

# GOLD LINE BRIDGE

THE ART OF DESIGN

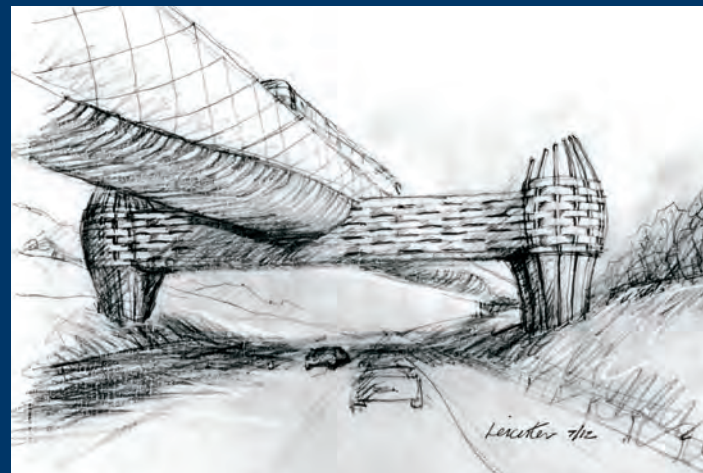


Metro Gold Line Foothill Extension Construction Authority  
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A METRO GOLD LINE FOOTHILL EXTENSION CONSTRUCTION AUTHORITY PROJECT



The mother art is architecture. Without an architecture of our own we have no soul of our own civilization. Frank Lloyd Wright



# The Gold Line Bridge

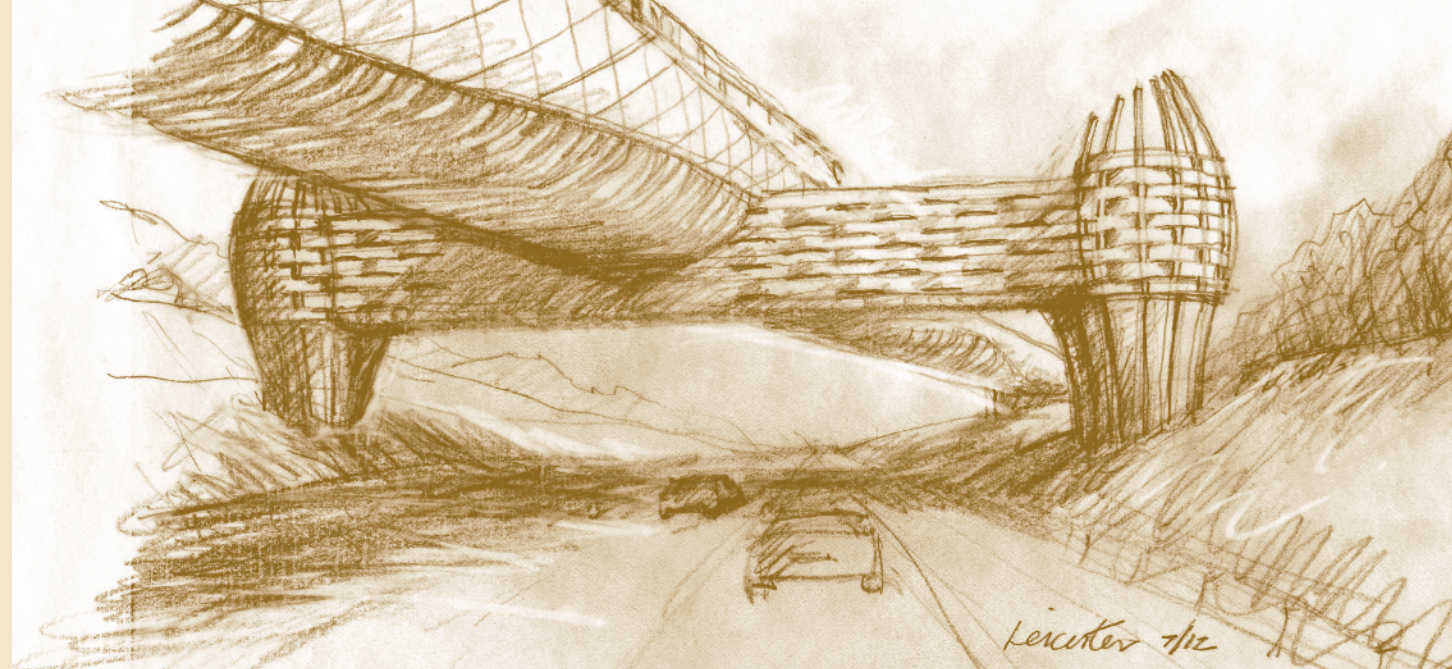
## PROJECT DETAILS

The Gold Line Bridge is a 584-foot bridge that spans the eastbound I-210 Freeway in Arcadia, California. The \$18.6 million dual-track bridge is the first completed element of the 11.5-mile Metro Gold Line Foothill Extension light rail project from Pasadena to Azusa, providing a connection between the existing Sierra Madre Villa Station in Pasadena and the future Arcadia Station.

The Foothill Extension is overseen by the Metro Gold Line Foothill Extension Construction Authority, an independent transportation agency responsible for the project's planning, design, and construction.

The Construction Authority, with the involvement of award-winning public artist Andrew Leicester, envisioned the Gold Line Bridge as a vivid expression of the community, past and present. This pioneering collaboration resulted in the creation of a sculptural bridge built for the same cost originally estimated for a more conventional structure of its size.

The Gold Line Bridge was built by Skanska USA, one of the largest general contractors and construction managers in the country. The company hired Los Angeles-based AECOM to be the lead architectural and engineering firm for the project and transform the Construction Authority's vision into a constructible reality. The design for the bridge was approved in November 2011 and site preparation began in April of that year. On budget and on schedule, the bridge was completed in December 2012.



## THE GOLD LINE BRIDGE: STATISTICS

**Length:** (end-to-end): 584 feet

**Width:** 115 feet between centerlines of the two signature support columns

**Height:** Rail vehicle wheels will be 33 feet above the freeway surface

**Clearance:** The bottom of the bridge is 19 1/2 feet over the freeway surface

**Exposure:** 255,000 vehicles pass the Gold Line Bridge daily, as they travel along the I-210 Freeway between Baldwin and Santa Anita Avenues in Arcadia, California

**Materials:** Concrete with steel reinforcement (92 percent from local and regional sources). The project required 6,500 cubic yards of concrete and 1.3 million pounds of steel rebar

**Cost:** \$18.6 million (funded by Los Angeles County's Measure R)

**Completion date:** December 15, 2012

## DESIGN CONCEPT

The design concept for the bridge was developed by award-winning public artist Andrew Leicester, who has created several international large-scale public art works. His bridge design was inspired by the local indigenous peoples and wildlife, as well as the roadside attractions of nearby Route 66 with its oversized architectural landmarks.

These inspirations permeate all elements of the structure. Most notable are the two 25-foot tall, 17-foot diameter sculptural baskets flanking the sides of the main superstructure, which are tied together visually by the relief pattern on the outrigger beam. The superstructure's serpentine main underbelly contains casted grooves and hatch-marks which simulate the patterns found on the Western Diamondback snake and metaphorically reference the connectivity of the transit system.

"THE BRIDGE  
EVOKES THE GREAT  
INFRASTRUCTURE  
DESIGNS OF THE 1930S  
WORKS PROGRESS  
ADMINISTRATION AND  
SIGNALS A NEW ERA OF  
ARTIST INVOLVEMENT  
IN MAJOR PUBLIC  
INITIATIVES OF OUR  
TIME."

**Barbara Goldstein**  
Former editor  
and publisher,  
*Arts and Architecture*





## DESIGN DETAILS

The complex patterns of weaving on the outrigger beam and ribbed pattern on the superstructure were created using hand-crafted primary casting forms, made of wood and rubber, that served as molds for the concrete.

Each woven basket is comprised of 60 individually pre-cast segments and features 16 reeds at the top which range from two to ten feet in height.

