35,000 TRANSPLANTS

IN THE TRADITION OF ARIZONA HIGHWAYS, A ROAD-WIDENING PROJECT INTEGRATES TRANSPORTATION, RESTORATION, AND BEAUTY.

BY KIM CORVIG

IMAGE CREDIT
Jacobs Engineering
GOING BEYOND 1960S “BEAUTIFICATION,” THERE IS A CLOSE RELATIONSHIP BETWEEN ENVIRONMENTAL FORM AND FUNCTION.

“We widened our roads, took the kinks out of them, improved alignment, but until recently, gave little or no thought to the immediate roadside. We still blasted with reckless abandon through hill and countryside, even where it could have been avoided, leaving permanent scars in our wake. Many of our borrow pits have become sources of erosion, as have our steep backslashes. We found topsoil stripped from the land, and natural plant life unable to reseed.”

So wrote Fred Guirey, a landscape architect for the Arizona Highway Department, in 1933, expressing concerns that sound all too familiar today. His article in the Arizona Department of Transportation’s magazine, Arizona Highways, was subtitled “Highway Engineers Turn Gardner[sic], Improve Unsightly Terrain.”

Guirey was an early advocate for what road builders today call “context-sensitive design,” or CSD. “Our ultimate goal,” Guirey wrote, “is to fuse the road into the surroundings in such a way that it will no longer have the appearance of a structure being forced through an unwilling natural setting.”

Three-quarters of a century later, Arizona remains a leader in roadside landscape works. Taking up Guirey’s legacy, an unusually collaborative team of landscape architects, engineers, and construction contractors recently won an Arizona ASLA 2011 Design Award for the Gonzales Pass project, as well as recognition from the National Association of Environmental Professionals.

About 30 miles east of Phoenix, U.S. 60 climbs over Gonzales Pass, crossing the Tonto National Forest, to the former—and future—mining town of Superior. In the brief Sonoran spring, this designated scenic highway is enfolded in a jeweled carpet of desert wildflowers. In early summer, the lavender flowers of ironwood give the road the feel →

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ABOVE
The restored, widened U.S. 60 crosses Gonzales Pass and Tonto National Forest, where ecological conditions provide “cactus nirvana.”

LEFT
Despite being widened just over a year ago for pressing safety reasons, the Gonzales Pass roadway can appear to have been in place for decades.

IMAGE CREDITS
Luis Colon Photography, left; © 2011 DigitalGlobe/© 2011 Google, above
The Gonzales Pass project was split, for administrative and financial reasons, into three design projects. As a result, there were two landscape architecture firms involved: Logan Simpson Design (LSD), headquartered in Tempe, Arizona, and Corral Dybas Group (CDG) of Phoenix. Both firms did native plant inventory and salvage, and slope and planting design, ultimately coordinating their work into a unified construction project.

Because much of the project was on federal forest land, a U.S. Forest Service landscape architect, Kim Vander Hoek, and a wildlife biologist, Steve Blair, were involved throughout the project in ensuring that the Forest Service’s standards of visual and ecological resource protection were incorporated. “Any time the Forest Service is involved,” notes CDG’s Ed Corral, ASLA, “LAs are often the only design professionals who can relate.”

In addition to its own landscape architectural staff, the Arizona Department of Transportation (ADOT) has found that “having a landscape architect in the field during construction has been beneficial to all of us,” says ADOT project manager Vicki Bever. Rod Stanger, ASLA, of LSD was contracted in this role, and spent much of his time at Gonzales Pass “waving my hands and designing” in the field with equipment operators and construction engineers.

The Phoenix office of Jacobs Engineering was engineer of record; the general contractor was Kiewit.
of passing through a cherry orchard, except for the tall silhouettes of saguaros, their heads haloed with large white buds.

Motorists might be excused for thinking the sweeping four-lane road, and the roadside vegetation, had been there for decades. In fact, until just over a year ago it was a narrow two-lane road, last rebuilt in the 1950s, with a terrible record of fatalities. The road’s fit with its surroundings is a careful artifice, designed not only for beauty, but also for sensitivity to context, which turns out to be highly cost-effective.

Leroy Brady is one of at least six landscape architects (see “Who Did What,” page 76) who played key roles in restoring the landscape of Gonzales Pass. Brady holds essentially the same position as Fred Guirey before him: He is the chief landscape architect for the (renamed) Arizona Department of Transportation (ADOT). Like Guirey, Brady was a pioneer in context-sensitive design before it had a name. He has spent much of his career persuading engineers that a landscape architectural approach to roadway design pays real benefits.

