

THE COLUMBIA: AMERICA'S GREATEST HIGHWAY

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Photo 1—Moffett Creek Arch, Columbia River Highway

ABSTRACT

After participating in the First International Road Congress in Paris, and inspired by the roads that they saw in Western Europe, Samuel Hill, entrepreneur, and Samuel Lancaster, engineer, artfully created the Columbia River Highway, America's first scenic highway. The road is located in the Pacific Northwest, in the state of Oregon, and was completed from 1913 to 1922. It was a technical and civic achievement of its time, successfully mixing sensitivity to the magnificent landscape with ambitious engineering. There, one finds a strict adherence to grade and curve standards, comprehensive curb and drainage systems, dry and mortared masonry walls, reinforced-concrete bridges, and asphaltic concrete pavement. Completion of this highway greatly influenced the design and construction of other scenic highways, including national park roads, in the 1920s and 1930s.

A new, water-level route bypassed the Columbia River Highway in the 1940s and 1950s. Much of the old road became a tourist route. Other parts were abandoned or destroyed. By the 1980s, a populist movement took hold to restore and rehabilitate the Columbia River Highway and to reopen abandoned segments for bicycle/pedestrian use. The road and its many waterfalls and scenic vistas continue to attract visitors 90 years since it first opened.

1. CONSTRUCTION

When entrepreneur Samuel Hill left France for the United States in November 1908 he could not wait to return to the Pacific Northwest to build good roads. Hill just participated in the First International Road Congress in Paris as part of the 19-member American delegation. He had sailed from New York in late August on the *SS Umbria* and brought with him as fellow delegates engineer and landscape architect Samuel C. Lancaster and Seattle Park Department commissioner Reginald H. Thomson. All three would later influence road building in the Pacific Northwest section of the United States.

The product of Hill's unbridled enthusiasm was the Columbia River Highway, constructed from 1913 to 1922. The road was located in the state of Oregon and followed the Columbia River for nearly 500 km (over 300 miles) from the northeastern part of the state to the Pacific Ocean. The 120 km (75 miles) segment immediately east of the city of Portland, in the beautiful Columbia River Gorge, was the most challenging and most rewarding for Hill and Lancaster. It is known today as the Historic Columbia River Highway and is acknowledged as the first scenic highway in the United States. This segment is significant for innovative engineering and for integrating the natural landscape with its design. Today, 88 km of those 120 km (55 of those 75 miles) have been restored for driving or bicycle/pedestrian use. Much of the Historic Columbia River Highway became a National Scenic Byway—All American Road in 1999 and a National Historic Landmark in 2000.

The Columbia River Highway, and its associated designed landscape, was a technical and civic achievement of its time, successfully mixing sensitivity to the magnificent landscape with ambitious engineering. In the Columbia River Highway, Lancaster emulated the European style carriage roads in the Columbia River Gorge, while also designing and constructing a highway to advanced engineering standards. Throughout the route, Lancaster and subsequent locating engineers held fast to a design protocol that he developed after years of practical engineering experience and experimentation. It included no grades greater than 5 percent and no curves with less than a 61 m (200-foot) turning radius. The use of reinforced-concrete bridges, combined with masonry guard walls and retaining walls, both on the road and on associated pedestrian trails, brought together the new with the old—the most advanced highway structures with generations-old methods. [1] [7]

Lancaster artfully created an engineering achievement sympathetic to the natural landscape and in doing so made the Columbia River Gorge's idyllic natural setting accessible to tourists without unduly marring its beauty. His Columbia River Highway truly embodied the National Park Service's "Lying Lightly on the Land" philosophy, but a full decade before the concept was adopted for NPS roads and trails.