The pre-cast segments for the basket are made of a unique aggregate mix developed specifically for the Gold Line Bridge. The concrete blend contains black stone, as well as clear, grey and mirrored glass to provide a subtle reflective quality to the material which responds to the atmospheric conditions of the site.

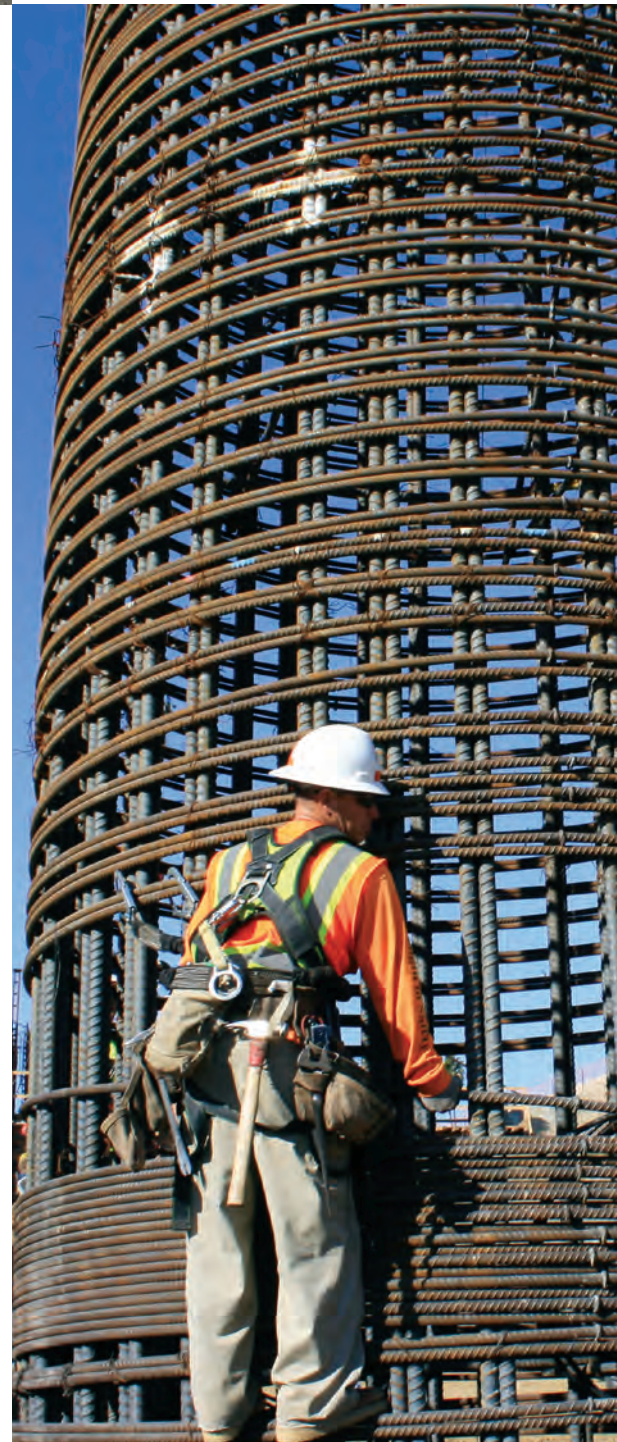
## ENGINEERING AND SEISMIC SAFETY

AECOM, an innovator in design consulting services, led the project's design and engineering. The firm was responsible for taking the conceptual design developed by Leicester and the Construction Authority and addressing the many challenging construction issues for the bridge.

Adding to the challenge of the unique artistic design was the need to create a long span crossing an active seismic fault. To address these issues, AECOM designed a three-span, cast-in-place post-tensioned box girder supported by a single column bent and one outrigger bent spanning the freeway. Because of the large vertical and lateral demands of the structure, AECOM designed three large-diameter cast-in-drilled-hole (CIDH) foundations—each approximately 110 feet deep and 11 feet in diameter.

## SMART COLUMN TECHNOLOGY

AECOM included time domain reflectometry in the three CIDH foundations, in what may be the first application of this technology in a reinforced concrete bridge. If a strong earthquake occurs, this "smart column" technology will allow engineers to make assessments about the integrity of the foundations below grade by using electronic data assessed at the site, rather than by the time-consuming traditional method of digging inspection trenches.



## LIGHTING AND LANDSCAPING

The construction team installed aesthetic lighting so that the bridge design may be appreciated at night. The freeway median and shoulder are landscaped with a variety of native plants to enhance the natural beauty of the site and stabilize the soil. The landscape plan accentuates the notion of arrival at and passage through a unique place.

## PROJECT SAFETY

The Gold Line Bridge was constructed without a recordable injury; approximately 95,000 incident-free work-hours were logged on the project. The success of the safety program is the result of careful pre-construction planning and diligent oversight by Skanska and the Construction Authority and a job site culture that involved everyone working toward a unified goal of zero workplace incidents.

The risks on any major construction project are significant. With the Gold Line Bridge project, the risks were greater because of the uniquely confined site located adjacent to an active freeway and nearly 100 nights of work between midnight and 5 a.m.

## ECONOMIC DEVELOPMENT AND LOCAL SOURCING

The Gold Line Bridge has boosted the local economy in several important ways. More than 92 percent (\$2 million worth) of the materials used in the Gold Line Bridge's construction were acquired from local and regional sources. Additionally, contracts valued at more than \$2.3 million were awarded to certified Small Business Enterprises participating on the design-build team, representing more than 12 percent of the total bridge project cost.

# About the Project Team

## METRO GOLD LINE FOOTHILL EXTENSION CONSTRUCTION AUTHORITY

The Construction Authority is an independent transportation planning and construction agency created in 1999 by the California State Legislature. Its purpose is to extend the Metro Gold Line light rail line from Union Station in downtown Los Angeles to Montclair in San Bernardino County, along the foothills of the San Gabriel and Pomona Valleys.

The Construction Authority built the initial segment from Union Station to Pasadena in 2003, on time and under budget. Work is underway on the next segments of the line, collectively called the Foothill Extension.

The Foothill Extension is a \$1.6 billion project that will connect Pasadena to Montclair in two construction segments. The first segment, between Pasadena and Azusa, is funded by Los Angeles County's Measure R. Work on the 11.5-mile segment will be completed in late 2015 and will include stations in Arcadia, Monrovia, Duarte, Irwindale, and Azusa.

The Construction Authority is managing three design-build contracts, totaling more than \$500 million, to complete the Pasadena to Azusa segment. This segment includes the Gold Line Bridge.

The Construction Authority is governed by an eight-member board of directors, including five voting members. Each member is appointed by a city or other governmental entity, and each member represents a corridor city. In addition, cities from South Pasadena to Ontario are represented on two advisory boards to the Construction Authority: the Joint Powers Authority (elected officials), and the Technical Advisory Committee (city managers or their staff appointees).

For more about the Construction Authority, please visit: [www.foothillextension.org](http://www.foothillextension.org).

"THROUGH THE WORK WE'VE DONE, WE'VE BEEN ABLE TO CONTRIBUTE TO A CULTURAL LEGACY FOR THE REGION AND ITS RESIDENTS, AND WE WERE ABLE TO DO IT BETTER AND MORE EFFICIENTLY THAN HAS EVER BEEN DONE BEFORE."

**Habib F. Balian**  
Chief Executive Officer  
Metro Gold Line  
Foothill Extension  
Construction Authority



## SKANSKA USA

With 39 offices nationwide, Skanska is one of America's largest general contractors, developers, and construction managers. From building the bridges of New York City to the historic Pacific Coast Highway, Skanska's experience has spanned America.

Skanska's history in the Golden State dates back to 1919 when Yeager Construction was founded. One of the premier heavy construction firms in the state, Yeager's work literally paved the freeways and infrastructure that supported Southern California's growth.