Those benefits go far beyond 1960s-style “beautification” of roads and are a large part of the reason that engineers and project managers have gained new respect for the landscape skills used to reconstruct transportation corridors.

For people who think of naturalistic landscape design as merely a nostalgic style of gardening, it can be hard to understand the value of sculpting and replanting roadsides to blend in with existing scenery. “There are, of course, those who scoff at this type of work,” wrote Guirey. Engineers, trained to think in terms of pragmatic costs and benefits, often balk at roadside landscape planting as mere prettification, and even landscape architects overemphasize visual aspects of replanting. That is changing as more and more people—in the professions and the public—understand the concept of “environmental services.” These services are essentially work done by soils and vegetation, if we don’t overemphasize them, that benefits humans directly. Purification of water and air are prime examples.

So although naturalistic design has an aesthetic component, there is a close relationship between
environmental form and function. The Gonzales Pass team used landform grading (a concept pioneered by Horst Schor in his book by that title), which avoids the regular planar cuts long favored by conventional engineering. Instead, S-curve slope profiles not only look more like naturally eroded hillsides, they also resist erosion better than conventional grading. “This project bears that out,” says Wayne Colebank, ASLA, the vice president of Logan Simpson Design Inc. (LSD) who, as project principal, was responsible for the naturalistic recontouring of the Gonzales Pass roadside. “Everything you see that we manipulated has held up pretty well,” he says, pointing out landformed slopes where vegetation is already well established. “Where the big engineered cuts are, it’s all gone to hell.” And in fact, a few of the project’s cut slopes retain the conventional profile, and those large planar surfaces are eroding, on their way to becoming naturalistic S curves. It’s tempting to say that’s what nature intended, but more accurately, the landform profile outperforms the conventional one, and also supports denser and quicker revegetation.

Getting the slopes right took an unusual combination of high and low tech, of design artistry and construction savvy. As soon as the initial road alignment was laid out, Colebank and Ed Corral, ASLA, a principal of Corral Dybas Group (CDG) in Phoenix, began changing it. “Having landscape architects involved from the conceptual phase is something we take a lot of pride in,” says Berwyn Wilbrink, the project engineer. “It has changed the way we do our design.” The landformed contours were used to update engineering drawings, and then to create 3-D models for visual analysis. Some people can’t read engineering plans (there’s a good deal of teasing about this point between the team members, but it’s also a serious issue whenever the public is involved), but can usually comprehend the 3-D visualizations. “We didn’t just use a single perspective,” notes Wilbrink. “Sometimes we needed to see what a slope looked like as you approach the pass from two or three miles out. We were able to have sessions where we modified things: That’s too steep... That’s not rounded enough.” The modified contours were digitally loaded into GPS-based controllers on the grading equipment.
In 2007, Judy Mielke began following up on saguaros that the Arizona Department of Transportation (ADOT) had transplanted over the years. Leroy Brady at ADOT had noticed that, like any transplants, some of the iconic cacti died after being moved. Just released in draft form and reported in the Arizona Republic, Mielke’s study shows that the displaced saguaros survive 71 percent of the time, a respectable rate for many species.

Mielke is happy to see the research having an effect beyond ADOT. “A lot of people want a saguaro in their yard, but kill them because they don’t know how to take care of them. They don’t leave enough of the root system, or they put them too deep in the ground because they think they need to keep them from falling over, or they don’t irrigate them for a couple years to get them established. The public has the idea, it’s a cactus, it doesn’t need care.”

Brady says, “You have one chance to do transplanting right. It becomes difficult to spend public money when you have high losses, so we want to maximize the benefits.” According to the Arizona Republic, ADOT spends $200,000 to $300,000 per mile on replantings—in 2 percent of the national average cost per mile of highway (about $10 million for rural highways, $15 million or more in mountainous areas like Gonzalez Pass). ADOT-sponsored experiments using innovative methods to transplant mature ironwood trees (Olneya tesota) won an Environmental Excellence Award from Valley Forward, a nonpartisan membership organization devoted to quality of life in the Phoenix region.

One interesting side effect of combining road building with control is that transplants from recent projects retain tags from the construction process, which allows researchers to identify exactly where they came from as well as their current location.

Along with research on revegetation, the trend toward context-sensitive design has produced results on an array of topics. Some cost money but protect animals, such as wildlife crossings; others actually save money and human lives. For example, one study found that for rural highways, where wider lanes are conventionally assumed to be safer, lanes wider than about nine feet increase speed and thus the likelihood and severity of accidents. The cost savings comes from sticking with narrower roads, which require less excavation, paving, and maintenance per mile.