The Columbia River Highway is an outstanding example of modern highway development in 20th-century America for its pioneering advances in road design. These include the adherence to grade and curve standards, comprehensive curb and drainage systems, dry and mortared masonry walls, reinforced-concrete bridges, and asphaltic concrete pavement—all on a rural, mountain road during the formative years of modern highway building in the United States. The Columbia River Highway is also the single most important contribution to the fields of civil engineering and landscape architecture by Samuel C. Lancaster. As the first scenic highway in the United States, its aesthetic and engineering achievements greatly influenced the design and construction of other scenic highways, including national park roads, in the 1920s and 1930s. [7]

Hill, a wealthy railroad attorney and financier from Minneapolis, came to the Pacific Northwest in the 1890s and brought with him entrepreneurial skills and a strong personal interest in good roads. By 1899 he helped charter the Washington State Good Roads Association and became its president. [11] [25]

Lancaster was a successful construction engineer from Tennessee who worked for the US government's Office of Public Road Inquiries when he met Hill in 1906 at a Washington State Good Roads conference. Hill and Lancaster became fast friends—the highway promoter and the highway designer. [2]

Shortly, Hill convinced Seattle Park Department commissioner Reginald H. Thomson to hire Lancaster to oversee the design and construction of a \$7 million park and boulevard system concept outlined by John C. Olmsted in 1903 as part of Seattle's preparation for the Alaska-Yukon-Pacific Exposition of 1909. The plan added 85 km (53 miles) of boulevards ringing the city and 800 hectares (2,000 acres) to Seattle's already large park system. [20] [24]

In August 1908, Hill the veteran European traveler, sailed for Paris as a delegate to the First International Road Congress (the International Congress on the Adaption of Roads to the New Means of Locomotion), where he represented the state of Washington and the Washington State Good Roads Association. He brought with him, at his own expense, Lancaster and Thomson. The Congress was not the only attraction for Hill and his associates. They left plenty of time in their itinerary for touring by automobile much of continental Europe and the British Isles. They saw first-hand examples of both new and well-tested road building techniques. They hoped to bring back fresh ideas that they might find particularly useful in the Pacific Northwest. Hill had in mind two routes. The first followed the Columbia River's north shore as a cross-state trunk route in Washington. The second ran from Canada to Mexico through Washington, Oregon, and California. [24]

The three travelers spent much of their time along Germany's Rhine River, looking at the rock retaining walls still there from Charlemagne's time. They were also impressed by local masonry that they saw in Italy. Finally, they were taken with central Switzerland's premier road, the Axenstrasse along Lake Lucerne, between the cantons of Schwyz and Uri. The road dated from the 1860s and included massive excavation and a nearly 500-foot windowed tunnel, hewn out of Valangien limestone escarpments. Masonry guard walls and parapets bordered the Axenstrasse for much of its length. [8]

The Swiss road truly inspired Hill and he told Lancaster and others that he planned to build a similar highway in the Pacific Northwest. He wanted the world to "come out and see the beauties of the land out of door . . . [to] realize the magnificence and grandeur of the Columbia River Gorge." Hill subsequently made several more trips to Europe to investigate roads and road building techniques. [24]

Upon returning from the First International Road Congress and his investigation of European road building, Hill immediately delved into preparing for the First American Congress of Road Builders that he planned for Seattle in July 1909 to run in conjunction with the Alaska-Yukon-Pacific Exposition. A "Good Roads Building" was even erected as part of the fair to exhibit modern road construction methods. This structure ultimately housed the University of Washington's Department of Highway Engineering. [16]

Meanwhile, as a political debate over highway legislation was underway in Olympia, Hill pursued his own experimentation in roadway design and construction. He called on Lancaster to conduct comprehensive road design studies at his Maryhill ranch, 160 km (100 miles) east of Portland. Hill sought to learn about road drainage, binding materials, and grade requirements in hopes of selling local politicians on the idea of undertaking a statewide comprehensive highway construction program. He looked forward to the day when Washington had the best hard-surface road construction anywhere. [25] [27]

Hill sought to show the world that durable hard-surfaced roads were an economically-feasible alternative to rutty summer trails and muddy winter wallows. For a society reliant on horses and wagons to transport people and freight, and increasingly dependent on automobiles, good roads were needed for efficient movement of traffic. Hill believed that his roads at Maryhill would “serve as a model for asphaltic macadam construction.” [25]