When Yeager joined Skanska in 2002, the people who made Yeager a household name stayed to steer Skanska into the California market. Both Skanska and Yeager understood that construction is a catalyst for economic health, and Skanska's California leadership remains committed to involving local contractors in all of its work.

Today, Skanska's work in California is managed by four principal offices that serve the state. Every Skanska office is staffed by local teams with core members who are lifelong residents of the region.

For more information about Skanska USA, please visit [usa.skanska.com](http://usa.skanska.com).

## AECOM

AECOM is a global provider of technical and management support services for a broad range of markets, including transportation, facilities, environmental, energy, water, and government.

AECOM provides a blend of global reach, local knowledge, innovation, and technical excellence in delivering solutions that create and sustain the world's built and natural environments.

A market-leading *Fortune 500* company, AECOM and its 45,000 employees serve clients in more than 130 countries.

For more about AECOM, please visit [www.aecom.com](http://www.aecom.com).





**Habib F. Balian**  
 CHIEF EXECUTIVE OFFICER  
 METRO GOLD LINE FOOTHILL EXTENSION  
 CONSTRUCTION AUTHORITY

**H**abib F. Balian serves as chief executive officer of the Metro Gold Line Foothill Extension Construction Authority. Balian oversees planning, funding, and construction of the light rail line from Los Angeles to Montclair.

During Balian’s 12-year tenure, the Authority has managed construction of the 13.7-mile segment of the Gold Line between Los Angeles and Pasadena. This design-build program was completed on time and under budget. Balian also has directed the preparation for construction of the Pasadena to Azusa segment and the planning studies to prepare the segment from Azusa to Montclair for construction.

Prior to his appointment as CEO, Balian served as the chief administrative officer of the Construction Authority. In both his current and former roles, Balian has worked closely with elected officials and government agencies at all levels to build support for the Foothill Extension Project.

Before joining the Construction Authority, Balian served as chief of staff for the Los Angeles County Metropolitan Transportation Authority (Metro). Reporting to Balian were departments that managed planning and environmental reviews and readiness of transit projects, management audit, board research, government relations, and labor relations. He also served for seven years with the Los Angeles County Board of Supervisors, advising on Metro and other transportation issues.

Balian is a lifetime resident of the San Gabriel Valley, currently living in Pasadena with his wife, Toni, and their two sons.

“I WANTED THE BRIDGE TO BE SCULPTURAL, NOT JUST AN EMBELLISHED STRUCTURE. I WANTED US TO CREATE SOMETHING FANTASTIC.”

## Interview with HABIB F. BALIAN

### Q: What was your vision for the Gold Line Bridge?

**HB:** I wanted the bridge to be sculptural, not just an embellished structure. I wanted us to create something fantastic, something never done before. I wanted the artist to address the landscape—the mountains—as well as the community and its history and culture. Ultimately, I wanted to meld art and the transit experience, and we did that.

We wanted the bridge to represent the entire area—the San Gabriel Valley, the foothills that surround it, and the indigenous peoples. It needed to be organic and well-rounded—not mechanical and high tech.

### Q: What is the Construction Authority’s philosophy for its public art program?

**HB:** We believe that art should be an integral part of our projects, and it should represent the uniqueness of the area’s history and culture. We use a standard set of architectural elements as a baseline for designing our projects, and then we include art for the stations and other key elements like the Gold Line Bridge, to serve as visual overlays that provide a unique character to the work.

We are also very community focused. For that reason, we bring our artists in early in the process to connect with the community while they develop their designs.

That early role for artists also ensures that their designs can be more easily integrated into the engineering for the project. The art is in place before the engineering, rather than trying to fit it in later. We have accomplished this with the Gold Line Bridge project, as well as with the station art, and it has helped keep costs down while ensuring that the line is unique and interesting for users and neighbors.

As a part of the overall Foothill Extension project, including the bridge, public art makes up about one-half of one percent of the budget, which is in accordance with federal standards.

### Q: Is the bridge on time and on budget?

**HB:** Yes, the project is on budget, and Skanska USA, the design-build firm for the bridge, has done an outstanding job in reaching the target completion date of December 15, 2012.

Completing the Gold Line Bridge on time and on budget is an important milestone. The Construction Authority recognized that to keep the Foothill Extension project on schedule, the bridge completion had to be an early-action item. We knew the process would be extensive because Caltrans would need additional time to review and approve the plans, especially with the unique design. The bridge needed to be ready for the next contractor to install the utilities and track as part of the light rail construction.



**Q: How much of the budget is devoted to realizing Andrew Leicester's artistic vision?**

**HB:** The Construction Authority originally estimated the cost for the bridge to be about \$25 million, based on an independent projection. Skanska's cost to design and construct the bridge was \$18.6 million, which includes Andrew Leicester's public art concept and his continuing involvement with the project as it moved from concept through design and into construction. We estimate that the custom architectural elements of the bridge make up approximately five percent of the total cost of the bridge—about \$1 million.



“THERE WERE THOSE WHO DIDN'T BELIEVE WE COULD BUILD THE BRIDGE WITH A LIMITED BUDGET, LET ALONE CREATE SOMETHING UNIQUE AND FANTASTIC. BUT WITH THE RIGHT MIX OF CREATIVITY, INSPIRATION, AND PLANNING, WE ACCOMPLISHED OUR GOAL.”

**Q: What was unique about the design process for the bridge?**

**HB:** Development of the design was very different in that the art inspired the engineering and not vice versa. Organizing the design process this way enabled us to be more fluid and allowed the design to develop organically. This was a collaborative effort that required many long and thought-provoking conversations.

In the end, there was a lot of experimentation by Andrew as he developed his design. He needed to be very flexible. Andrew understood that his design had to be equally functional and beautiful. In all, more than a dozen different design concepts were considered before the final one was determined, and Andrew was required to go back to the drawing board many times. Ultimately, the design was forged from a process that included the artist, the engineers, the builder, and multiple public agencies.

**Q: How were the different groups involved in making the Gold Line Bridge a reality?**

**HB:** This was a truly collaborative process. It included the community that selected the artist; staff from multiple agencies that shared the vision of the sculptural design and allowed Andrew to think outside the box; our board of directors who supported that vision; and the design-build team that made it happen.

We were successful because of this collaboration and because we were proactive. Having the right chemistry made coordinating and planning easier, especially with all the stakeholders working together. We learned that much can be accomplished, very economically, with early planning, the right team, and the community's support.



**Q: How does public art serve the community? What kind of impact can art have on public transit?**

**HB:** Public art makes the whole transit experience more memorable and enjoyable. It's a statement of where you are. In the case of the bridge, the structure reflects the region's unique cultural history. It tells a story.

The visual quality of the nation's transit systems has a profound impact on transit patrons and the community at large. Quality art and design can improve appearance, give vibrancy to a space, and make passengers feel welcome. Every transit system should be a positive symbol for a region and its residents.

**Q: What will the Gold Line Bridge mean to the community?**

**HB:** It's something no one in this region has ever seen or done before. Hundreds of thousands of people pass by the bridge daily,

and I think they will appreciate the time and attention we gave to its design.

There were those who didn't believe we could build the bridge with a limited budget, let alone create something unique and fantastic. But with the right mix of creativity, inspiration, and planning, we accomplished our goal.

The Gold Line Bridge represents an interaction between the built environment and the people who pass through that environment. The Construction Authority and its board share a vision of improving public space. I believe this piece of inspired infrastructure changes the quality of life for everyone who experiences it. I'm proud of that.

Through the work we've done, we've been able to contribute to a cultural legacy for the region and its residents, and we were able to do it better and more efficiently than has ever been done before.

Andrew Leicester  
DESIGN CONCEPT ADVISOR



Andrew Leicester is the design concept advisor for the Gold Line Bridge project. Leicester is internationally recognized for more than three decades of work as a public artist, lecturer, and panelist.

Leicester believes his art should exist in the public domain and form social, historical, and environmental links between its specific location and the community.

