APPENDIX H: TRACK SHIFT WORKS

SCOTT BOULEVARD TO GILROY
ALTERNATIVE 4
CONSTRUCTABILITY ANALYSIS

GENERAL CONSIDERATIONS FOR TRACK WORKS

December 2018

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SCOTT BOULEVARD TO GILROY. ALTERNATIVE 4. CONSTRUCTABILITY ANALYSIS. GENERAL CONSIDERATIONS FOR TRACK WORKS

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1. WORKING APPROACH

1.1 Purpose

The purpose of this report is to define the improvements to be made in corridor to increase its performance so that in the future it can be used by Caltrain, UPRR and high speed.

For this reason, a series of construction phases and construction procedures are proposed that minimize the traffic disorders during the works and making the circulation through the corridor compatible with the works of modernization of the line.

Currently, San Jose to Gilroy Corridor is operated by Caltrain and UPRR. Caltrain provides commuter services between both cities and UPRR freight services. In the future, this corridor will be used by high-speed, commuter and freight circulations. The line adaptation will involve the realization of a series of works. The planning of these works has been carried out reducing the impact to the current services, for this reason the constructions phases have been adapted.

In addition, they have taken into account the indications of Caltrain in terms of temporary windows to undertake the work.

1.2 Existing Operational Assumptions

The works along the corridor, are mainly consisting on track realignment along the route and track layout reconfiguration at some stations. Maintaining the service in operation under an electrified line is the main assumption considered to develop the inception and organization of the works to adapt the line to the future blended system including high speed trains.

The definition and organization of the construction described herein was developed to comply with the criteria included in the “Caltrain Operating Conditions and Constraints” (RFP Design-Build Electrification Services, 2014) developed for the Caltrain electrification project (CalMod). The guidelines for construction are based on taking advantage of the lower density services on weekends by running service on a single track in segments and conducting preliminary and follow-up activities during night periods without traffic. According with the CalMod criteria, this approach will be managed within a flexible frame: “When possible, Caltrain will maintain an operating profile that matches the 2014 operation. However, adjustments will be made as construction and ridership necessitates”.

The track realignment construction is being defined based on the same criteria: working in single track by segments on weekends and on both tracks night both closures. Due to the nature of the construction for of the trackway, the needs of track possession will be substantially greater than the required just for building the OCS, but it will be maintained within the frame of the main criteria.

Regarding service operations, it will be necessary to take into account that some temporary speed restrictions will be introduced in limited segments; crossovers functionality could be temporarily limited during relocation works and at critical stages some stations and platforms could be closed to carry out special tasks.

In summary, the assumptions considered are:

- The line is in operation from Scott Boulevard to Gilroy and the OCS is in service between Scott Boulevard and CP Michael in the corridor prior to construction.
- The track realignment construction will be carried out according to track possession work windows:
    - Weekday days, each day (Monday-Friday): Mid-day during week between morning and afternoon rush hours. Single tracking 9am – 5pm.
    - Weekday Nights (Monday and Thursday only): Single tracking 8pm until 4am, Monday night and Thursday nights, with both tracks out of service after completion of revenue operations 1am until 4am.
    - Weekends (Friday night to Monday morning): Weekend, single-tracking, 56-hour continuous work window from 8pm Friday night until 4am Monday morning, with both tracks out of service after completion of revenue operations 1am until 4am Friday, Saturday and Sunday night.

  The above Work Window hours include the track time required for mobilization and set-up.
- Station platforms will be closed occasionally.
- Speed restrictions will be limited to the minimum required period.
- Crossovers functionality could be temporarily limited during relocation works.

1.3 Regulations Applied

The regulations applied for the checking of the geometric layout of the Scott to Gilroy realignment are as follows:

- “California High-Speed Train Project Design Criteria September 2014, Rev 2.
- SECTION 01040. WORK HOURS AND TRACK ACCESS of the CalMod Design-Build Electrification Services.

1.4 Analysis Assumptions

Currently the San Francisco to Gilroy Caltrain corridor is not electrified, but it is assumed to be for the purposes of this study. The segment between SF and SJ is assumed that the electrification is complete. The segment between SJ and CP Michael only the right track is electrified. The rest of section is considered without electrified.