At the ranch, Lancaster and Hill conducted both pure and applied research in the field of highway engineering. It was at the cutting edge during the infancy of a new science to understand the properties of binding rock and petroleum products in creating durable, long-lasting road surfaces, and it had direct application in the field of highway engineering, both nationally and internationally. The “Maryhill Loops Road” became the first asphalt-covered highway in the state of Washington. [7]

At Maryhill, Lancaster also applied economical and aesthetically-pleasing solutions for shoring up roadway fills and providing safety rails and edge of pavement markers along the experimental roads. He used the locally-plentiful volcanic basalt in creating dry masonry retaining walls, wet masonry guard walls, and coping stones, also known as guard rocks. [7]

Lancaster also sought to reduce construction costs by improving upon tried and true excavation machinery then in use. He even designed a special wagon to haul and spread stone and asphalt mixes. It was constructed of steel, unlike the common wooden slat wagon, and could haul four cubic yards, double the ordinary amount. Lancaster’s wagon also had special main axles and steel tires arranged to carry most of the weight, while using the same number of mules for power. In addition, the new wagon could spread stone or asphalt evenly and at a much faster rate than the old-fashioned model, thus reducing time and costs and the need for extra crews of men. This wagon design was later used on the Columbia River Highway. [23]

By 1912, Hill increasingly looked to Oregon and, in particular, its lawmakers and prominent Portland businessmen, to back his pet project of a Columbia River highway. In the meantime, Hill had failed to convince Washington state lawmakers to fund a cross-state highway that, in part, followed the Columbia River. He then looked to Oregon for backers of a river route where there was some local interest. In 1912, lumber baron and future hotelier Simon Benson had employed convict labor with \$10,000 of his own money to build a road around a particularly unstable talus slope in the Gorge known as Shell Rock Mountain. With Hill and Benson’s influence, the Multnomah County Commission created a roads and highways advisory board. Hill also directed his energy toward Oregon lawmakers. [6]

In the spring of 1913, Hill brought the entire Oregon legislature to Maryhill, by special train, to see Lancaster’s roads. Shortly, lawmakers created the Oregon State Highway Commission and threw their support behind a statewide network of good roads that would include a Columbia River Highway. By late summer, the Multnomah County Advisory

Board on Roads and Highways met with the County Commissioners at Chanticleer Inn high on a bluff about 35 km (22 miles) east of Portland to recommend that they construct a highway through the Columbia River Gorge. [5] [9]

Soon, the state hired Lancaster to survey and design nearly 35 km (22 miles) of highway from Chanticleer Point to the Hood River County line. His road would adhere to strict engineering principles for grade and curvature that he had developed at Hill's ranch. He began his work in September to create a road with a maximum 5-percent grade, a minimum of 60 m (200-foot) turning radius on curves and an average 7.3 m (24 feet) roadway cross-section comprising a 5.5 m (18-foot) macadam travel way and two 0.9 m (3-foot) gravel shoulders. Construction began that October. [1]

Lancaster sought to find the most practical route but at the same time to locate the road "so as to take advantage of the magnificent landscape and natural beauty of the region." He took great pains to secure the best alignment for the road as he felt that this was not "an ordinary country highway." Lancaster believed that he was opening up the Columbia Gorge's "hidden waterfalls and mountain crags, dark fern coves, and all else" for all to enjoy. At one location, Lancaster developed a series of loops to carry the highway from an elevation of nearly 210 m (700 feet) to river level, while still maintaining grade and curvature constraints. Other engineers followed Lancaster's standards when laying out the road in adjoining counties. [1] [5]

John Arthur Elliott, a locating engineer on the Columbia River Highway, eloquently summed up the entire rationale for the route's alignment and construction. He wrote,

The ideals sought [for the Columbia River Highway] were not the usual economic features and considerations given the location of a trunk highway. Grades, curvature, distance and even expense were sacrificed to reach some scenic vista or to develop a particularly interesting point. All the natural beauty spots were fixed as control points and the location adjusted to include them. Although the highway would have a commercial value in connecting the Coast country with the eastern areas, no consideration was given the commercial over scenic requirements. The one prevailing idea in the location and construction was to make this highway a great scenic boulevard surpassing all other highways of the world. [4]