Leicester has created public art projects in the United States, the United Kingdom, and Australia that range in size from small courtyards to municipal transit plazas, park entrances, and water gardens. His work often addresses the issues of sustainability—specifically reclamation and wind and solar power.

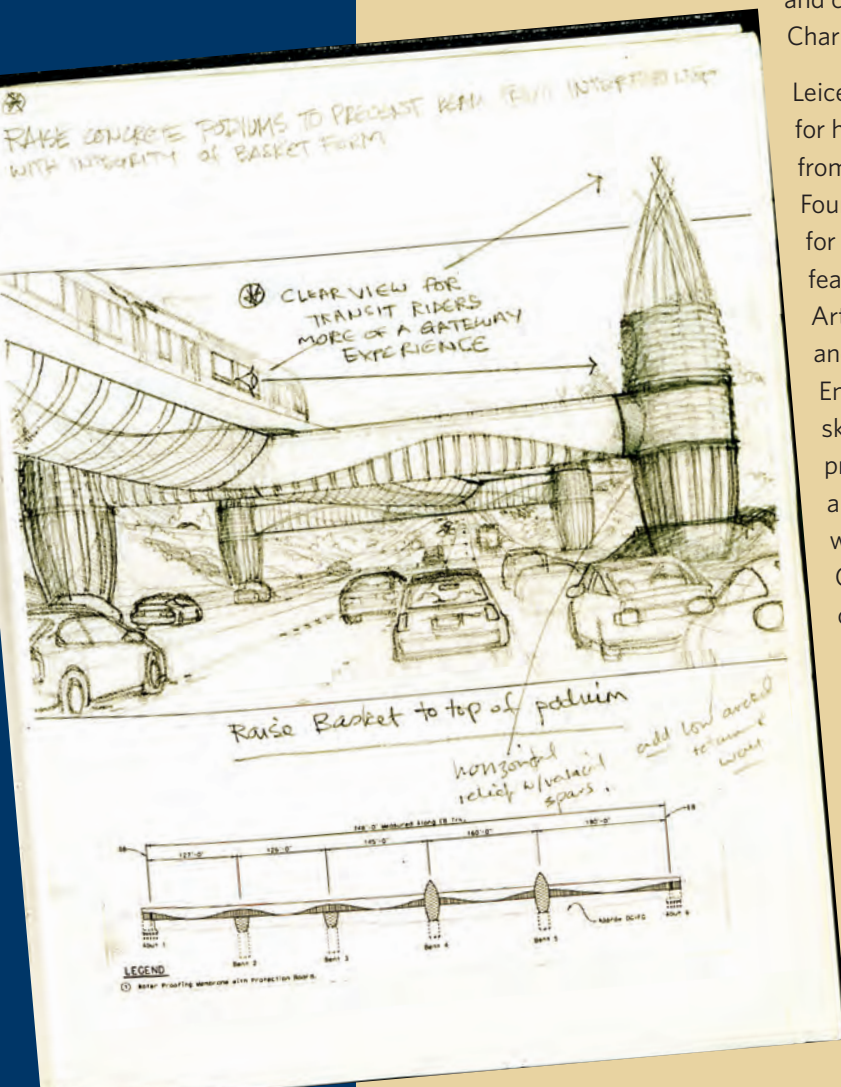
Among Leicester's other projects are "Parade of Floats," 16 sculptures lining pedestrian routes to the Civic Center in San Jose, California; and "Flying Shuttles," 27 elements integrated into the exterior facade and courtyard of the Bobcats Arena in Charlotte, North Carolina.

Leicester has received numerous awards for his work, as well as fellowships from the Bush Foundation, McKnight Foundation and National Endowment for the Arts. His projects have been featured in exhibitions at the Walker Art Center in Minneapolis, Minnesota, and the Serpentine Gallery in London, England. Leicester's extensive sketchbook for the Gold Line Bridge project was selected as one of only a few dozen creative professional works on view at the Art Center College of Design's "Pages" Exhibition ongoing through January 13, 2013, in Pasadena, California.

Leicester was born in Birmingham, England, and emigrated to the United States in 1970. He lives in Minneapolis with his wife Mary and two sons.

For more about Leicester and his work, please visit [www.andrewleicester.com](http://www.andrewleicester.com).

"THIS MONUMENTAL BRIDGE IS A SYMBOLIC GATEWAY INTO THE SAN GABRIEL VALLEY, AS WELL AS A TRIBUTE TO THOSE WHO INHABITED THIS SPECTACULAR LANDSCAPE."



## Interview with ANDREW LEICESTER

**Q:** Why did you choose to engage in public art?

**AL:** As a young kid growing up in the English countryside, I would explore abandoned quarries, old canals, viaducts, industrial plants, and brick kilns. It was fascinating to see this industrial archaeology in complete ruin and covered in ivy. Those forms had the look of ancient funerary and ritual architecture and resulted in my first thoughts about a possible career focused on art and architecture.

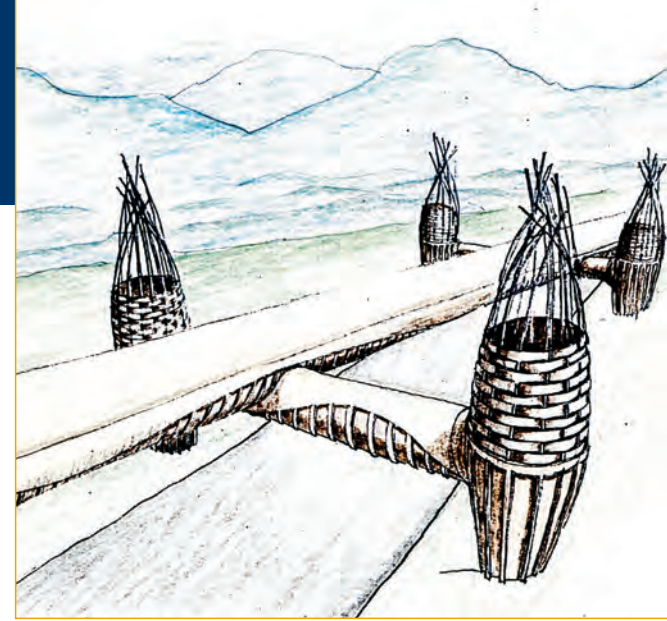
I studied physical geography—understanding landforms and how humans have altered them, such as the redirection of rivers. I love landscape and its scale. I wanted to work on a level where the artwork is commensurate with the mass of the surrounding landscape, as well as with the urban infrastructure.

How art functions in the context of a specific community and its environment is a particular interest of mine as seen in my earliest works, which were primarily land art and environmental installations that document erosion over time.

Public art is encountered in everyday life and, as a result, has a huge audience without requiring the viewer to go to a specific space to see it. Unwittingly, people experience art in an environment oversaturated with other visual stimuli.

**Q:** How did working with the Construction Authority differ from your previous commissions?

**AL:** This was an extraordinary opportunity. Within the Request for Proposals link was a video of Habib Balian, CEO of the Construction Authority, and art consultant Lesley Elwood standing at the bridge site by the freeway, describing how they wanted an artist to create the concept for the bridge



from the start. I could not believe it and was intrigued that the artist was not an afterthought—as is the case with so many public projects.

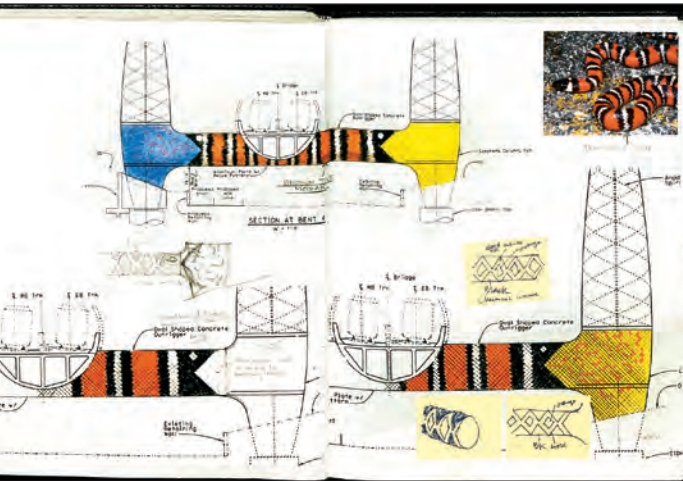
I immediately started working on ideas and researching the area before flying to Los Angeles for the interviews to present my sketchbooks that demonstrated my creative process. Being involved from the beginning really allowed me to impact the overall gestalt. I am deeply grateful to the Construction Authority for their leadership and commitment to quality, which ensured the bridge adhered to the original concept.

