



Change and the Santa Clara Tower



Norm Spaulding Photo

By Doug DeLong

Many times polar opposites are intimately bound together. In electromagnetism, positive and negative electrical charges attract, providing the force that keeps electrons bound to atomic nuclei in all matter. Likewise, north and south magnetic poles attract, providing the force that points a compass needle northward.

So too, in historic preservation, there is an on-going process in which we must consciously and sensitively implement restorative changes to counteract natural forces of decay working to obliterate the cultural treasures we seek to preserve for the future. Throughout this work there is a constant tension between stasis and change. Even a simple act like a new coat of paint entails choices between preserving the history embodied in multiple coats previously applied versus removing them to provide a more stable foundation for the new coat.

From a number of standpoints the Santa Clara Tower and SBHRS' efforts towards it have been through many changes over the tower's operational life and our stewardship of it post-operation. It also seems that in the recent past and currently we are seeing

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some significant inflection points in those paths of change.

This article, which I expect will be the first of a number relating to the tower, seeks to lay out this landscape of change. In so doing I hope it will help more members become engaged with tower-related activities. To facilitate that process you will find historic photographs included in this article that even include rolling stock, plus a link to video! It is anticipated that later articles will get into detail on more focused topics, like the interlocking machine that our newsletter editor first approached me to write about.

Although they are inextricably intertwined, I address these changes and inflection points under a number of separate categories:

- **Previous SBHRS members' and others' efforts on tower preservation, restoration, interpretation, and presentation**
- **The tower building and its immediate built environment**
- **The track arrangement under control of the tower and its successor Control Points**
- **Railroad methods of operation and the span of control**
- **Signal technologies**
- **Peninsula rail traffic mix**
- **GRS interlocking machine**
- **Operational simulation**
- **Interlocking machine reactivation**
- **Tower visitor patterns**
- **Future SBHRS tower-related activities**

Previous SBHRS members' and others' efforts on tower preservation, restoration, interpretation, and presentation

I wanted to give this category top billing because without these prior efforts we might not even have a tower in our midst at the present time and certainly not one as well preserved. Personally I feel a huge debt of gratitude for being able to enjoy the fruits of those accomplishments. So I felt the need to acknowledge and honor those earlier efforts as the first order of business.

In preparing this article I sought out prior Block articles related to the tower and the editors were kind enough to refer me to three issues: Summer 2000 (Volume 9 Number 3), Spring 2002 (Volume 11 Number 2), and Fall 2002 (Volume 11 Number 4). We are reprinting two photos from the first and last of those issues to provide some visual linkage to that legacy, but I also want to acknowledge additional individuals beyond those mentioned in that prior ink, mention some research findings from those issues, and discuss some of the turnover in those working on tower-related efforts in the last few years. If I have left out anyone that should be mentioned, please bring it to my attention and I will attempt to correct that oversight in a future article about the tower.

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Join Your Local Chapter Of The National Model Railroad Association

OWR&N PASSENGER CAR RESTORATION PROGRESS



Work continues in restoring the Oregon-Washington Railroad & Navigation Business Car #184. The Air Conditioning system (HVAC) was 95% completed during the week of June 16th and is operational.

The goal now is to complete the following list of items, hopefully by the November Open House: Install, stain and varnish the wall paneling in the observation room and hallway leading to the dining room, repair damaged outside lettering (will be painted; not vinyl letters), repair roof leaks before rain, repair/replace light fixtures including those in the dining room. If time permits, the secretary's room will be painted. The lighting in the Observation Room is nearing completion. The fluorescent lighting behind the stained glass will have a diffusing material added to help reduce intensity and better show off the stained glass.

If you have any skills that might be of value in this restoration project, consider volunteering. Contact Robin Gilstrom to talk about what you can do to help.

Board of Directors Quarterly Meeting

The SBHRS Board of Directors met on Saturday, August 6th for their quarterly meeting. Highlights of some of the topics that were covered are:

- (1) Front Dock repairs have begun. Please contact Chris Ewing if you can help out.
- (2) The flooring in the hallway leading to the Waiting Room will be replaced. Ed Thelen is the Project Manager.
- (3) The next All Members Meeting is Tuesday, September 13, 2016 at 7 PM. Nominations will start for the Member At Large, who will serve as a non-voting representative for the Board. This member will be an intermediary between the SBHRS members and the Board. Only standard members can be nominated.
- (4) The National Model Railway Association will hold its 2021 national convention right here in Santa Clara. The SBHRS will be a central group during this convention.
- (5) The Covenant between the SBHRS and the Joint Powers Board, of which Caltrain is a subsidiary, will be renewed in 2017. This is the document that governs the relationship between our Society, and Caltrain/Joint Powers Board.
- (6) The south end of the depot will have to be repainted this summer. If you can help, please contact Jack Morash, or any corporate member. This project still needs a Project Manager.



Internet provider for SBHRS

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Photo 1 - Tower Upstairs Interior Restoration, Joe Hoffmann photo

The first photo, from the Summer 2000 Block, was taken on the occasion of completing upstair interior restoration on the tower. In it, from left to right, are Chuck Catania, George Holtzinger, Roland Trautwein, Ed Peterman and Walt Stephenson standing around the interlocking machine.

