highways/standardplans/Standard%20Plans/Public%20Sidewalk%20Curb%20Ramps |
| ME | Special Provision 608 Detectable Warnings (pp. 75-77)<br>http://www.maine.gov/mdot/comprehensive-list-projects/bp014871.10.pdf |
| MD | MD-655.11 -- MD-655.13 Sidewalk Ramps<br>MD-655.40 Detectable Warning Surfaces<br>http://apps.roads.maryland.gov/BusinessWithSHA/bizStdsSpecs/desManualStdPub/publicationsonline/ohd/bookstd/toccat6.asp |
| MA | M/E 107.6.5R Detectable Warning Panel for Wheelchair Ramps<br>http://www.mhd.state.ma.us/downloads/engineeringDirectives/2004/E_04_007.pdf |
| MI | R-28-G Sidewalk Ramp and Detectable Warning Details<br>http://mdotwas1.mdot.state.mi.us/public/design/englishstandardplans/index.htm |
| MN | 7036F Pedestrian Curb Ramp (2 sheets)<br>7038A Detectable Warning Surface Truncated Domes<br>http://standardplates.dot.state.mn.us/StdPlate.aspx |
| MS | SDCRR-1 Curb – Cut Ramp<br>http://ftp.mdot.state.ms.us/ftp/roadway_design/SpecialDesign/ADAramp.pdf (last visited 6/27/11) |
| MO | 608.10N Concrete Sidewalk and Curb Ramps (4 sheets)<br>http://www.modot.mo.gov/business/standards_and_specs/documents/60810.pdf |
| MT | 608-15 – 608-40 Public Sidewalk Ramps (6 sheets)<br>http://www.mdt.mt.gov/other/const/external/detailed_drawings/2009/english/608_CONCRETE_SIDEWALKS_2009_ENG.PDF |
| NE | 303 Curb Ramps (pp. 8-9)<br>http://www.transportation.nebraska.gov/roadway-design/pdfs/stan-spec/standard.pdf |
| NV | R-5.2.1 Sidewalks, Curb Ramps<br>http://www.nevadadot.com/business/contractor/standards/index/pdfs/english/r5_2_1.pdf |
| NH | Sidewalk Curb Ramps With Detectable Warnings<br>http://www.nh.gov/dot//org/projectdevelopment/highwaydesign/detailsheets/documents/crbrmp.pdf |
| NJ | CD-607-1 Public Sidewalk Curb Ramps Detectable Warning Surface (Sheet 37)<br>http://www.state.nj.us/transportation/eng/CADD/E/RoadwayDetails/pdf/eRoadwayDetailsSet.pdf |
| NM | Pedestrian Access Details (10 sheets)<br>http://nmshtd.state.nm.us/upload/images/Plans_Specs_Estimates/Design_Directives/608.pdf |
| NY | 608.1 Sidewalk Curb Ramp Details (4 sheets)<br>https://www.nysdot.gov/main/business-center/engineering/cadd-info/drawings/standard-sheets-us-repository/608-01.pdf |
| NC | 848.05 Wheelchair Ramp, Curb Cut (4 sheets)<br>http://www.ncdot.org/doh/preconstruct/ps/std_draw/06english/08/default.html |
| ND | D-750-3 Curb Ramp Details<br>http://www.dot.nd.gov/divisions/design/docs/standards/D750-03.pdf |
| OH | BP-7.1 Curb Ramps (3 sheets)<br>http://www.dot.state.oh.us/Divisions/ProdMgt/Roadway/roadwaystandards/Standard%20Construct%20Drawings/bp7.1_10-15-10.pdf |
| OK | WCR-2 Wheelchair Ramps<br>http://www.okladot.state.ok.us/roadway/roadway99/pdf/e098f.pdf |
| OR | RD755 – RD757 Sidewalk Ramps<br>RD757 Truncated Dome Detectable Warning Surface Details and Location<br>http://egov.oregon.gov/ODOT/HWY/ENGSERVICES/roadway_drawings.shtml#Roadway_700___Curbs__etc_ |
| PA | RC-67M Curb Ramps and Sidewalks (13 sheets)<br>ftp://ftp.dot.state.pa.us/public/Bureaus/design/pub72m/RC-67M.pdf<br>PennDOT Technical Information Sheet #139 Curb Ramps |

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| | ftp://ftp.dot.state.pa.us/public/pdf/BPR_PDF_FILES/Documents/LTAP/TechSheets/TS_139.pdf |
| RI | 48.1.0 Detectable Warning System (p. 263)<br>http://www.dot.state.ri.us/documents/engineering/stddetails/RIDOT_Std_Details_07312009.pdf |
| SC | 720-905-01 – 720-905-04 Detectable Warnings (pp. 119-125)<br>http://www.dot.state.sc.us/doing/sd_book.shtml |
| SD | 651.01 – 651.03 Curb Ramps (9 sheets)<br>http://www.sddot.com/pe/Roaddesign/plates_index.asp |
| TN | RP-H-3 – RP-H-9 Handicap Ramp and Truncated Dome Surface Detail (7 sheets)<br>http://www.tdot.state.tn.us/Chief_Engineer/engr_library/design/Std_Drwg_Eng.htm |
| TX | PED-05 Pedestrian Facilities Curb Ramps (4 sheets)<br>ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/standard/roadway/ped05.pdf |
| UT | GW5A – 5C Pedestrian Access (3 sheets)<br>http://www.udot.utah.gov/main/uconowner.gf?n=567973324329877850<br>http://www.udot.utah.gov/main/uconowner.gf?n=567975530563879633<br>http://www.udot.utah.gov/main/uconowner.gf?n=567976704028881482 |
| VT | C-3A Sidewalk Ramps<br>http://www.aot.state.vt.us/caddhelp/DownLoad/Standards/English/PDF/stdc3a.pdf |
| VA | CG-12 Detectable Warning Surface<br>http://www.extranet.vdot.state.va.us/LocDes/Electronic%20Pubs/Standards/TOC200.pdf<br>A59 Curb Ramps<br>http://www.extranet.vdot.state.va.us/LocDes/Electronic%20Pubs/insert/a59.pdf |
| WA | F-40.12-01, 14.01, 15.01, 16.01 Curb Ramps (4 sheets)<br>F-45.10-00 Detectable Warning Surface<br>http://www.wsdot.wa.gov/Design/Standards/Plans.htm#SectionF |
| WV | PVT7 Sidewalk Ramps (2 sheets)<br>http://www.transportation.wv.gov/highways/engineering/Documents/revisedstandarddetails/Pvt701_09_24_10.pdf (last visited 6/27/11)<br>http://www.transportation.wv.gov/highways/engineering/files//websp/Pvt702.pdf (last visited 6/27/11) |
| WI | 8D5-14a – 14e Curb Ramps (5 sheets)<br>http://roadwaystandards.dot.wi.gov/standards/fdm/16-05-001e001.pdf |
| WY | 608-1A Concrete Sidewalk and ADA Accessibility (6 sheets)<br>http://www.dot.state.wy.us/webdav/site/wydot/shared/Engineering_Services/Standard%20Plans/608-1A%20%20(DEC_2006).pdf?bcsi_scan_C17DAEAF2505A29E=0&bcsi_scan_filename=608-1A%20%20(DEC_2006).pdf |