A handful of designers blended engineering, economics, and aesthetics to create the bridges, of which many were one-of-a kind structures. They took on the challenge of working with a new construction medium of concrete and steel reinforcing bar to create several wonderful spans. They include the Latourell Falls Bridge, a three-span reinforced-concrete, braced spandrel deck arch; the Shepperds Dell Bridge, a reinforced-concrete ribbed deck arch; the Benson Footbridge at Multnomah Falls, which mimics the Shepperds Dell Bridge, only on a human scale; the Moffett Creek Arch, a very shallow reinforced-concrete three pin-hinged deck arch; and the Mosier Creek Bridge and the Dry Canyon Creek Bridge, two reinforced-concrete deck arches by acclaimed Oregon bridge engineer Conde B. McCullough. [20]

The designers also created four tunnels along the route, beginning with Oneonta Tunnel, the Mitchell Point Tunnel—the "Tunnel of Many Vistas"—that took its form from the Axenstrasse Tunnel in Switzerland, and finally the Mosier Twin Tunnels.



Photo 2—Mitchell Point Tunnel—the Tunnel of Many Vistas.

The first leg of the Columbia River Highway officially opened on July 6, 1915, when eight autos left Portland at 6:00 A.M., with Oregon Governor James Withycombe, Sam Hill and Simon Benson leading the procession. By 11:00 o'clock they had reached the summit of the Cascades Mountains. Just over 100 km (about 65 miles) east of Portland and late that afternoon the citizens of Hood River greeted them to a gala reception. It was the first road trip from Portland to Hood River and the beginning of a new age in the Pacific Northwest.

At Crown Point, Lancaster envisioned a building to provide comfort to the traveler and a monument to early Oregon pioneers. A prominent Portland architect, Edgar Lazarus designed the domed eight-sided structure in the German Jugendstil style with basement restrooms, caretaker's quarters, a main floor gallery and a second story outdoor observatory balcony. Multnomah County had budgeted \$10,000 for its construction, but when completed in 1918, the cost had grown to nearly \$100,000. [7]

On June 27, 1922, Simon Benson, with rake in hand, ceremoniously helped spread the "hot stuff" (asphalt pavement as it was called) over the Columbia River Highway near Rowena. It was a symbolic marking of the ten-year effort to construct a modern highway through the Columbia River Gorge. The Columbia River Highway from Portland to The Dalles was officially completed—a road some 135 km (84 miles) long containing 24 bridges, 7 viaducts, 4 tunnels and countless miles of masonry walls and parapet guardrails. [7]

1.1 Reaction to the Road

Sunset Magazine's Howard O. Rogers wrote that he had seen Niagara Falls, the Grand Canyon, Pike's Peak, and Yellowstone Park, which he marveled at and became awestruck, but after driving the Columbia River Highway through the Columbia River Gorge, in 1917, he believed that the highway was "a grand achievement in the science of modern road-building—nothing short of a national asset." In 1920, a writer for the periodical *Excavating Engineer* believed that the Columbia River Highway "stands today as undoubtedly the greatest monument to the road building industry in the West." "That most modern of roads," was Walter Winston Crosby's estimation of the Columbia River Highway in his 1928 textbook entitled *Highway Location and Surveying*." Harriet Salt stated in her 1937 volume entitled *Mighty Engineering Feats: Clear and Concise Descriptions of Ten of the Greatest American Engineering Feats* that the Columbia River Highway was "one of the world's greatest examples of highway engineering." [17] [3] [18]

Phil Townsend Hanna, editor of the Los Angeles-based *Western Highways Builder*, wrote that "The hardy and honest people of Oregon have built the greatest highway in the world .