The article accompanying that photo also acknowledged the contributions of John Dietrich and Jack Morash to the restoration and mentioned Jim Holmes as a resource for then-planned interlocking machine reactivation.

I understand that several others also made significant contributions to tower restoration up to that point. Rick James actually started caring for the tower area while it was still in service by using spills from Granite Rock hoppers to provide a comfortable walking surface around the tower. He also kept the fence that used to be along the stub end of Benton painted. Larry Helling led early tower restoration efforts and manufactured replacement window sashes for two that were too badly deteriorated to save or had been removed for an air conditioner installation. For appropriate replacement material Doug Gross, who was assisting Larry, supplied well-seasoned redwood reclaimed from a deck that Doug was rebuilding. Ed Del Prete created a replacement window sill for another wounded soldier. Bob Dolci enlisted a number of volunteers from NASA Ames' DART (disaster and recovery team) to help with exterior surface preparation and painting. I also heard Robin Gilstrom was involved and saw Bob Marshall in some photos taken while a wall was being installed downstairs to shore up the second floor because SP had removed some original downstairs walls.

The Spring 2002 Block article described the model board restoration and mentioned Jerry Avallone in addition to those cited above. That article proved to be an interesting piece of tower research material because it clarified that the restored model board used the original sheet of metal and just had the surface and markings recreated for a more presentable appearance. Since there are not any additional lampholder holes in that panel we now know it post-dated certain previously-used levers being taken out of service. That supports the notion that track occupancy might not have always been provided within the tower's plant.

The Fall 2002 Block article covered the tower's dedication ceremony, with Jim Holmes' turn at the mike being featured on the cover page as in the second photo. To the right in the photo is Santa Clara Council Member Jamie Matthews, who spearheaded the

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dedication ceremony and the presentation of a city plaque commemorating the event.



Photo 2 - Jim Holmes Speaking at Tower Dedication in 2002, Joe Hoffmann photo

In addition to those three, somewhat historical, Block editions brought to my attention by the editors, the Summer 2015 (Volume 23 Number 3) Block featured a cover story about the improved walkway to the tower that was recently completed. Bob Marshall, Jack Morash, Steve Costa, Vance Johnson, Teresa Nemeth, Ed Thelen, and Robin Gilstrom participated in the work party to complete that project, improving access to the tower entrance.

Another recent improvement relative to the tower is a wireless extension of the depot network to the tower and integration of the tower into the VOIP telephone system now serving the depot. Web cams mounted trackside and connected to the network may provide views of passing trains if a suitable video hosting arrangement can be developed. Micheal Stockwell and John Wiley did those installations.

So what happened with those earlier plans to reactivate the interlocking machine and why are some new faces being connected with the tower these days? As is often the case, it's complicated. As many already know, Ed Peterman passed away several years ago and Jim Holmes left this world more recently. Some time ago George Holtzinger moved out of the area; aside from tower activities, we sure miss his service on the weed control detail.

Chuck Catania had been very active in SBHRS and very passionate about preserving the tower in particular - as one of those articles mentioned he was an SBHRS Director at the time. Unfortunately, when Caltrain broached to SBHRS the possibility that the tower might have to be relocated on account of Caltrain construction, Chuck could not get enough votes from his fellow Directors for the SBHRS Board to adopt the response to Caltrain he advocated. I gather he felt his principles of preservation were not being supported by SBHRS so he removed the simulation equipment he had installed downstairs in the tower and some collectables he had placed upstairs and severed ties with the organization. I wish we had not lost Chuck as a participant in tower activities, but that was his decision.

Walt Stephenson had been Chuck's right-hand man for some of the tower painting and docent activities during Open Houses and stepped into the void when Chuck departed, hosting visitors upstairs during several Open Houses with Teresa Nemeth's assistance. Over time Walt's health has declined to the point that he is no longer able to participate in SBHRS activities. Teresa took over leading the docent activities until her personal situation required her to step away from active participation in SBHRS activities for a time. She brought a valuable broader historical perspective that I hope she can help expand on if she is able to resume.

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Larry Helling, after leading early restoration efforts, supported Chuck's desire to assume the lead role. Larry later moved on within SBHRS to construct the ADA ramp from the platform to the trackside loading dock at the depot, a project motivated by his wife's condition and enjoyed by many others since it was completed, including former Block editor, Joe Hoffmann. Larry is currently focused on caring for his wife, whose condition has declined significantly since the last time she was able to enjoy a visit to the depot museum, although he and Vern Deto worked on some tower painting within the last few years.

Upon his retirement from his day job in 2012, founding member Bob Dolci moved to New Mexico. Doug Gross is no longer active in SBHRS. Robin Gilstrom continues to be active in SBHRS on a number of other projects. Roland Trautwein is retired in Gilroy and no longer involved in SBHRS; he may have taken up with another group closer to his home. John Dietrich and Jack Morash are still around, but John took on another tough restoration project, the south windows of the Boardroom, and Jack got himself promoted, so he is focused on running SBHRS as a whole now, as is Bob Marshall.