The main track profile is identified on the proposed plans and existing corridor track charts for the northbound track (San Jose to San Francisco direction) only. It is assumed that the southbound track (San Francisco to San Jose direction) profiles matches the northbound track, for both the existing and proposed alignments.

It is important to note that there is no information for the thickness of the ballast layer nor the condition and characteristics of the railway platforms. Therefore in this study it will only be reflected if there will be increases or decreases in the future track level regarding the existing one.

1.5 Input data

The starting point for the analysis of this adaptation is the developed within the study and is grouped as it follows:

- Current Situation:
  - Layout file: TT-Existing-2016.alg
  - File dgn: X-FJ-TT-ALGN-EXST-CALTRAIN-2016.dgn
- Future situation:
  - Layout file: Alt4-CPCST-CPLK.alg
  - File dgn: X-JM-TT-ALGN-PROP-ALT4-CPCST-CPLK.dgn Scott to CP Lick
  - File dgn: X-JM-TT-ALGN-PROP-ALT4-CPLK-GLRY.dgn CP Lick to Gilroy

2. CURRENT SITUATION

The existing Caltrain corridor is a non-electrified, two track configuration, with shared commuter service (operated by Caltrain) and freight service (operated by UPRR). The main purpose of the existing corridor is to provide a service for commuters and short distance journeys. Construction of the CalMod project, prior to the construction of High Speed Rail (HSR), will provide electrification and control systems to the Caltrain service.

The Caltrain corridor runs in a high density, urban environment between San Francisco-4th & King Station and San Jose-Diridon Station; then continues south to Gilroy.

Next to the existing railway alignment, at certain locations, there are other railway infrastructure systems, such as the Bay Area Rapid Transit (BART) and the Light Rail Transit (LRT).

Caltrain current has 9 existing railway stations between Scott and Gilroy, the main ones being:

- San Jose
- Gilroy

The route is generally at-grade, with a large number of at-grade crossings with local roadways. Crossings with major communications routes have been resolved by raising the utility above the existing railway line.

Along the railway corridor there are several railway yards and tie-ins; such as the connection to the UPRR Coast Subdivision (with service from Oakland) and the railway facilities (workshops, garages, etc.) connection located next to the San Jose station.

3. FUTURE ACTIONS

Implementing high speed service along the Caltrain corridor will mean adapting the existing layout to the higher standards. Among the actions to be carried out are:

- Adaptation of the existing alignment to various degrees, both in horizontal and elevation; increasing the value of the existing radii and the track centers.
- Implementation of new platforms for the current stations.
- Remodeling of existing stations accordingly for high-speed services.
- Actions on the main track to include new railway facilities.
- Removal, replacement and installation of turnouts.
- Adaptation of electrification to the new layout.

The Caltrain stations along the route will undergo an adaptation where existing platforms will be remodeled to a length of 700 ft. and some of the stations will be relocated. The San Jose and Gilroy stations will be equipped with exclusive high-speed platforms with lengths of 1,400 ft. and 800 ft. respectively.

Future railway operations will combine high speed and commuter and freight services along the same corridor, creating a blended system.

3.1 Actions in the horizontal layout

3.1.1 Classification

The actions on the railway grade consist of moving it to improve the existing route or increase the distance between track centers. These lateral displacements (track shifts) will be conditioned by the presence of poles for electrification.

The following classification is established:

- **Lateral displacements of the track between 0 and 1 ft.**

  In this case, it is assumed that the tolerances of the existing electrification system will allow the lateral displacements of the track without needing any new OCS posts. For displacements between 0 and 1 ft. a tamping machine is used.

Figure 1. Tamping machine used for lateral displacements of the track between 0 and 1 ft.

- **Lateral Displacements of the track between 1 and 10 ft.**

  In this case, the poles of the existing electrification are affected so it is necessary to remove them to move the track. When it may be required to maintain the service during construction, it will be necessary to install an auxiliary electrification system.

  In this distance, a lateral displacement of the existing track to its definitive position would be constructible, but it would not possible to construct new track parallel to the existing while keeping service in operation since the ties would overlap.