**Q:** What was the creative evolution of the initial concept for the Gold Line Bridge?

**AL:** The Construction Authority set the mandate for me to create a unique gateway that reflected aspects of the San Gabriel Valley region. As with all public art projects, it involved many conversations with the community, listening to their responses, and incorporating their input in my preliminary sketches.

Understandably, people in the community have a better intuition about local history, myths, and legends. Their responses and reactions guided my steps. The crucial synthesis for the design came from this exchange of ideas and eventually led to a final concept.





I drew my inspiration from two sources: the region's cultural history and its architecture. The large baskets that adorn the bridge metaphorically represent the indigenous peoples of the region and the growth of agriculture as a primary catalyst for the San Gabriel Valley's development. The baskets also pay tribute to the iconic sculptural traditions of nearby Route 66, with its oversize commercial architecture, such as the windmill atop the Denny's restaurant on Huntington Drive (originally an iconic Van de Kamp's restaurant) and the Aztec Hotel on Foothill Boulevard north of the freeway.

It also seemed appropriate to reflect the centuries-old migratory history of the area. Prior to the Spanish missions, these ancient peoples traveled from the interior desert states and great basin areas along the San Gabriel Foothills on their way to the ocean.

Some of the most notable and recognizable artifacts of these peoples' cultures are their elaborately designed baskets, which served a utilitarian purpose and were valuable trading commodities. Their creation remains an ongoing tradition to this day.

The basic bridge is comprised of a carriageway (where the train will run) that is supported by a cross beam across the I-210 freeway. The cross beam is supported by two columns on either side of the freeway. This

simple arrangement creates a giant "post and lintel" doorway for eastbound motorists. Adding to its immensity is the serpentine carriageway, representing the Western Diamondback, above with its exposed "ribs."

**Q: Can you explain your creative process for the Gold Line Bridge project?**

**AL:** I did research for nearly a year, designing and presenting preliminary ideas to the Construction Authority in person and via emails and conference calls, while also including feedback from a group of community stakeholders representing the corridor's cities from Pasadena to Montclair.

The original concept for the bridge included using a variety of materials. Following a Caltrans and Metro review, however, it was determined that the bridge should be constructed in concrete for maintenance and safety reasons. (Soil borings had confirmed the existence of the active Raymond Fault running directly underneath the bridge.) Special seismic engineering required sinking foundations more than 100 feet down, beefing up the three main columns, and adjusting the profile of the baskets and main crossbeam.

I presented half a dozen ideas before the Construction Authority approved the final design concept.

The next task was to engineer the various components—the reeds, baskets, and serpentine skeleton of the bridge—to pass a Caltrans' review. The engineering crew addressed these intricacies and understood how we would execute all of the elements, while still preserving the visual integrity. The advice and amazing skills of architect Rivka Night were crucial when working on the many complex computer drawings and calculations.

**Q: What sort of inspiration do you hope the bridge will provide to the community?**

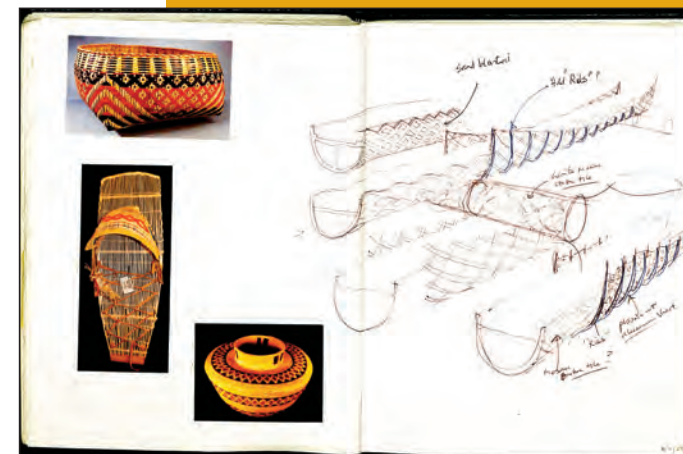
**AL:** Nearby Route 66 (now Foothill Boulevard) basically parallels the entire Foothill Extension project from Pasadena to Montclair. This "California Mother Road" has had an indelible effect on the minds of many Americans as the quintessential American motorway with its larger-than-life figures and quasi-architectural objects advertising a local attraction. As history moves inevitably onward, cultural shifts will wipe out these cultural artifacts, as well as traces of earlier peoples.

This monumental bridge with its supporting columns is a symbolic gateway into the San Gabriel Valley, as well as a tribute to the earliest settlers who inhabited this spectacular landscape. In addition, it emphasizes to the traveler that they have arrived in a unique place, which is one of the driving principles behind the art program for the Foothill Extension.

At night, lights will illuminate the baskets, creating spectral sentinels for those who are driving along the freeway or taking the train—something passengers can look forward to as a landmark on their journey. As I mentioned before, the average person does not ordinarily encounter art in their everyday environment. I want people to be intrigued by the mystery of it.

As with most ceremonial portals, the symbolic and decorative elements of the bridge serve a vital role in conveying a message to anyone who passes through. They announce the beginning of the San Gabriel Valley, and to those who live there, they say "you are not far from your destination." The bridge provides that warm, confident feeling of heading home.

"AS WITH MOST CEREMONIAL PORTALS, THE SYMBOLIC AND DECORATIVE ELEMENTS OF THE BRIDGE SERVE A VITAL ROLE IN CONVEYING A MESSAGE TO ANYONE WHO PASSES THROUGH. THEY ANNOUNCE THE BEGINNING OF THE SAN GABRIEL VALLEY, AND TO THOSE WHO LIVE THERE, THEY SAY 'YOU ARE NOT FAR FROM YOUR DESTINATION.' THE BRIDGE PROVIDES THAT WARM, CONFIDENT FEELING OF HEADING HOME."





**Rivka Night**  
LEAD ARCHITECT, AECOM

**R**ivka Night serves as the lead architect for the Gold Line Bridge. Night works for AECOM, the primary design and engineering firm for the project.

Night specializes in the design and implementation of rail transit projects—from concept to final construction. Night works with multi-disciplinary teams of planners, engineers, and architects to develop underground, at-grade, and aerial rail stations and support facilities.

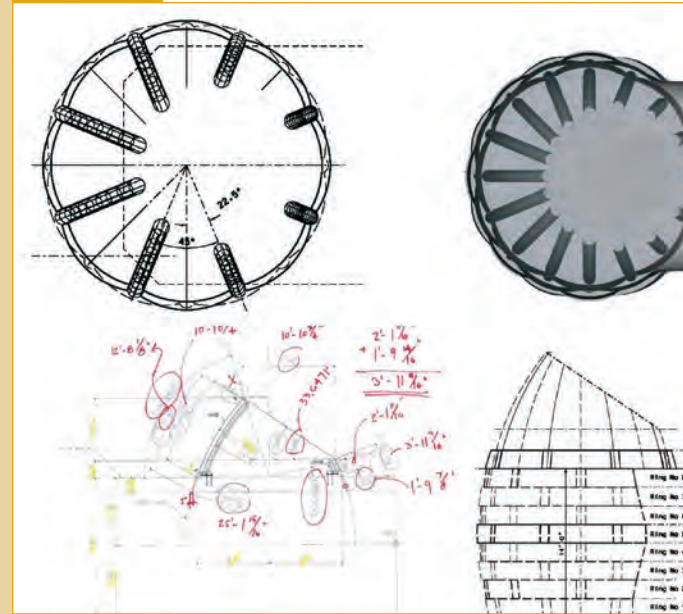
For the Gold Line Bridge, Night was responsible for translating the vision of Andrew Leicester, the project’s design concept advisor, into a buildable structure. Working with Leicester and the AECOM engineers, Night created a harmonious design with continuous lines—both horizontally and vertically—which was a complex challenge because of the curved profile of the baskets and the horizontal wave design on the face of the superstructure.