. . . no matter from what angle you consider it, as a transportation artery, as a scenic boulevard, or as an engineering feat.” United States President Theodore Roosevelt believed that in the Columbia River Highway, Oregon “had the most remarkable road engineering in the United States, which for scenic grandeur is not equaled anywhere.” During a drive over the Columbia River Highway in 1915, Major General George Washington Goethals, builder of the Panama Canal, said that the highway “is splendid engineering, and absolutely without equal in America for scenic interest.” [6] [12]

“There is but one Columbia River Gorge [that] God put into this comparatively short space,” Samuel Lancaster wrote, “[with] so many beautiful waterfalls, canyons, cliffs and mountain domes.” “Men from all climes,” he believed “will wonder at its wild grandure [*sic*] when once it is made accessable [*sic*] by this great highway.” Lancaster was so taken by Multnomah Falls, some 48 km (30 miles) east of Portland, that the words he wrote to describe it erupted from his heart and soul. He believed that the 188 m (620-foot) cascade was ideal, “It is pleasing to look upon in every mood,” he wrote, “it charms like magic, it woos like an ardent lover; it refreshes the soul; and invites to loftier, purer things.” Lancaster envisioned Multnomah Falls as a destination for motorists much as it had been for steamship passengers and train travelers in previous decades. He saw Multnomah Falls as the single most important natural feature in the Gorge. [12]



Photo 3—Multnomah Falls and Multnomah Falls Lodge, c.1948

Lancaster and Hill, and several local promoters, created a route that employed the most advanced techniques available for road construction. In reflecting on the work’s progress, Lancaster acknowledged that because of the country’s rugged nature, with its wind and rain and winter weather, construction had been “slow and tedious and somewhat more expensive than ordinary work.” But he saw it as an extremely worthwhile task, “for if the road is completed according to plans, it will rival if not surpass anything to be found in the civilized world.” It will be the “King of Roads.” [16] [15]

2. DECLINE—OBSCURITY, 1930s—1980s

The Columbia River Highway’s popularity was even more than its promoters and builders imagined. Countless visitors gathered at the falls and viewpoints week day and weekend crowding the highway, using the travel lanes for parking. As people relied more on automobiles and trucks for transportation and their numbers increased, that proliferation

became apparent on the highway. With larger and more powerful automobiles, motorists passed hurriedly through the beauty spots, more interested in traveling to their destinations in the shortest time possible. The idea of a leisurely drive at 30 kmh (20 mph) as originally envisioned by Lancaster was becoming a thing of the past. Stopping vehicles in the middle of the road to take in the vistas and the landscape was considered foolhardy or at the most, impractical. Motorists tended to speed through beauty spots, more interested in traveling from here to there in as short a time as possible. It was no longer practical for tourists to stop their vehicles in the middle of the road to look at a falls or take in a view of the Columbia River Gorge. Even the route's name changed. With the adoption by the Bureau of Public Roads of a Federal Highway Numbering System in 1926, the Columbia River Highway became a part of US Highway 30, a transcontinental highway that stretched from Atlantic City, New Jersey, and to Astoria, Oregon. It was now not only a scenic highway to the Columbia River Gorge, but a part of a national highway system.

Recognizing the increasing demands on the highway and changing conditions, the Oregon State Highway Commission in the early 1930s made plans for a new river level highway, particularly for the section from Troutdale to Hood River. However, limited funds available for improvements forced postponement of implementation to an indefinite future.

The first realignment of the highway occurred near Toothrock and Eagle Creek in 1937. This came about as the consequence of a Depression-era Public Works project to construct Bonneville Dam on the Columbia River, 65 km (40 miles) east of Portland. Backwaters would ultimately require a 244 m (800-foot) tunnel through Toothrock a bridge over Eagle Creek and 6.5 km (4 miles) of new road. The old road was abandoned.

Roadway designers in the late 1930s extended the new alignment around Bonneville on paper to the east and west to provide a modern, water-level highway along the that was founded on dredgings from the Columbia River. The Second World War delayed plans and work would not begin in earnest until 1946. The new route mimicked the older highway in the sense that it had a curvilinear alignment with gentle curves and grades. It was integrated into its landscape. Two lanes were completed to The Dalles, some 135 km (84 miles) east of Portland. The road became a four-lane, limited-access highway by 1970.