Thus, over time the list of potential suspects for leading tower efforts has been getting thinner and thinner. Apparently I did not stand far enough out of the line of fire to avoid getting drafted.

The tower building and its immediate built environment

It would be wonderful if we had our hands on a dedication photo marking the tower's completion of construction in 1926 or its commissioning into operation in 1927, but at the present time we have a 27-year gap in our visual record of the operational history. Nevertheless, we are fairly certain the tower is sitting on its original, poured-concrete, slab foundation in its original location.

John Harder took the photo below of the tower from the former Brokaw Rd. grade crossing over the Peninsula mains and Newhall yard north throat. Dave Hambleton generously donated a print of this photo and another taken in the same area by Harre Demoro around the same timeframe to SBHRS and has provided us with digital scans of those negatives in his collection. The Demoro photo was taken closer to the tower facing more toward the north and features many of the same elements as the Harder photo. Those in common include the tower itself, speeder shed (peeking out from the right side of the tower in the Harder photo), high searchlight signal for the Peninsula main to San Francisco, small outbuilding (behind the high searchlight signal case and late model Ford in Harder photo), train order stands for both Peninsula mains (only San Jose bound one visible in Demoro photo), poleline signal wiring exiting the south wall of the tower near the top of the lower floor, and other signal wiring exiting the east wall of the tower below the south window and just above ground level. The tool shed on the left of the Harder photo is out of frame in the Demoro shot, but the latter shows a low-band VHF television antenna above the packing company behind the tower (hidden behind the tower in the Harder shot).



Photo 3 - Tower in 1954 from Brokaw Rd. Crossing, John Harder photo, Dave Hambleton collection

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Harder's records indicate a date of 1954, although some of his other photo dates are understood to have proven to be less than precise. Rick James and Ed Del Prete examined the print of the Harder photo and their consensus identification of the vehicles from left to right is: 1941 Chevrolet, Plymouth or Frazier (partially hidden behind Model A), Ford Model A (made from 1928 to 1931), and 1949 or 1950 Ford (partially hidden behind signal case). Thus, the photo is almost certain to have been made sometime after 1949.

The Demoro photo also indicates a date of 1954 but, in contrast to the palm trees behind and north of the tower in the Harder shot, it shows stacks of fruit boxes and lugs at the packing company behind the tower, where the Santa Clara Police Department headquarters is now located. We aren't certain whether this reflects just the different viewpoints and angles of the two photos or also a difference in the dates they were taken.

As mentioned above, both photos show a small outbuilding, no longer present, that was between the tool and speeder sheds on the west side of the tower. They show what appears to be utility power wiring coming down from the pole behind the high signal in the Harder photo to that small peaked-roof structure. Whether that merely housed components of the utility AC power to the tower, played a part in the tower's signal electrical system, or served some other purpose is not yet known.

Notably missing from both the Harder and Demoro photos is the silver bungalow that was installed south of the tower and connected to it via two horizontal conduits. This tells us that change occurred later in the tower's operational life.

The track arrangement under control of the tower and its successor Control Points

Although we tend to think of railroads and their networks of trackage as unchanging cultural features of the landscape, upon closer examination they are more like living organisms - constantly evolving in response to changes in business and technology. I am going to present this category in reverse order, starting from the present and stepping back toward the past at least a few decades. To go back farther than that, future research will be needed to develop a clear picture.

At the present time the area of Southern Pacific trackage once controlled by the Santa Clara Tower and its single human operator is under the control of dispatchers working for Transit America Services, Inc. (the current contractor hired by the Peninsula Corridor Joint Powers Board to operate the Caltrain Peninsula Commuter Service) in San Jose and Union Pacific in Omaha, Nebraska. Those dispatchers remotely exercise their oversight via four Centralized Traffic Control (CTC) Control Points (CPs).

In the first current photo you see the trackage of CP Coast and a teasing glimpse of one switch of CP De La Cruz at the bottom edge of the frame. CP De La Cruz is a universal crossover north of CP Coast, incorporating the lefthand (LH) crossover between the Peninsula mains (previously part of the tower-controlled trackage and an earlier post-tower CP Coast) and a new righthand (RH) crossover that supported construction of the island platform and associated Santa Clara Caltrain station reconfiguration. Aside from the CP Coast trackage, the other striking feature of this photo is the decidedly passenger-centric nature of the rail facilities - particularly in comparison to the historic trackage photos that follow.

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The SBHRS website

Is at:

www.sbhrs.org

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Photo 4 - Current CP Coast and CP De La Cruz Trackage, Jim Bartolotta photo

The second current photo, from a slightly different vantage point, shows better the CP Franklin trackage beyond the depot building. CP Franklin was first created at the time the tower was deactivated, consisting of a RH crossover and a turnout to the Santa Clara Drill. This was very similar to the south (RR east in SP days) portion of the tower plant in its final days. To support the station re-configuration project a LH crossover was added, making CP Franklin also a universal crossover.