Night has worked on several local rail projects, including the Metro Red Line segment to North Hollywood, the Metro Gold Line Eastside Extension, and the Regional Connector. Each station along these lines has been developed with a theme, which resulted from the incorporation of physical, cultural, and historical elements from the surrounding neighborhoods.

Night worked for the Metropolitan Transit Authority of Harris County in Houston and the Dallas Area Rapid Transit System while those transportation systems were in the planning stages. Night has worked for AECOM for 17 years.

“IT WAS THE ULTIMATE PROFESSIONAL EXPERIENCE TO BE SO CREATIVE AND CONTRIBUTE TO THE AESTHETICS OF THE BRIDGE. WORKING ON THE BRIDGE WAS AN UNUSUAL OPPORTUNITY AND VERY GRATIFYING.”

## Interview with RIVKA NIGHT



**Q: What was your first impression of the design Andrew Leicester developed for the Gold Line Bridge?**

**RN:** I had the same reaction as everyone when they first saw it—Wow! It is very unusual and not at all a traditional design. My immediate thought was, “Is it really going to be constructed out of concrete?” It seemed that it might be a very complicated construction because of the unusual shapes.

It is not often that an architect is asked to collaborate with an artist on a bridge. Since I was just completing work on the Gold Line stations in East Los Angeles, where every canopy was unique and every platform had artwork, I thought this bridge project was a natural continuation for me and very exciting.

When I first met Andrew, we spent a whole day touring the Gold Line, looking at those individual station designs and talking about how my moving from the stations to working on his large-scale artwork with its architectural and structural elements was so exciting.

**Q: What was AECOM’s role in the project?**

**RN:** AECOM was responsible for ensuring that the bridge design met the structural and maintenance requirements of the project stakeholders (the Construction Authority, Metro, and Caltrans) and that Andrew’s original concept was implemented. To accomplish this, AECOM formed a team that included Patrick Nicholson, the project design manager, and the company’s structural and civil groups, landscape designers, and me as project architect.

As the project manager, AECOM also served as the single point of contact for all the principals in charge, including coordinating with multiple agencies, Skanska, and our design team. Since this was not a traditional Caltrans bridge, we worked very closely with them. The design went through considerable scrutiny to ensure its safety and constructability.

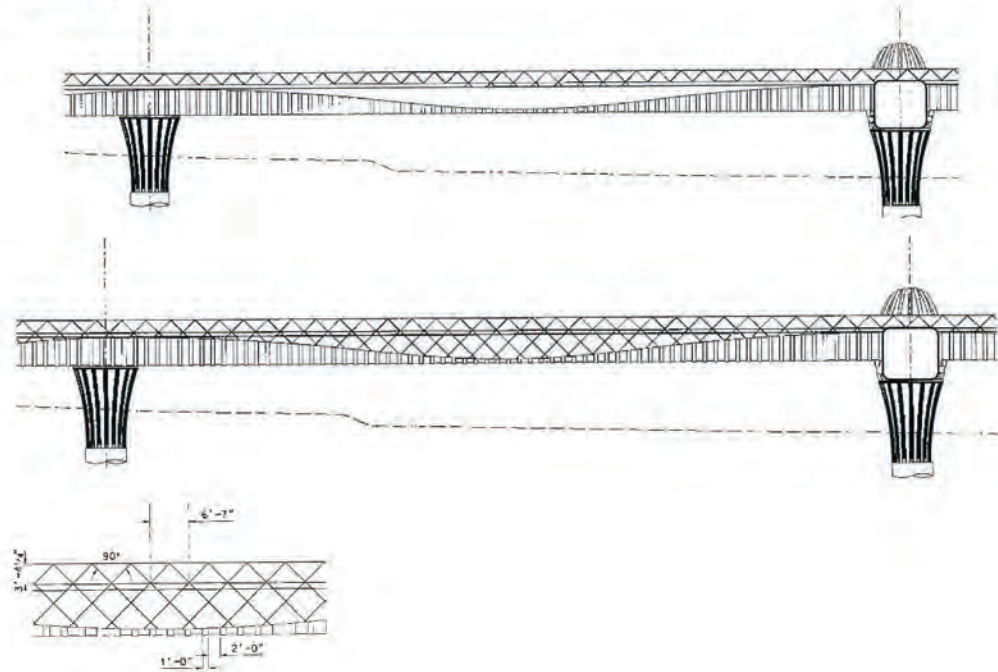
**Q: What were some of the challenges?**

**RN:** As the project evolved, the design binder became thicker and thicker. I looked at the first sketch I received compared to what was built and I saw a lot of changes—specifically how we treated the different surfaces and how the top of the baskets and the reeds were handled. These went through several transitions, but we stayed very close to the original design. That was our goal.

From the initial concept to the final design, you can see the path of adaptation of art to the structure being buildable, functional, and structurally safe. The final goal was to achieve a successful “marriage” of art and engineering.

There were many interesting creative challenges. Andrew and I worked together in front of the computer to see

The Guideway



how the different elements of the design complemented each other. The reeds and the grooves on the columns are one continuous vertical line. It was our goal to make it one smooth piece. Each basket has nine horizontal layers and is connected by a horizontal piece, called the "bent," which is supported by the two columns. We took the horizontal layers of the baskets and blended them into the horizontal bent, so these layers are consistent.

The reeds in the initial sketches were tall and skinny, and they couldn't be built like that due to structural considerations. The baskets needed to be larger because of seismic requirements. Therefore, the baskets became wider, as did the support columns. There is a magic line that goes from the tallest reed to the shortest reed, and everything around it proportionately goes along that line.

Finally, Caltrans was initially reluctant to allow the grooves under the superstructure. They are used to smooth surfaces, and it took a lot of back and forth to work through the agency's concerns. In the end, Caltrans agreed to allow it, and you have to give Skanska a lot of credit. There is a lot of unconventional detail in that bridge.

It was great working with Lawrence Damore, Skanska's project executive. He was very understanding and willing to push the envelope to accommodate the unusual design. The whole team was wonderful. Andrew said he was pleasantly surprised how the design process had actually allowed the design to improve. Ultimately, it's about collaboration, particularly on a bridge project of this kind.

The entire process worked well and, although a few of the design elements needed to be augmented, the end result is a beautiful design that works for all the project's stakeholders.

**Q: Andrew said your advice and skills were crucial. How did using computer-aided design (CAD) software add to the success of the process?**

**RN:** CAD changes everything in project design. It speeds up the process and gives us unlimited possibilities to visualize what we are trying to do. You don't have to build a physical model, and CAD is instrumental in checking accuracy.