Figure 2. Lateral Displacements of the track between 1 and 10 ft

- **<u>Lateral Displacements of the track between 10 and 21.34 ft.</u>**

  In this case, the poles of the existing electrification will be affected so it is necessary to remove them to move the track.

  This distance allows the construction of the new track parallel to the existing one, while keeping the railway traffic in service, as long as the existing electrification pole is removed.

Figure 3. Lateral Displacements of the track between 10 and 21.34 ft

- **<u>Lateral displacements of the track greater than 21.34 ft.</u>**

  The works are carried out outside the area of influence of the existing railway track, so the railway traffic is not affected.

Figure 4. Lateral Displacements of the track greater than 21.34 ft

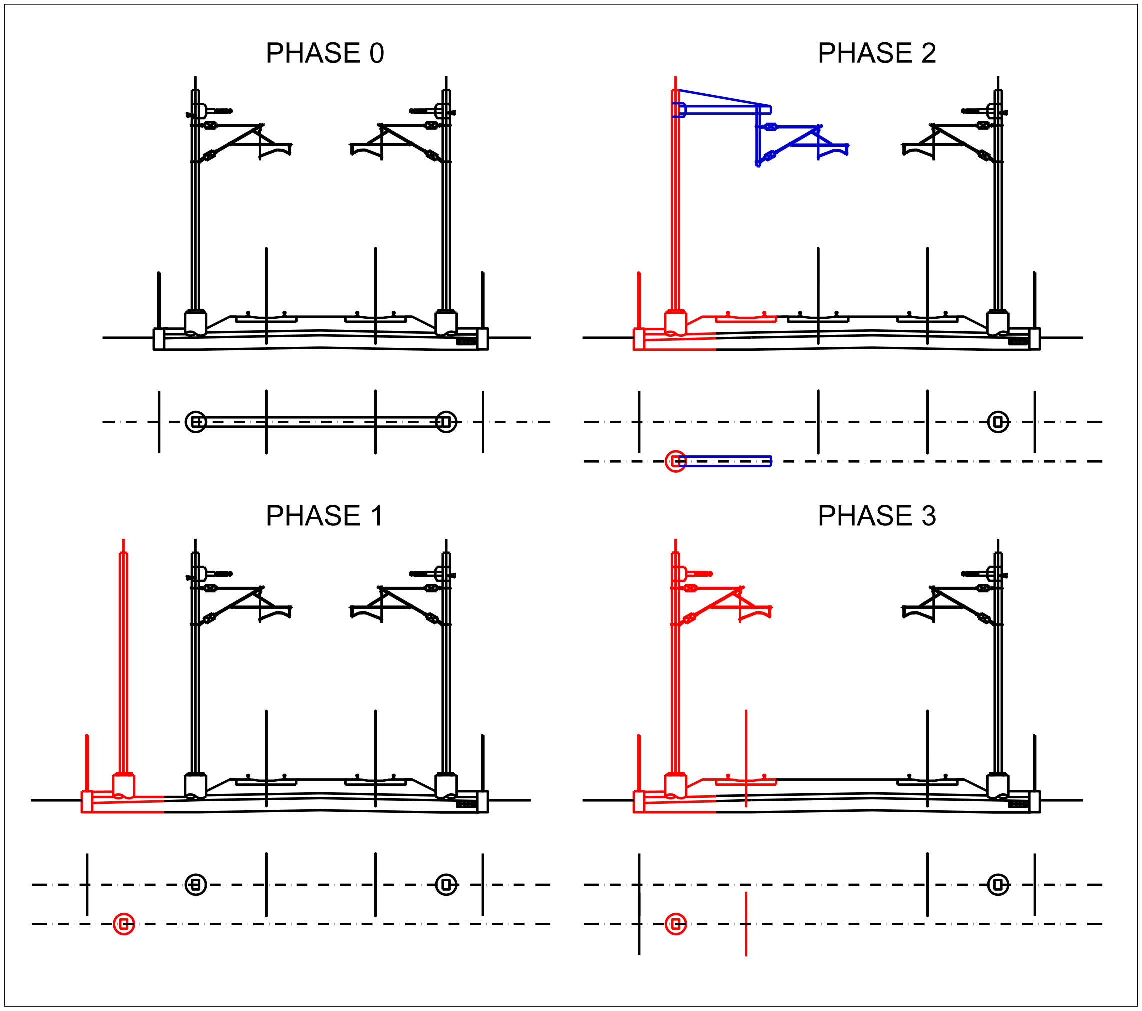

Figure 5. Classification of actions in the horizontal layout

3.2 Actions in elevation

Actions needed in elevation are required due to variation of the longitudinal profile of the new track adapted for high speed service and the existing one.

The required action on the track related to the elevation depend directly on its position in the plant and will define the actions to take. Three possible cases is possible define according to lateral displacement:

- **Case 1: When lateral displacements of the track is between 0 and 1 ft.**

  The axis of the future track is located at a horizontal distance lower than 1ft from the current one in these cases. In this case, there is no variation of the railway grade extension, that is, the cross section is practically the same.

  In turn, this case is subdivided into the following cases:

- *Raising of the longitudinal profile:*

Depending on the proposed profile changes, the thickness of the existing ballast layer and the existing platform characteristics, the following cases are distinguished:

  - Adjust by tamping the existing ballast layer, valid for increases in elevation of up to 0.01 ft.
  - Adjustment by tamping with addition of ballast for elevations between 0.01 and 0.167ft.
  - Overall conditioning of the entire section, including the trackbed and the rest of the layers, for greater elevations.

- *Lowering of the longitudinal profile:*

  - Adjust by tamping the existing ballast layer, valid for decreases in elevation of up to 0.01 ft.
  - Removal of ballast for reductions between 0.01 and 0.05ft.
  - Rebuilding of the entire section, including the trackbed and the rest of the layers, for greater descents.

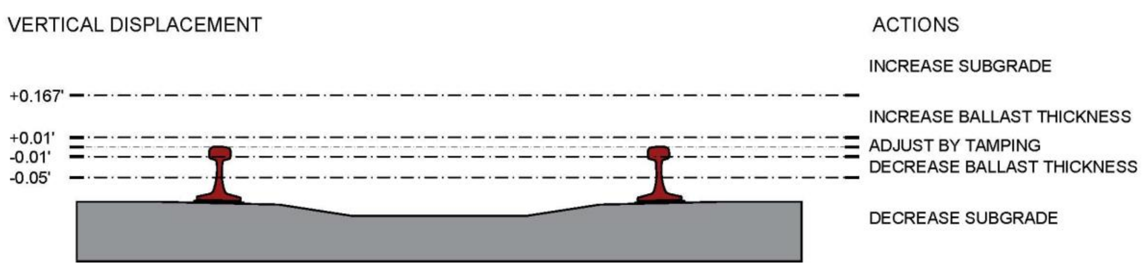

Figure 6. Actions in section for variations in vertical alignment

- **<u>Case 2: When lateral displacements of the track is between 1 and 21.34 ft.</u>**

The axis of the future track is located at a distance between 1 and 21.34 ft. from the old one in these cases.

Given the magnitude of the displacement, it is necessary to expand the existing railway grade. This means the cross section is significantly extended, not only in the upper layers of ballast, sub-ballast and form layer, but also in the embankment.

In turn, this case is subdivided into the following cases:

- *Raising of the longitudinal profile:*

  The enlarged area, where the extension of all the layers mentioned above will be carried out regardless of the amount of elevation change experienced by the longitudinal profile.