Photo 5 - Current CP Franklin Trackage, Jim Bartolotta photo

The nearest cantilever seen in the first current photo is a little unique in that the signals facing the camera are part of Caltrain's CP Coast, while those mounted on the far side for northbound traffic are part of UP's CP CO045 CP Coast. The third current photo shows that latter CP's bungalow and antenna linking it to Omaha, as seen from the sidewalk on the north side of the De La Cruz overpass. The large white building in the right background is one of the many data centers that have sprung up in recent years to take advantage of Santa Clara's low electric rates and the proximity to long-haul fiber optic backbones strung along rail corridors.

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Photo 6 - Current UP CP CO045 CP Coast Bungalow and Antenna, Jim Bartolotta photo

As hinted at above, the current collection of four CPs was preceded by two, an earlier CP Coast and an earlier CP Franklin. Those were created when the tower was retired from service. The electronics for that initial CP Coast were housed in a large beige bungalow that sat on the west side of the ROW a short way north of the tower. It wasn't particularly photogenic and I didn't have ready access to an image of it - no loss there.

Toward the end of the tower's operational life another change was the restoration to operation of SP 2472, which had sat rusting at the San Mateo Fairgrounds for decades. A Peninsula excursion with the 2472 leading an early livery Caltrain F40 was captured in 1991 near the tower. The crowd of railfans to the right of the tracks are standing where the initial CP Coast bungalow would land a few years hence. In contrast to the current photos, note the Newhall Yard trackage still in place with a good number of freight cars present. The passenger boarding facilities (behind the special train) were relatively primitive, non-ADA-compliant, and required observation of the Holdout Rule due to passengers walking across active main track to reach some trains.

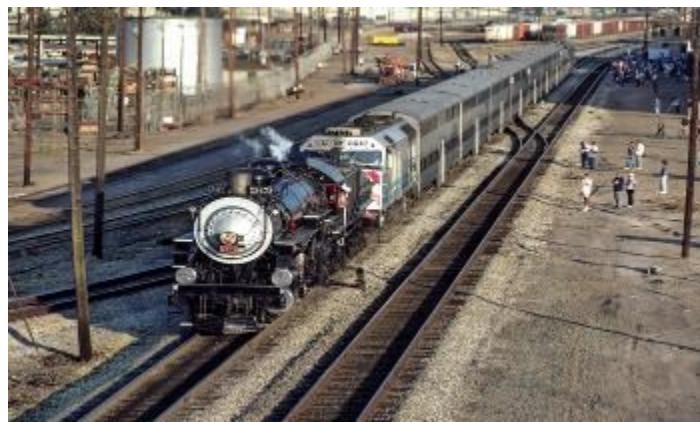


Photo 7 - September 1991 Steam Excursion at Tower, Jim Bartolotta photo

What a difference a few years makes. In 1984, just seven years earlier, an SP 4449 excursion with a beautiful parade of Daylight-painted cars was captured as it passed by the tower on its way to San Francisco. As it happens, our esteemed editor, Mr. Norm

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Spaulding, was aboard that train and shooting video to the extent the technology of the day and other railfans crowding at the vestibule doors would permit. He reports that for the entire trip from Sacramento to San Francisco the only time the wheels stopped turning was briefly at Oakland. Norm captured the sights and sounds of portions of the Oakland-to-San Jose segment and has posted that video so others can participate, if only vicariously, in the thrill he experienced that day. Click this link to see this video: [<http://westcoastspecial.com/4449.html>]



Photo 8 - May 1984 Steam Excursion at Tower, Jim Bartolotta photo

Compared to the 1991 photo, look at all that action in the yard - it's plugged with cars, caboose, and engines everywhere! A little less exciting, note the industrial spur track west of the Peninsula mains in the foreground that had been removed by the time of the 1991 photo. Between the 4449 and the camera is a lefthand crossover between yard leads and the main toward San Francisco, then at the bottom of the frame is one switch of the righthand crossover from that main to the Mulford main to Oakland. The other switch of the latter crossover was located under the De La Cruz overpass, requiring the Mulford line home signal controlled by the tower to be north of that overpass.

Those two historic photos also show how much better the tower looks today after SBHRS' TLC compared to the monicolor scheme it wore in its latter years of operation.

Unfortunately, the John Harder B&W photo shown earlier in the article reveals little about the trackage arrangement of that 1950s time and there was over two decades of tower history before that.

We have located some historic track schematics, yard track capacity charts, and surveyed track drawings of various dates to extend our knowledge of the tower's trackage farther back in time. But much more research, possibly using our own library, that of the California State Railroad Museum (CSRM) in Sacramento, and other resources will be needed to grasp the entire history, if that is indeed possible.

Examination of the tower's interlocking machine is also providing some tantalizing clues to those early days. Many lever positions thought to have never been used show subtle signs of having been utilized in the tower's earlier days. More on that as I get a bit

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more technical discussing the interlocking machine below.

Railroad methods of operation and the span of control

When the first railroad locomotive was invented, probably nobody was concerned about it running into another one. In the years since that naive perspective has obviously changed, with many different methods of operation being developed along the way to reduce the chances for accidents.