(Study: http://treatsforpeople.org/node/714. General source for CSD information: www.contextsensitive.org)
Even the best simulations, though, benefit from adjustment in the field. Rod Stanger, ASLA, a landscape architect at LSD who was contracted by ADOT as the field liaison among the contractor, USFS, and ADOT itself, recalls going out at five or six in the morning to catch strong sideways light and shadows that revealed existing landform patterns. He and Brian Franscom, ADOT's resident engineer (who supervises and inspects contractors' work), used these sessions to massage the placement of fill, extending patterns of ridges and swales that were already along the route. Communicating about design in this way also involved the equipment operators who carried out the work. "They really got it," says Stanger. "Even Brian got it," he adds, grinning at his colleague. "By the end, they were suggesting things to me."

Some of the grading was also modified to create wildlife crossings—another trend in CSD—for the numerous turtles that move through the area. During construction, the turtles seemed to prefer dodging heavy machinery and crossing on the pavement.

Both the technology and the human communications were put to the test when several cut slopes collapsed, leaving hundreds of thousands of cubic yards of soil and rock that had to be "wasted" somewhere on site. "The established relationships really paid off," says Colebank. In the field, Stanger and Franscom would decide where the unanticipated materials could be trucked efficiently and without
disrupting public traffic. The GPS grading process meant they had up-to-the-minute mapping of both untouched and once-graded areas, and could easily integrate the “wasted” material into those plans. All this information went back to the landscape offices, where a revised model was produced, showing how the new fill could be landformed and how it would look. Once again, the models were downloaded to guide the contractor’s equipment. “And that whole process would take less than a week,” notes Wilbrink.

Judy Mielke, an LSD landscape architect who formerly worked for Phoenix’s Desert Botanic Gardens and is the author of a book on Sonoran Desert plants, influenced the engineering design in a different way. Her charge was to inventory the native plants within the right-of-way. For some 7,000 larger specimens (saguaro, ocotillo, and barrel cactus, affectionately known as the SOBs), precise locations were surveyed using GPS, and size, condition, and suitability for transplanting were noted. Nearly 10,000 smaller cacti (whose names sound like a roster of fauna rather than flora: hedgehog cactus, teddybear cholla, and buckhorn cholla) were simply tallied.

Existing densities per acre were calculated for each species, and these density patterns were used as a basis for replanting plans. Like the landform grading designs, these were adjusted in the field, by eye and with artistry.

“Believe it or not,” recalls Mielke, “we LAs got to affect the roadway and shift its alignment to preserve some big specimens in place.”

“Landscape architects are trained to read the landscape,” says Colebank. “Even the engineering department was starting to notice patterns and accept their importance.”

Clearly, this is a lot of work just to make scenery, and every so often a politician or private citizen questions the costs. The best answer to these challenges, the team agrees, is that environmental services are restored by careful, naturalistic design.

“Revegetation puts back the cover of the earth, which looks good, of course,” says Mielke. “But it also holds the soil in place.” Besides being a legal requirement,
THE BEST WAY TO RESTORE IS TO PRESERVE; THE BIGGEST COST SAVINGS IS IN NOT REDOING.

What about the emphasis on protecting and transplanting native species? Landscape Architecture Magazine has hosted arguments, some quite heated, that a plant is a plant, regardless of native status. Seen in terms of environmental services, that argument falters. Kim Stone, a horticulturist at the Boyce-Thompson Arboretum, just beyond Gonzales Pass

prevention of soil loss and sediment pollution of waterways actually saves costs: ADOT has several older projects, notes Brady, where “every time there’s a storm, they pay $10,000 to clean the ditches at the bottom of their cut slopes.” Vicki Beaver, a project manager with ADOT, concurs: If a whole slope washes out, it is both costly and dangerous: redoing one slope she knows of cost $125,000. “The biggest cost savings is in not redoing things.”

BELOW
U.S. 60 moves seamlessly through a landscape far less disrupted than where conventional engineering gives way.

IMAGE CREDIT
Jacobs Engineering
RESTORATION MANAGEMENT

Project management is an essential skill, but even practitioners admit it’s boring to write about. Nonetheless, it’s worth a quick summary of some of the human issues that contributed to success at Gonzales Pass.

The team was involved from the start. Landscape architects and people with construction contracting expertise were brought in early, not after all the decisions were made. This spirit carried over into the field once construction began.

The project kickoff included a bus tour, and the Arizona Department of Transportation (ADOT) senior management took the tour too. Meetings were held at the site, which pulled everyone out of their cell-phones and office zones, equalizing relationships.

All deliverables were electronic, there were two web sites, one public and one password protected for construction documents and reports. After some arm-twisting, ADOT has made it official policy to allow the 3rd-winning contractor to upload ADOT’s design drawings directly; any agencies refuse to share, forcing the contractor to re-create digital information from paper.