Designers in the 1940s sacrificed the old highway at the heart of the Columbia River Gorge for the new route. There was simply nowhere else to build their road. Other segments, which included four tunnels, were abandoned and closed to the public. However, the engineers kept open the western "waterfalls section" from Troutdale to Dobson and the eastern "farm-to-market" section from Mosier to The Dalles open for tourist and local traffic.

3. AWARENESS, REBIRTH

Present-day recognition and awareness of the highway came about slowly. Though it was listed on contemporary highway maps as a "scenic highway," it was not perceived as much more than the "Old" Columbia River Highway. Recognition came about, but in a piecemeal manner. In 1971, the US Department of the Interior designated Crown Point, the location of Vista House, as a National Natural Landmark. Vista House itself was listed in the National Register of Historic Places in 1974. Multnomah Falls Lodge was added a few years later.

In 1981, prompted by group of local, state and federal agencies, the National Park Service began brought together a group of professionals to research and investigate the historic and recreational resources along the entire highway, including both the drivable and abandoned segments. Conditions were less than ideal on the road:

Nearly every section of stonework has experienced deterioration. In some areas mortar was loose, had turned to powder, or was missing. Throughout the Highway, guard walls had missing stones or end posts, or were simply out of alignment. Likewise, exposed steel reinforcing in railing caps had rusted and damaged the concrete. In some areas, concrete caps had slipped off of guard walls because of decayed reinforcing or because of crumbling masonry. On bridges, exposed reinforcing steel caused spalling on concrete railing balusters and decorative arched railing panels. In several locations, vehicles had also taken their toll on masonry walls, concrete railings, and guard rocks. Fortunately, only two bridges on the entire route have overhead bracing members and damage from tall vehicles has been limited to these structures.

This study produced two important documents offering guidance for maintenance and options for conservation and reuse. Both were benchmarks for existing conditions and provided a foundation for protecting, preserving, and restoring the Columbia River Highway. [19] [15]

In 1982, the need to protect and preserve the Columbia River Highway became even more apparent, when the Hood River Bridge, a large three-span reinforced-concrete parabolic arch, was destroyed to make way for a new structure. The public was very critical about the loss of this historic resource and pressed ODOT about the state of the entire Columbia River Highway. In response, the state agency created a task force to address their concerns. One product was a National Register nomination for 88 km (55 miles) of the road and associated designed landscapes. In October 1983, 70 years after construction started on the Columbia River Highway, then Governor of Oregon Vic Atiyeh in his cover letter to the Keeper of the National Register, stated that, "Its harmonious relationship to the landscape, the excellence of engineering, and the beauty of construction that went into it set a standard by which all other motor routes can be judged." [22]

The listing of the highway was the single most important step in its preservation. It permitted the state of Oregon, through the Department of Transportation, to be proactive in preserving and restoring the highway's historic features and to seek funding for restoration. A management plan, written in 1996 and revised in 2006, was a critical tool because the highway is still a public transportation facility and subject to federal and state standards that sometimes contradict with historic preservation goals. In 1983, the Oregon Transportation Commission resolved that "maintenance or preservation work [on the Old Columbia River Highway] will, to the extent practical, be aimed at restoring the original appearance of this highway in keeping with its scenic and historic nature." It further states that "whenever restoration of this facility involves rebuilding or major repair, the action will, to the extent practical, result in an appearance approximating the original." [10]

In 1986, US President Ronald Reagan signed the Columbia River Gorge National Scenic Area Act (Public Law 99-663), which protects the scenic, cultural, natural, and recreation resources of the Columbia River Gorge. The Scenic Area is managed similar to a national park in the United States, but through local and federal cooperation. This act was two fold in its effect on the Columbia River Highway. First, it directed Oregon to "prepare a program and undertake efforts to preserve and restore the continuity and historic integrity

of the remaining segments of the old Columbia River Highway for public use as a Historic Road, including recreation trails to connect intact and usable segments.” Second, it provided the opportunity for federal funding and support in preservation and restoration of the highway.