Here I won't even try to expand all the alphabet soup that these are known by, including ATC, PTC, ATS, CTC, TWC, DTC, ABS, BRT (not bus rapid transit!), TT&TO, and more. I will simply point out that some of these methods depend upon tracks being equipped with reliable occupancy detection circuits and associated electrically-operated signals, while others can function in "dark" territory not so-equipped. That distinction bears upon our efforts to fully understand all of the tower's and its interlocking machine's history.

The various methods of operation also bear upon the span of control that can reasonably be exercised by an individual tower operator or dispatcher. With more modern methods, like ATC, PTC, and CTC, an individual dispatcher can exercise control over hundreds of miles of railroad, as Union Pacific's desk #58 currently does in this part of northern California. In more primitive methods, a tower operator might exercise control over trackage in the immediate area of the tower, often within visual range. On the Peninsula Corridor, it was the greater span of control offered by CTC and other methods that led to the retirement of manned towers along the line, including the Santa Clara Tower.

But it is slightly ironic that the area of trackage once controlled by a single Santa Clara Tower operator per shift has now been replaced by 4 separate CPs directed by dispatchers half a continent apart.

Signal technologies

The invention of steam locomotives and the recognition that organized means were needed to keep them from getting into trouble did not have the good grace to wait for the availability of electricity. The earliest signals were moved directly by human actions and, if nighttime visibility was needed, oil lamps or the like were the illumination solution.

Once electricity came on the scene, hand-operated semaphores could be operated by electric motors and other devices and illuminated with electric lights.

Searchlight signals sought to improve reliability and reduce maintenance by eliminating the large blades found on semaphores, shifting the moving parts into a housing, using a white light source at all hours, and filtering that source via a movable roundel assembly to display the appropriate aspect.

Position light signals, color position light signals, and colorlight signals (the latter currently deployed at CP Coast) have no moving parts at all, providing even higher reliability and reduced maintenance, particularly when LEDs take the place of incandescent lamps.

When electricity first became available it could be produced by rotating machinery - a generator to produce DC or an alternator to produce AC - or by a primary (e.g., dry cell) battery that would have to be replaced when it became depleted. Storage batteries could store DC from a generator for later use and provide back-up in case of a generator outage. But in those early electric days there was no electronic means to convert between AC and DC or to change DC voltages - motor-generator sets were the only means to those ends.

In that context, the early 20th century General Railway Signal (GRS) publications show interlocking machines operating solely on 110 Volt DC, with motor-generators and storage batteries supplying it.

Later generation signal equipment utilizes transformers and solid-state rectifiers to convert AC utility power to various DC voltages

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NEW BOARD POSITION

The Board of Directors held its last Board meeting on Saturday, August 6th. One of the more important things passed was the new Board Position, Member at Large. This is the position we took a poll on a couple months ago. This person is the non-Corporate Board position. The description of this position is:

Member at Large

This position is a Board Guest and participates in all discussions of the Board except personnel matters. This person does NOT have voting rights. This position has a 2 year term and will be voted on by the non-corporate members at the same time the regular board positions are voted on. They are a direct representative to the Board for the non-Corporate members. Duties would include keeping track of members who are willing to volunteer to help complete the work on the depot. Be directly involved with Project Managers and the Facilities Director to get workers as needed. Other duties as required.

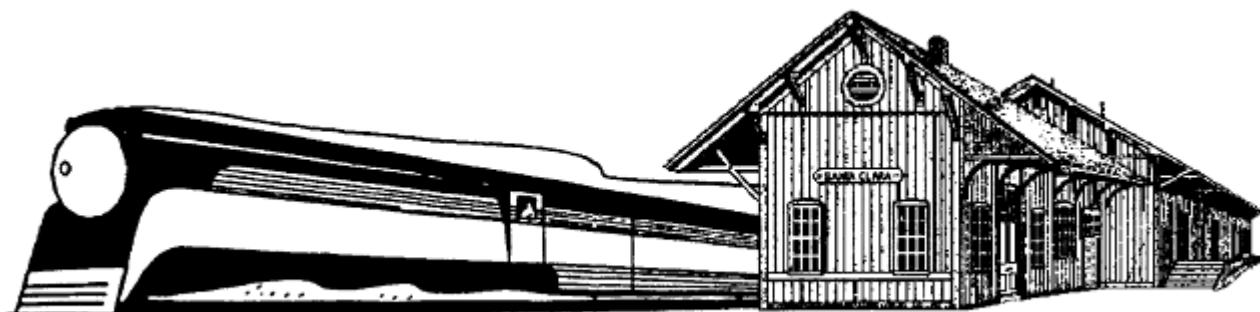
This position will be filled during the upcoming Board Member elections later this year. For the Standard, non-Corporate members, this is your representative to the Board. The elections start at the All Members Meeting in September with nominations. Start thinking of whom you would like to have in that Board seat for you. Or maybe you would like to get yourself nominated.

Mark your calendar for the next All Members Meeting, September 13th at 7:00PM. This is the 2nd Tuesday in September.