CAD allowed us to translate Andrew's concept of basket-designed columns

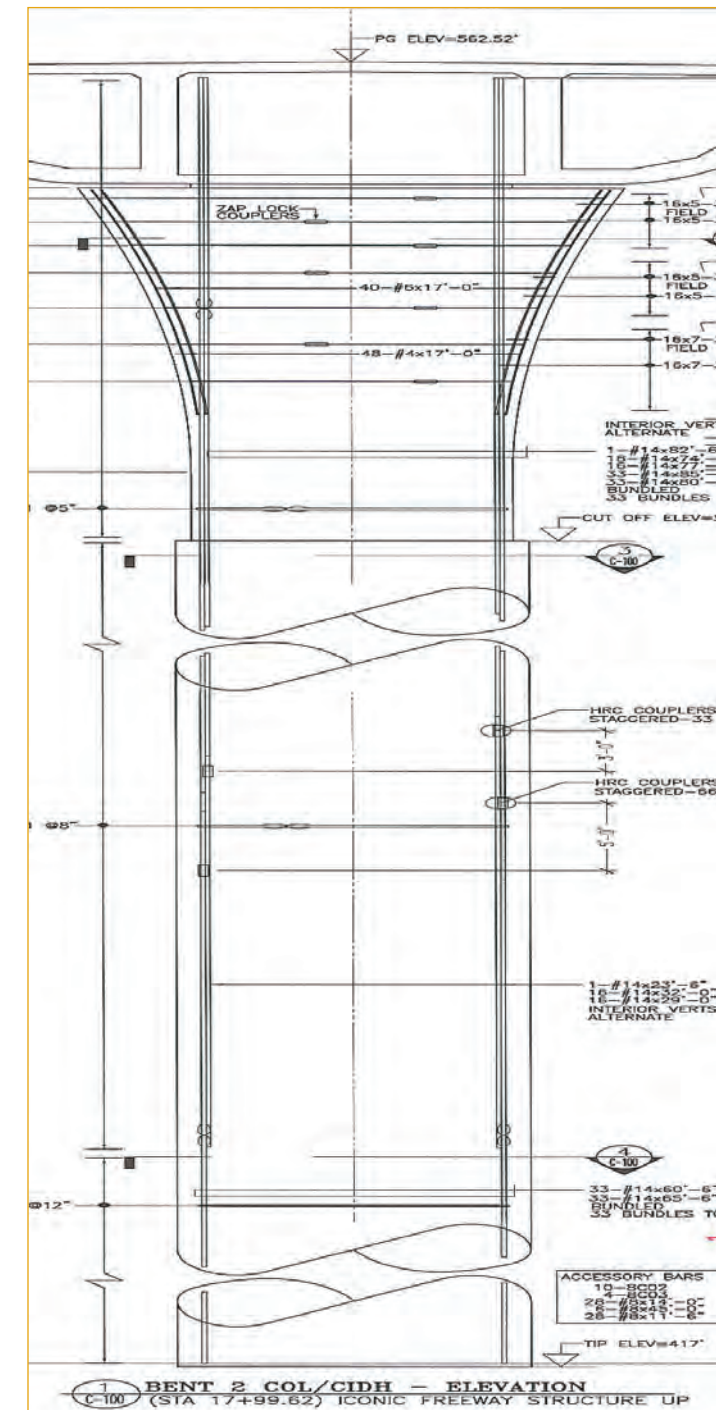
and curved shapes into a buildable superstructure. I integrated the various parts of the bridge using CAD to visualize it from many different angles, creating a harmonious structure with continuous lines, both horizontally and vertically for the curved profile of the basket and the horizontal wave on the face of the bridge. The technology enabled us to take a conceptual design through to final construction.

**Q: Andrew hoped that the Gold Line Bridge design might start a paradigm shift for bridge building in California. After working with an artist on the bridge and seeing the results, what are your thoughts on this possible paradigm?**

**RN:** I hope this could prove to be a shift. If you Google *iconic bridge*, you can see many beautiful bridges that have been built around the world. It's all in the hands of the client. The artist can present ideas and promote the creative possibilities in bridge design. But the bottom line is: how willing is the client to go outside the norm? I'm glad the Construction Authority took that chance with the Gold Line Bridge.

"THE ARTIST CAN PRESENT IDEAS AND PROMOTE THE CREATIVE POSSIBILITIES IN BRIDGE DESIGN. BUT THE BOTTOM LINE IS: HOW WILLING IS THE CLIENT TO GO OUTSIDE THE NORM? I'M GLAD THE CONSTRUCTION AUTHORITY TOOK THAT CHANCE WITH THE GOLD LINE BRIDGE."

When I heard the Authority was creating a bridge as an artwork, I thought it was wonderful, and I was delighted to be invited to work on the project. It was the ultimate professional experience to be so creative and contribute to the aesthetics of the bridge. Working on the bridge was an unusual opportunity and very gratifying.



## Lawrence Damore

PROJECT EXECUTIVE  
SKANSKA USA

Lawrence Damore is the project executive with Skanska USA for the Gold Line Bridge project. Damore is responsible for managing the design and construction of the \$18.6 million bridge, as well as coordinating with the Construction Authority.

For the Gold Line Bridge, Damore heads a team of nine in-house superintendents, quality and safety managers, and project engineers—an especially challenging role on a project with unique design elements and a small construction site over an active freeway.

Damore is a registered civil engineer with nearly two decades of construction management for highway construction projects in Southern California. In the region he has overseen the Foothill/Eastern Transportation Corridor Project in Orange County, the reconstruction of I-5 in the cities of Orange and Anaheim, the extension of I-210 in the Inland Empire, and the Alameda Corridor.

In San Diego, Damore managed highway improvement projects on I-805, as well as the extension of California SR 905 to the international border. Recently, he also directed site development work for the Pelican Hill Resort, an Irvine Company project.

Damore served as an officer in the United States Army Corps of Engineers. He lives in Aliso Viejo with his wife, Nora, and their two children.



“THE ARCHITECTURAL ELEMENTS OF THE BRIDGE ARE UNIQUE. NEARLY EVERYTHING ON THIS PROJECT WAS SPECIALLY DESIGNED AND MANUFACTURED FOR THE PROJECT, AND REQUIRED OUR CREWS TO INSTALL THEM USING DETAILED CRAFTSMANSHIP UNLIKE ANY OTHER BRIDGE I HAVE BEEN INVOLVED WITH.”

## Interview with LAWRENCE DAMORE

### Q: What is your role on the Gold Line Bridge project?

**LD:** As project executive for Skanska USA, the design-builder for the Gold Line Bridge, I am responsible for overseeing the design and construction teams, including AECOM, our engineering and architecture subcontractor.

I have an on-site team that includes a superintendent, project engineers, a quality assurance and control management unit, and others. Together we have managed more than a dozen subcontractors and some 100 trades workers who put in approximately 95,000 work-hours on the project since site preparation began in April 2011.

We are extremely proud that in that time we have been able to maintain an excellent safety record with no recordable incidents.

### Q: What is Skanska's history locally?

**LD:** With the merger of Yeager Construction Co. with Skanska in 2002, that means our company has worked in California since 1919. During that time, we have paved the freeways and created the infrastructure that supported the growth of southern California and the Inland Empire.

### Q: You have built many bridges in your career. What made this project unique?

**LD:** It is always challenging to build over an active freeway. What made this project even more challenging was the small footprint for our working area and, of course, the unique design. In addition to the Construction Authority, Caltrans and Metro had to review and approve the design for the bridge. Each agency had their own requirements and standards to take into consideration,

and each had more stringent standards in response to the bridge being located over an active fault.

This was something very different for my team to tackle. The design required the construction team to implement the architectural elements through their craftsmanship. All of the details seen on the exterior of the superstructure and crossbeams, for instance, required crew members to install form liners one piece at a time by hand. They did an outstanding job, and I am very proud of the results.

### Q: What advantages did you find working from the start of the project with Andrew Leicester, the project's design concept advisor?

**LD:** Andrew understood the constructability issues, and our team, especially our architect, worked collaboratively with him to address these issues. Andrew listened to the concerns and made innovative changes to work through the challenges.



“I’M MOST PROUD OF PUTTING TOGETHER A TEAM THAT COULD GET THE JOB DONE. STARTING WITH THE DESIGN ENGINEERS AT AECOM, THEN OUR VARIOUS SUBCONTRACTORS, AND FINALLY GETTING OUR CREW ON BOARD TO BUILD IT—THEY ALL DID A TERRIFIC JOB.”