In 1987, the 64th Oregon Legislative Assembly created an advisory committee to make recommendations to ODOT regarding the Historic Columbia River Highway. The lawmakers was very forthright in their direction, stating “that it is the public policy of the state of Oregon to preserve and restore the continuity and historic integrity of the remaining segments of the Historic Columbia River Highway for public use and enjoyment.” In addition it directed the advisory committee and the Department of Transportation to “reuse and manage the highway as a continuous visitor attraction, rehabilitate, restore, maintain and preserve all original roadway and highway related structures, connect intact and usable highway segments with recreation trails and to assist and cooperate with other agencies of the state, federal governments and others to the extent necessary to carry out the provisions of the bill.”

With both federal and state legislation in place, the Western Federal Lands Highway Division of the Federal Highway Administration, the US Forest Service, the Oregon Parks and Recreation Department, and ODOT were invited to participate in projects and undertakings on an equal and cooperative basis for the highway and adjacent forest and park lands. The result was a cooperative agreement, or memorandum of understanding, among these agencies to lend assistance, support and cooperation in the management and conservation of the highway. The cooperative spirit of the participatory agencies has proven to be very effective in restoring and preserving the highway. Mostly it has fostered a philosophical change in the agencies management and attitudes towards the highway as a sensitive historical resource and property.

4. PRESERVATION PROJECTS

In the immediate period after relevant legislation and direction was in place, ODOT embarked on movement to implement projects and maintenance activities to restore and repair the highway’s structures and visitor facilities. State funding was limited, but maintenance dollars were found and authorized to address some of the repairs identified in the 1981 National Park Service reports. Masonry stonework and mortar was repaired, concrete caps replicated and deteriorated concrete spindles in bridge railings were recast and replaced. Adhering to the policy of restoration, new concrete milepost markers were placed along both drivable and trail segments of the highway. This initial project set the tone for future work, and was symbolic of the new view that the highway was once again a single road and not a collection of disconnected parts. Other major restoration projects have required the support and partnerships developed in the memorandum of understanding as well as private funding sources.

4.1. Two-Rail Wooden Guard Rail Replication

In 1995, ODOT proposed replacing the existing “C” and “W” –style steel guardrail with reproductions of the original 2-rail wooden guard fence that the agency had developed for the road in 1920 and had become a standard for many highways in the western United States.

The original wooden guardrail did not meet modern highway crash standards. With minor modifications to the original design, ODOT believed that it could create a safer rail and still

meet preservation goals. The agency developed a new rail consisting of wooden posts but with steel-backed wooden rails and heavier hardware. The Texas Transportation Institute subjected the rail to an 80 kmh (50 mph) crash test and it was approved for use on the Columbia River Highway. It was installed at all existing drivable segments at locations noted in a 1922 roadside inventory. The Federal Lands Highways Program of the Federal Highway Administration provided \$1.7 million for the project. The National Park Service and other agencies throughout the country have adopted the ODOT steel-backed wooden guardrail for their historic and scenic roads. [6] [10]

4.2. Eagle Creek to Cascade Locks, Bike and Pedestrian Path

The Western Federal Lands Highway Division of the Federal Highway Administration was the lead agency in 1997 to reopen 4 km (2.5 miles) of highway abandoned since 1937, from Eagle Creek to Cascade Locks, as a bike and pedestrian trail. This effort, which cost \$1.2 million in federal funds, required construction of a pedestrian tunnel under Interstate 84 to create a continuous, usable trail segment. Here, as on other connection projects, trailheads were developed, with parking areas and information kiosks. The project restored the original highway alignment and added new roadway segments to fill in missing pieces.

This project joined up with another one that ODOT completed a year earlier. All tolled, nearly 20 km (over 11 miles) of abandoned highway have become segments of the "Historic Columbia River Highway State Trail." In 2002, the US Department of Interior designated it a National Recreation Trail because of its historical merits, proximity to a large urban area, and its connections to other hiking trails in the Columbia River Gorge National Scenic Area.