Jack Morash

Chairman of the Board

SBHRS



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needed to operate signal equipment, generally restricting higher voltages like 110 Volt DC to powering switch motors. Track circuits used to detect the presence of rolling stock almost universally utilize low DC or AC voltages that do not constitute safety hazards.

This pattern of signal technology development leaves us uncertain as to the tower's early history. Some sources indicate that H-2 searchlight signals did not become available until the mid-1930s. A Union Switch & Signal rectifier (i.e., battery charger) test procedure (for devices similar to one bolted to the inside of the north downstairs tower wall) available on the web is dated 1935, an indication of when alternatives to motor-generators became commercially available. It seems likely that when the tower was first built all of the signal equipment ran off of 110 Volt DC that was supplied from a motor-generator and a storage battery array of 55 (or some multiple thereof) lead-acid cells.

If that was the case, features we today assume all signal equipment must provide, like track occupancy detection and signal time locking, may not have yet been provided. However, artifacts in the tower provide fairly conclusive evidence that they were installed at some point in its operational life. We need to do further research in an attempt to figure out just when.

Peninsula traffic mix

Although it wasn't a topic I originally had in mind for this article, the set of photos presented above cried out for addressing the dramatic shift in Peninsula rail traffic over the last several decades.

From the time the Peninsula first was traversed by rail in 1863 until the mid to late 20th century, San Francisco was a major ocean-going cargo port, with other ports around the bay playing more supporting roles in water-borne freight. For most of its existence the Peninsula rail line served to connect the Port of San Francisco with the rest of the country, supporting the large Bayshore yard just south of San Francisco and day and night freight runs up and down the Peninsula line. At the south end of the bay, College Park yard, later augmented by Newhall yard, supported the local agricultural industry's and other commercial enterprises' freight needs.

These steady sources of rail freight business started to unravel for two main reasons, the construction of the nationwide US and Interstate highway systems and the conversion of ocean freight from breakbulk to containers. Highway system development provided shippers a viable land transport alternative to rail, particularly for time-sensitive cargos like perishables. This drove much traditional rail business toward trucks. On the ocean side of things, San Francisco lacked sufficient real estate to become a viable container port so, independent of longshoreman militancy, Oakland was destined to become the new dominant player.

In the 1984 photo of the 4449 steam special you can see Newhall yard toward the end of its hayday, then by the 1991 steam special the tracks in the yard are much less busy. That also overlaps the takeover of Southern Pacific's Peninsula Commute operations by first the California Department of Transportation (Caltrans) and later the Peninsula Corridor Joint Powers Board (JPB), both under the Caltrain brand. The 1991 photo shows an F40 in early Caltrain livery behind the 2472 on the point.

Today, the Peninsula Corridor is a very passenger-centric rail line, with Caltrain handling more than four times as many average weekday riders as when SP threw in the towel and sold the corridor. What freight traffic remains is handled by some local switch jobs and haulers, with most moves at night to avoid conflicts with the robust passenger schedule. The appearance of the Santa Clara station facilities in the current CP Coast trackage photo is certainly consistent with that new reality.

With some recent JPB actions, if the requisite state and federal funding pieces come into play as planned Caltrain could begin electrified operation under 25 kV catenary around 2020. A potential rub in relation to the tower is the electrical safety clearance envelop for that traction supply voltage. Because the electrification infrastructure procurement is for a design-build contract, the

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detailed design of the catenary and support structure has not yet been developed. We certainly hope that will not result in a requirement that the tower be relocated, but that possibility cannot be ruled out at this point in time.

GRS interlocking machine

The elephant in the living room on the second floor of the tower is its interlocking machine. As indicated at the outset, this topic will require a rather extensive article all its own in a future issue. Thus, I will just briefly introduce it here.

Fully enclosed in elegant varnished oak cabinetry with glass windows on top, this electro-mechanical interlocking machine was built by the General Railway Signal (GRS) Company of Rochester, New York, having earlier been headquartered in Buffalo, New York. GRS began delivering their Model 2 interlocking machine some time before 1905, with detachable handle grips available in a variety of colors. Apparently interior decor was not a big selling point for railroads and some time before 1913 GRS developed the Model 2 Unit Lever Interlocking Machine, as installed in the Santa Clara Tower. This variant made the metal handle grips an integral part of the lever itself.

Although GRS documents refer to this as an electric interlocking machine, it definitely has mechanical components as well. Perhaps omitting mechanical from the description was a bit of marketing license on GRS' part. At any rate, this machine is a very clever amalgam of mechanical and electrical components. Borrowing from earlier all-mechanical (AKA Armstrong for a good reason) interlocking plants, it incorporates a mechanical digital logic array to preclude unsafe combinations of operations. It also has what amounts to mechanical flip-flops - devices that latch a logic state much as an electronic flip-flop would today in a computer.

The electric side of the machine eliminates the pushrods connecting all-mechanical machines to the field switches and signals by linking a contact assembly (Circuit Controller in GRS-speak) to each lever. Electricity thus controlled powers switch motors and signals. Electrical feedback from those devices is also an integral part of the machine's safety design.