**Q: How did the design concept change in response to specific criteria required by Caltrans and Metro?**

**LD:** We proposed lengthening the span of the bridge and reducing the number of columns and foundations. Initially, Andrew’s design concept envisioned five columns—three in the center median and two on the southern shoulder. However, as we worked through our design we realized we could offer a more efficient structure with just three columns founded on an 11-foot diameter concrete pile reaching 110 feet deep into the ground. And, where Andrew had envisioned four tall, relatively narrow baskets and columns, the end result was very different—two shorter, wider baskets.

**Q: How did your team accommodate building over the Raymond Fault—especially the “smart column” technology built into the bridge’s deep foundations?**

**LD:** Every component of the design was driven by the seismic criteria. Designers start out by determining optimum span lengths. From there, column and abutment design can proceed. Finally, foundations supporting those columns and abutment are designed. The columns had to be founded on single large-diameter cast-in-drill-hole

(CIDH) piles, which represent significant design challenges, especially with seismic considerations.

Within the large-diameter piles, we have embedded sensitive coaxial cables. After a significant earthquake, a monitoring device can be attached to the ends of these wires to determine if significant bending took place below the ground level of the pile. Without this system, a working crew would have to excavate up to 20 feet below the ground level to inspect for any obvious signs of concrete cracking.

We believe that this is the first time this time domain reflectometry has been incorporated into a reinforced concrete bridge.

**Q: Did the curved underside of the bridge present any specific challenges?**

**LD:** Making the serpentine soffit shape began with building the temporary falsework that supported all of our forms and, eventually, the concrete. The forms for the curved exterior were fabricated offsite and hoisted into place. We created the ribbed look by installing rubber pieces, called formliners, onto the curved forms. The cross-hatching was accomplished by nailing small pieces of wood, called chamfer, to the form.

The architectural elements of the bridge are unique. Nearly everything on this project was specially designed and manufactured for the project, and required our crews to install them using detailed craftsmanship unlike any other bridge I have been involved with.

**Q: How did your team respond to the unique degree of craftsmanship?**

**LD:** Our crews did an outstanding job in properly installing the forms and formliners

to ensure the highest degree of quality and craftsmanship in the structure itself. Each form and formliner was installed individually and with great attention to detail. This was necessary to get the shape of the structure, as well as the grooves and hatch-marks, to line up and create the overall effect desired by the Construction Authority. Our crews are very proud of their work on this bridge and how their efforts have created something truly unique and quite beautiful.

One key was also finding the right company to create and install the baskets. Skanska brought on a masonry contractor, Masonry Concepts, to perform that work. They, in turn, hired Moonlight Molds to actually cast the baskets and the reeds above the baskets. There are 120 basket pieces that were brought out to the site and carefully set in place by crews from Masonry Concepts.

**Q: What are you most proud of regarding this process and the outcome?**

**LD:** The thing I’m most proud of is putting together a team that could get the job done. Starting with the design engineers at AECOM, then our various subcontractors, and finally getting our men on board to build it—they all did a terrific job.

We ultimately want to recognize the crew that was out there. It’s incredibly tough working outdoors, especially this past summer when temperatures reached well over 100 degrees. Add to that the dangers of working adjacent to and above live freeway traffic and dealing with the noise and dust. I am very proud of the collaboration and teamwork that made it happen.



# Evolution of the Gold Line Bridge



# Baskets: The Bounty of Human Ingenuity

By Stephanie Hashagen and Wintress Odom

When early humans began weaving baskets, they weren't thinking about them as artistic statements or historical artifacts. They weren't thinking about how their designs would influence the way people tens of thousands of years in the future would go about their daily lives.

The earliest baskets solved problems. They collected the bounty that nourished families and communities. They provided a secure vessel for holding daily essentials like food, tools, and money.

True symbols of human ingenuity, baskets have been invented and reinvented by societies and cultures, well before modern technology helped us share knowledge and know-how.

Historians and researchers have found evidence that people from some of the world's oldest civilizations—from Asia to Africa, from Central America to the Middle East—were creating baskets more than 10,000 years ago.



In most of these early cultures, women were responsible for weaving baskets. Women also kept the art of basket weaving alive, passing their traditions down from generation to generation. Mothers taught their daughters, and in time, those daughters grew up and taught it to their daughters.

Each new generation of weavers improved on existing designs and used their skills to create completely new designs. Baskets became art—and the women and girls who created baskets became artists. They became storytellers and historians responsible for preserving their culture's way of life.

Although they couldn't have imagined it at the time, these women were also shaping modern life: Think of the metal and plastic baskets we fill with food at the supermarket. Imagine the wooden baskets we tote to picnics, or the "virtual" baskets we use when shopping for goods online.

Although they've changed and evolved with society, baskets continue to be useful tools and symbols of bounty and plenty. In that way, baskets weave together our past, present, and future in ways that few other objects can.



"CHANGE DOES NOT ALWAYS MEAN THAT A CULTURE OR CULTURAL PRACTICE HAS BEEN DESTROYED BY MODERNISM AND IS DEGRADING OR DYING OUT—MODERNIZATION IS NOT SYNONYMOUS WITH CULTURAL LOSS. BASKET WEAVING IS ALWAYS TRANSFORMING TO FIT THE CHANGING CULTURAL OBLIGATIONS OF THE WEAVERS AND THEIR COMMUNITIES."

Valerie Verzuh  
Museum of Indian Arts and Culture, New Mexico

# Credits

Through the collaborative process instituted by the Construction Authority, hundreds of people helped make the Gold Line Bridge a reality, including planners, designers, engineers, trades workers, support professionals, an artist, agency staff and others. Although we would like to provide credits for each, here is a highlight of some of the key players:

## METRO GOLD LINE FOOTHILL EXTENSION CONSTRUCTION AUTHORITY BOARD OF DIRECTORS

Doug Tessitor	Councilman, City of Glendora
Sam Pedroza	Councilman, City of Claremont
Ed Reyes	Councilman, City of Los Angeles
Keith Hanks	Councilman, City of Azusa
John Fasana	Mayor, City of Duarte
Bill Bogaard	Mayor, City of Pasadena
Lara Larramendi	Gubernatorial Appointee
Daniel Evans	City of South Pasadena Appointee

## METRO GOLD LINE FOOTHILL EXTENSION CONSTRUCTION AUTHORITY STAFF

Habib F. Balian	Chief Executive Officer
Chris Burner	Chief Project Officer
Crandal Jue	Chief Financial Officer
Mitch Purcell	Chief Contracting Officer, In-House Counsel
Gary Baker	Director of Construction
Lisa Levy Buch	Director of Public Affairs
Sylvia Beltran	Community Relations
Rodrigo Gonzalez	Media Relations

## HILL INTERNATIONAL, INC. TEAM

John Skoury	Program Manager
Lesley Elwood	Public Art Program Manager
Tanya Patsouras	Station Environment Coordinator
Wei Koo	Structural Engineer
Michael Estrada	General Counsel, Richards, Watson & Gershon



## DESIGN BUILDER

Skanska USA	Lawrence Damore, Project Executive
	Mike Aparicio, Executive Vice President
	Tim Wilson, Vice President Operations
	John Yen, Project Executive
	Jeff Jonker, Superintendent
	Troy Marak, Superintendent
	Justin Waguespack, Project Engineer
	Andrew Grubb, Project Engineer
	Kenny Glover, Project Engineer
	Trevor Kelly, Project Engineer
	John Ostler, Quality Assurance and Control
	Glen Curtis, Inspector
	Joseph Hernandez, Community Liaison
Design Concept Advisor	Andrew Leicester, Artist
AECOM	Pat Nicholson, Design Team Manager
	Rivka Night, Architect
	David Yee, Bridge Structural Engineer



## IN SPECIAL RECOGNITION:

The Construction Authority wants to recognize and thank Caltrans District 7 and the Division of Engineering Services, the California Highway Patrol, as well as the City of Arcadia staff and Police Department, for the significant effort provided in support of the Gold Line Bridge project over the last several years. Additionally, we want to sincerely thank our project neighbors for their patience during construction.