4.3 Mosier Twin Tunnels

One of the more complicated projects has been the rehabilitation of the highway's bypassed Hood River to Mosier section for bike/pedestrian use. This nearly \$10 million project restored or rebuilt masonry guard walls and unburied and shored up two 1920s tunnels that were abandoned in the early 1950s. The most critical component of the project and most expensive, however, was creating a 212 m (700-foot) rock catchment structure over the trail segment west of the tunnels. This type of engineered roadway feature was unseen in the United States and required designers to look abroad, to Japan, for solutions to their problem. The result was a roof-like reinforced-concrete structure anchored into the basalt formation with post-tensioned corbels and resting on a colonnade of bents. The roof's cellular concrete can absorb the energy of a 2.268 tonne (5,000-pound) rock falling 61 m (200 feet).

4.4 Vista House Restoration

The Vista House Restoration is probably the best example of various government agencies and the private sector working together to meet a common objective. Designed to look like the mythical Valhalla and placed on Crown Point along the Columbia River Highway, the dome-like Vista House was a monument to Oregon pioneers and a public comfort station that opened in 1918. Vista House survived the harsh climate of Crown Point for over 80 years, but by the late 1990s it needed a complete restoration. Through funding from many sources, both public and private, a \$4 million project began six years ago to waterproof the exterior. This involved addressing failed mortar on the light gray sandstone, and sealing the dome and recreating the original tile roof. Interior spaces also received much needed attention. Finally, an exterior ramp and an interior lift were installed

to make Vista House free of mobility barriers. Vista House reopened in May 2006, some 90 years since construction first began on this wonderful icon.

4.5. HCRH Gutter Restoration

In 2006, the \$3 million Gutter Restoration project focused on rehabilitating 3.6 km (12,000 feet) of the original concrete gutter drainage system along the Columbia River Highway. Designed by Samuel Lancaster to take rainwater away from the road surface and empty it into nearby landscaping, the gutters had been overlooked for years. Many sections had failed; rock had buried other segments. In addition, layer upon layer of asphaltic-concrete pavement had created a large drop-off near exposed gutter segments. The project recast or patched all the gutter segments. It also removed the excess pavement and covered Lancaster's original macadam road with new asphaltic concrete. This work eliminated the dangerous drop-offs and provided a smooth driving surface.

The Western Federal Lands Highway Division also reconstructed two dry masonry retaining walls, repaired some concrete curbs, and replaced several missing rock delineators or guard rocks. All of these features were from the highway's original construction and, no doubt, Hill, Lancaster, and Thomson saw similar work on their tour of European roads in 1908.

4.6. Oneonta Tunnel Restoration

The Oneonta Tunnel Restoration is a project that began in 2006. It calls for reopening the Oneonta Tunnel as part of a pedestrian path to a new parking area east of Oneonta Gorge, a popular recreation destination. Sam Lancaster designed this 38 m (125-foot) tunnel in 1914 through Oneonta bluff. With about 5 m (16.5 feet) of horizontal clearance, it was too narrow by the 1940s to meet traffic demands and was bypassed and abandoned. Reopening this tunnel offers the opportunity for those visiting the Columbia River Gorge to experience a wonderful piece of highway engineering that was unreachable for 60 years. The Western Federal Lands Highway Division designed the \$2 million project, which is scheduled for completion in the summer of 2007.

4.7. Crown Point Viaduct Restoration

The Crown Point Viaduct Restoration will restore a sidewalk structure along the Columbia River Highway that encircles Vista House. Nine decades of severe weather have deteriorated the structure, which has a deck and parapet wall resting on a colonnade anchored to a side slope. The Oregon Department of Transportation and the Western Federal Lands Highway Division partnered to evaluate the structure and put forward a solution that preserves the viaduct's historic integrity and improves its structural sufficiency. This project is scheduled for 2007.

5. CONCLUSION

The Columbia River Highway's construction and rehabilitation are both stories of the partnerships of visionaries, skilled engineers, and talented crafts persons. The passion for good roads that brought Sam Hill and Sam Lancaster together to build this highway after participating in the First International Road Congress also fueled the collaboration over the past two decades among agencies and individuals to restore this important part of our history for future generations.

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