Although we have been able to peruse original volumes of GRS publications from 1905, 1913, and 1917 in the collections of local railfans, we are fortunate that electronic copies of these are now available in PDF format, eliminating the risk of damaging those fragile originals. The 1905 volume, although pre-unit-lever, provides very useful illustrated parts breakdowns of the machine's internal workings, including part descriptions and prices. The 1913 volume indicates some of the differences implemented in the unit lever variant, while the 1917 volume is essentially a reprint of the 1913 on slightly thinner paper.

From these references we have determined that the original GRS design required two separate levers (one long and one short) to control the two switches of a crossover, with the short, handle-less lever being slaved to the long one mechanically via a pin through them both. Short levers and other artifacts present in the Santa Clara machine are consistent with that original design, but those short levers had all been deactivated (Circuit Controller and slaving pin removed) some time before the tower was retired.

The Santa Clara machine also was apparently partially converted to low voltage operation at some time in its service life. Whether this corresponded with the arrival of the bungalow south of the tower is not yet clear.

Additionally, artifacts in the machine indicate that a number of lever positions previously thought to have never been used must have been operational, likely in the as-delivered configuration. Also, one lever that controlled a crossover lacks a short mate, indicating that crossover was probably added after other crossovers had been converted to single-lever operation and all short levers deactivated.

Although we haven't yet completed full reverse engineering and validation of the interlocking bed versus the assumed track plan, we do have a good grasp on the basic interlocking machine operation and some of the changes it went through during its operational life. However, those changes apparently evolved much more than was initially evident and there is still a good deal of research, analysis, documentation, and reverse engineering to be conducted.

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Operational simulation

As an interim measure pending reactivation of the interlocking machine, an operational simulation has been implemented in the tower. Initially this was done via hardware and software installed by Chuck Catania, but he chose to take those things with him when he left SBHRS. Subsequently they were replaced by items supplied and programmed by Craig Williams. The operational simulation shows activity on the model board and signal indicator panel below it representative of typical routes through the plant that was under control of the interlocking machine. At the present time the simulation just continuously cycles through a fixed set of routes.

Once the interlocking machine is reactivated, the levers would be able to control the choice of route and trigger simulated movement of a train through a route when the entrance signal lever is moved to clear that signal.

An even more elaborate simulation would present typical rail traffic for the operator to route through the plant without delay. We are quite a ways from achieving that objective, but would like to get there. But all these fancier simulations will require that the interlocking machine be reactivated for demonstration purposes.

Interlocking machine reactivation

At the present time we are able to manipulate a lever for visitors to demonstrate the linkage between it and the interlocking bed, but we cannot manipulate the machine in any operationally-meaningful way. Aside from mechanical maintenance (a relatively tedious, but straightforward task) the main impediment is that manipulation of switch levers requires energizing their locking magnets and manipulation of both switch and signal levers requires energizing their indication magnets. All those magnets are designed to only be energized briefly, so the power to them needs to be turned on and off in a timely manner to avoid burning them out.

Electrical measurements have shown that the locking magnets are low voltage, so driving them can be done directly by the type of modular process-control hardware the current simulator is built from. Likewise, sensing contact closures in the interlocking machine directly with process control input modules should be straightforward. Unfortunately, the indication magnets (of which there are many more) are high voltage (110 Volt DC). The process control output modules typically can handle AC voltages that high or higher, but only low DC voltages. Therefore some interfacing circuitry will likely be needed to drive the indication magnets.

The need for 110 Volt DC can be both a problem and opportunity. We need to develop a supply for it and it is a high enough voltage that more care needs to be taken from a safety standpoint than with voltages below 24. The opportunity side is the upstairs power control panel might be energized so the meters would indicate and the lamp light, but an enclosure (perhaps clear rigid plastic) would need to be placed around it for safety reasons. Such an enclosure would also have the added benefit of preventing damage to the power panel's elderly components.

Tower visitor patterns

When I first started spending time in the tower during Open Houses (when Chuck Catania was heading up the docenting, assisted by Walt Stephenson) many of the tower visitors were fairly hard-core railfans. You know the type - at least one camera strap around the neck. Their numbers also tended to be somewhat sparse - groups of less than half a dozen at a time, with frequent gaps between groups that afforded Chuck, Walt, and I considerable opportunities for conversation.

After Chuck chose to leave SBHRS and Walt took over as the head docent, sometimes assisted by Teresa Nemeth and myself, the pattern was similar before and after the tower tour hiatus caused by the Caltrain station reconfiguration. There didn't seem to be much change after Walt had to bow out due to his declining health, leaving Teresa to do presentations with my help.

About the time Teresa's personal situation required that she stand down from SBHRS activities, including being a tower docent during Open Houses, we were blessed by a significant increase in publicity outreach leading up to each Open House. This brought an influx of new attendees to the depot-centric aspects of the Open Houses as well as the tower.