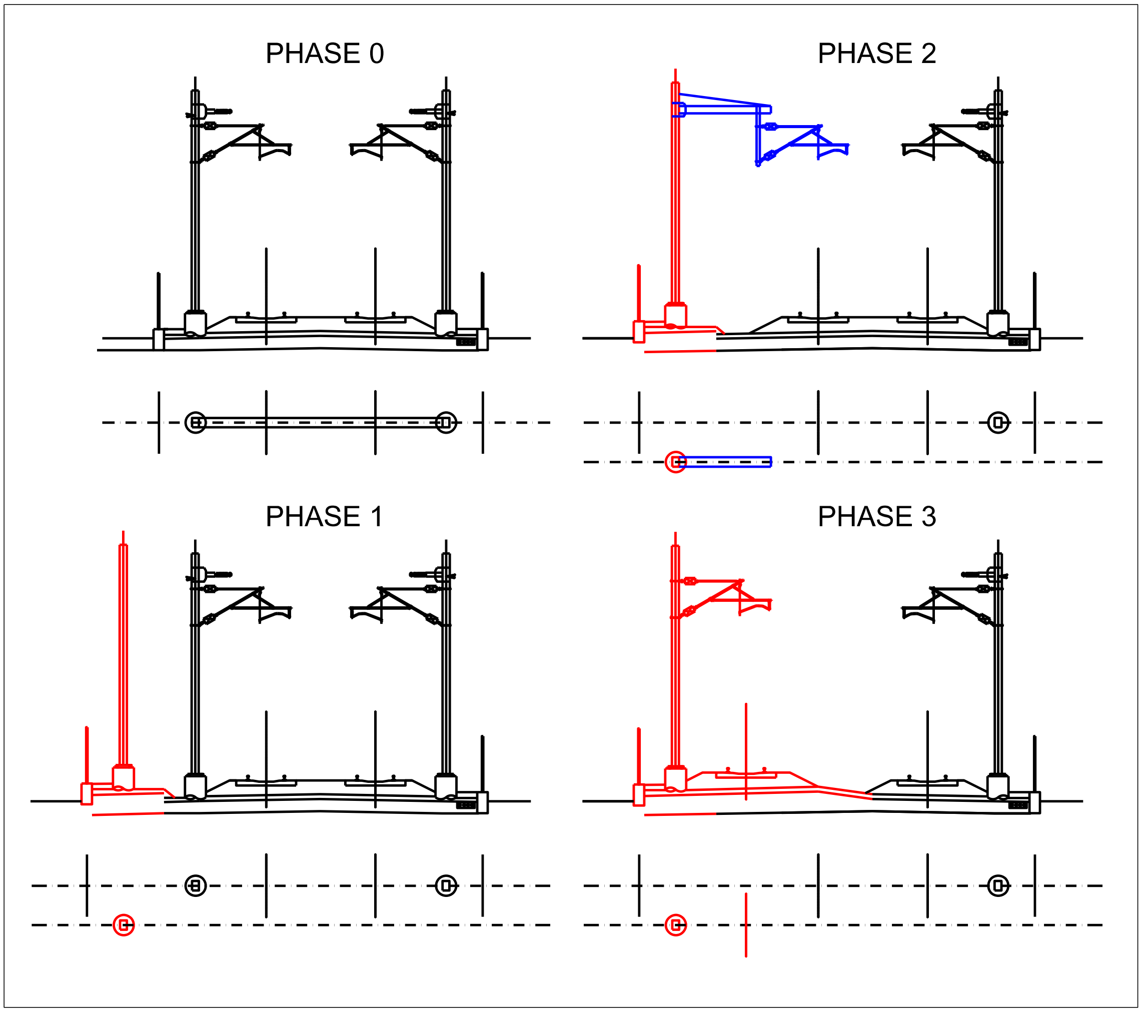

Figure 7. Phases of works for the ascent of the longitudinal profile

- *Lowering of the longitudinal profile:* In this case, it is necessary to study the current railway grade status, measure the thickness of the current ballast, sub-ballast layer, and determine the necessary actions to adapt it to the future situation of the new longitudinal profile.