Both Logan Simpson Design and ADOT did training sessions for the contractor’s staff concerning what was expected, unusual issues such as noxious weed removal, and so on.

Project Credits

PROJECT OWNER: ARIZONA DEPARTMENT OF TRANSPORTATION, PHOENIX (JACK BEVER), PROJECT MANAGER, BRIAN FRANCIS, RESIDENT ENGINEER: LEROY BRADY, CHEF LANDSCAPE ARCHITECT, LANDSCAPE ARCHITECTS: LOGAN SIMPSON DESIGN, TEMPE, ARIZONA (WYNN COLEBANK, ASLA, PRINCIPAL LANDSCAPE ARCHITECT, ROD STANGER, ASLA, RESIDENT LANDSCAPE ARCHITECT, JUDY MIELKE, NATIVE PLANT SPECIALIST), AND CORRAL DyBS GROUP, PHOENIX (ROGER DyBS, PRINCIPAL), EDWARD CORRAL, ASLA, LANDSCAPE ARCHITECT, CIVIL ENGINEERS: JACOBs ENGINEERS, PHOENIX (BERNARD WELBRINK, TRANSPORTATION GROUP MANAGER, PROJECT MANAGER), AECOM, PHOENIX (CHRIS ANDREWS), PROJECT MANAGER, KAREN URBAN, SENIOR PROJECT ENGINEER), AND DIBBLE ENGINEERING, PHOENIX (KEVIN DIBBLE, PROJECT MANAGER, SUSAN DETWILER, PROJECT MANAGER), COOPERATING AGENCY: U.S. FOREST SERVICE, PHOENIX (KIM VANDER HOEK, LANDSCAPE ARCHITECT).

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on U.S. 60, not only admires the artfulness of the replanting work, but notes that “in arid regions, the best way to restore is to preserve, and you can’t get a more resource-efficient plant than one that’s already established.” Brady keeps track of specific services that native plants provide; for example, brittlebush (Encelia farinosa) is a pretty, yellow-flowering native that outcompete tumbleweeds. Since those invasive imports otherwise create highway maintenance nightmares across the West, the cost savings are real, if hard to work out to the exact nickel.

Brady, Mielke, and Stanger have been involved in some unusual efforts to answer cost-benefit questions: ADOT-funded research projects into transplant survival rates, for example (see “Research at the Roadside,” page 79). Colebank refers to these methods as “art in search of the science.” He and other team members note that the public wants Arizona’s unique flora protected. “If we would go out there and just scrape the saguaros, there would be an uprising,” says Colebank—and in fact, utility companies have been causing just such concerns by “scraping” their easements and chopping up the saguaros in large numbers.

In most Western states, says Brady, sounding a lot like his predecessor Guirey, “road projects are built with no awareness of the kind of country they are in.” In Arizona, notes Bever, “we’ve evolved from California landscaping, with lots of oaks, lawns, and heavy, heavy irrigation, to locally hardy landscaping, and finally to desert restoration. Each step, and a lot of the cool stuff that people think is art, has been driven by decreasing funding”—in other words, by the savings possible when you work with what’s around you. Although regional awareness may start as an aesthetic idea, it has clear functional benefits that require, and repay, scientific and practical observation.

In May, nearly a dozen of the team members gathered at LSD’s Tempe offices to discuss their award-winning project. It was immediately apparent that this group had been through the trenches together. It gradually became clear, too, that they had largely torn down the usual specialist “silos” that isolate engineers, landscape architects, and contractors in neatly defined, sometimes antagonistic roles.

Collaboratively managing a big project takes expertise (Bever is certified by the Project Management Institute), effort, and attitude adjustments. “One thing we can say, and ADOT can document,” says Colebank, “these kinds of collaboration have resulted in a 90 percent reduction in change orders and cost overruns. That’s big.” Like awareness of and integration with the regional environment, a whole-team awareness smooths project interactions and has measurable value.

Collaborative, context-sensitive design is now the benchmark for ADOT projects. “It’s typical now,” says Bill Leister, a planner with the Central Arizona Association of Governments, which coordinates regional traffic plans. “But it wasn’t 10 years ago. It’s a new thought process, started with ADOT, and has been spreading to other jurisdictions.”

“We keep wondering why landscape architects would think this kind of work would be boring,” says Colebank. “It has all the stewardship things that landscape architects take as their mantra, but too often never really get to do.” Though it may lack some of the glitz and glamour that draw attention, as luxury projects fade into distant memory, public works landscape architecture may be an increasing opportunity. Says Brady, “There is no landscape seen by more people than a public transportation project.”