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As a result, most tower visitors for the last couple of years have been first-timers up there and they have been coming up in greater overall numbers. Frequently, I find myself making continuous presentations from the time the tower opens until it closes, generally to groups of 10 to 15 visitors in each group. So there has been both a quantitative and qualitative shift in the visitor population.

Michael Stockwell made the suggestion that SBHRS members stationed outside the tower start taking a more active role in the presentation process. I think that is an excellent idea that can be broadened to present things beyond the tower itself.

For example, during Open Houses there is so much going on inside the depot building that historical presentations (other than the static artifact displays) are not really practical in that setting. Many attendees may not really grasp the historical status of the building that they are enjoying model trains and layouts or having lunch inside of nor the context of the larger historic site they are present on.

Additionally, and I have to acknowledge Teresa for bringing some of this to my attention, there is the wider historical context within which a railroad was constructed between San Francisco and San Jose before the Transcontinental Railroad was completed. The pre-rail alternatives between those cities were stage coaches and steamships, which were either very uncomfortable or rather pricey. There was a definite niche for the railroad to fill - shades of Silicon Valley! The local farming, food processing, and other industries also form parts of that larger historical context.

During Open Houses, the relative calm of the area around the tower, tool shed, and speeder shed seems like a good setting to make live presentations of this type of historical interpretation material to the attendees. But doing so will require both developing those presentations and many more members stepping forward to make them. We might even consider adding "Historic Site Tour" to the Open House branding.

Aside from making the members' tasks outside of the tower more important and interesting, presenting as much historical information as possible outside the tower will also have the benefit of freeing up visitor time inside the tower for presentation of the interlocking machine and tower operator duties, helping us manage the keen visitor interest evident in the last couple of years.

Future SBHRS tower-related activities

In addition to the potential for expanding the docent program in the tower vicinity as discussed above, there are many things that need to be done to fully understand the tower's history, develop enhanced demonstration capabilities regarding the interlocking machine, and handle the maintenance and preservation tasks that present themselves.

This isn't the place to go into details, but in a recent communication to the SBHRS Board I grouped those activities under the following broad categories:

- Visitor safety and asset protection
- Tower building maintenance and restoration
- Interlocking machine research, reactivation, and demonstration

Like railroading itself, railroad preservation is a team sport and many different skills will be needed to accomplish these things. There is historical research needed into employee timetables, track diagrams, photographs, and manufacturers' literature. There is building construction-type work (carpentry, painting, flooring, etc.). There is mechanical maintenance work on the innards of the interlocking machine. There is electrical, electronic, and software design and implementation to reactivate the interlocking machine.

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As they say, it's gonna take a village. Please join us in that journey as we move forward regardless of whether you wish to be a bemused observer or a more active participant.

About The Author

While fascinated by trains at an early age, Doug's interests ran more toward electricity and electronics, leading to his electrical engineering education at Rice University in Houston. He earned a masters degree and admission to the PhD program but left college after two more years of coursework sans doctorate. Taking a bit of an intellectual breather, he did electronics repair at a local hi-fi, video, and commercial sound retailer for a few years before moving to Mountain View in 1975 as a result of being hired into the defense electronics industry. That provided the opportunity to start riding the Peninsula SP commuter trains to and from San Francisco while the flat-sided galleries and single-level coaches with rotting wood windows were still in service.

After taking a voluntary separation program in the early 1990s, doing a few consulting jobs, and looking at the options available in the commercial electronics industry, he determined that his future did not lay in that direction. He was a volunteer Graffiti Buster in Mountain View for a few years and got paid for some public service during both the 2000 and 2010 Census.

With a little more free time on his hands in this part of his life, his latent railfan persona seems to have started emerging more from the closet. While Chuck Catania and Walt Stephenson were finishing up painting the downstairs interior of the Santa Clara Tower, Doug started hanging out there on Saturdays during at least a portion of their work sessions, beginning to learn about that unique facility. When Chuck and Walt would host visitors during Open Houses, Doug would spend hours with them upstairs listening to the presentations and getting into various discussions whenever there was a lull between visitor groups.

After Chuck made his decision to leave SBHRS, Doug continued to assist Walt and Theresa Nemeth while they were serving as tower docents during Open Houses. After the hiatus in tower Open House visits due to a major reconfiguration of the passenger facilities at the Santa Clara Caltrain station, Doug continued to assist Walt and Theresa as long as they were able to continue as docents. When their various personal circumstances no longer made that possible and no SBHRS members had signed up to open the tower during an Open House, Doug made himself available for that duty. After a few more Open Houses, one Saturday, as he was enjoying the Geezer Bench at the depot, he was informed that he had been made a member of SBHRS by action of its board.

Subsequently, he has continued to host visitors upstairs in the tower during Open Houses and a recent Santa Clara Historic Home Tour that included the depot and tower. He is also working to restart the process of reactivating the interlocking machine for demonstrations and to address a number of other restoration and maintenance issues connected with the tower. He feels extremely indebted to those SBHRS members (and others) who saved the Santa Clara Tower once it was taken out of active service and did such an amazing initial restoration job on that structure. Hopefully, through his efforts and those of other members, people will be able to enjoy that look back into local railroad history indefinitely.



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