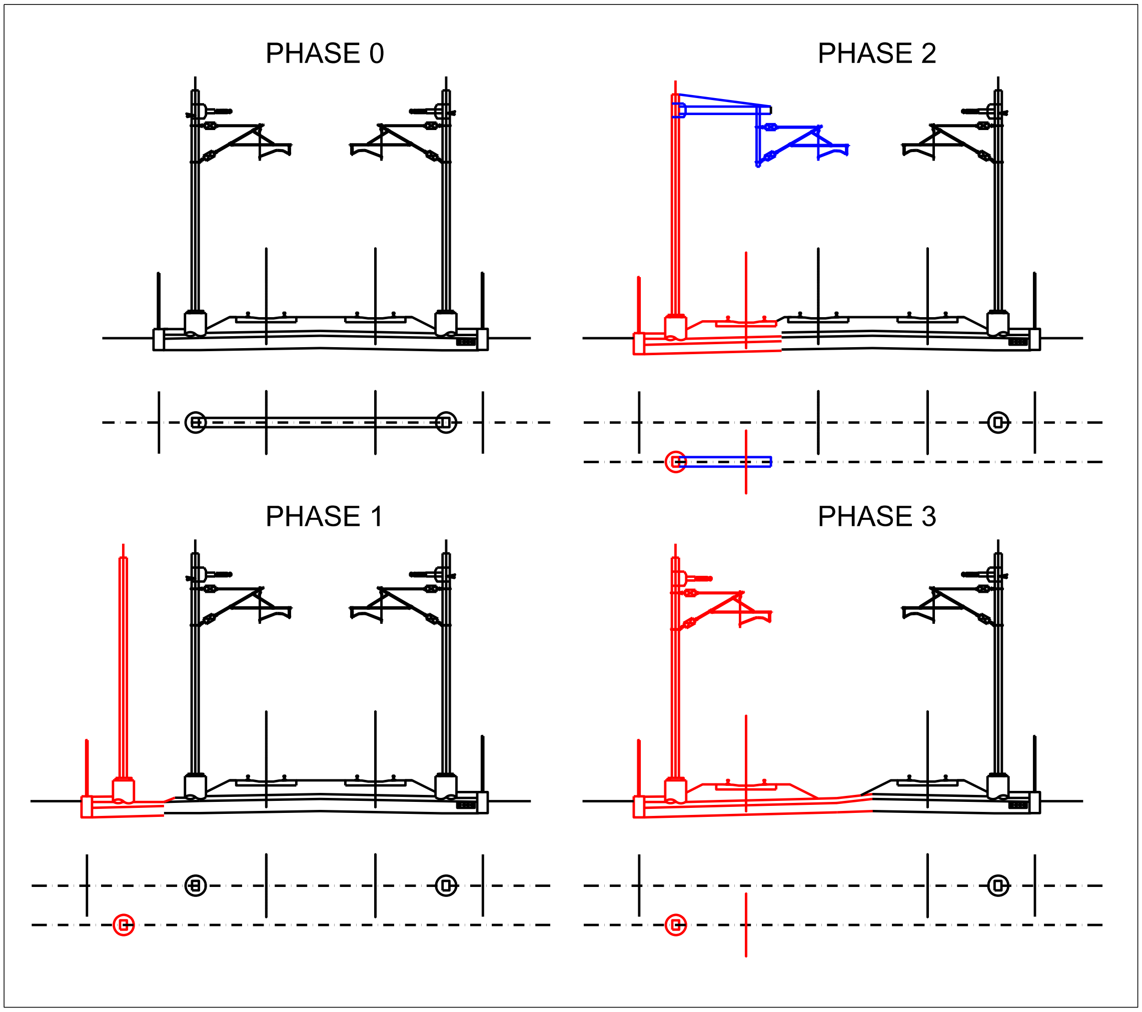

Figure 8. Phases of works for the descent of the longitudinal profile

- **<u>Case 3: When lateral displacements of the track is greater than 21.34 ft.: No influence:</u>**

  In these cases, given the magnitude of the displacement in horizontal, the variation of longitudinal profile is irrelevant since they can be considered independent and, will executed separately.

3.2.1 Impacts on the Existing Traffic

The impacts on traffic will depend on the magnitude of the lateral and vertical displacements of the track from the existing situation to the future situation and the length of the section for the construction area.

- **Lateral displacements of the track between 0 and 1 ft. without subgrade affectation**

  The impact on the existing traffic in this case is minimal since there´s no need to act on the railway subgrade or the catenary poles, just adapting the brackets for the repositioning of the contact wire.

  The works will be carried out during the Work Window hours established in the SECTION 01040. WORK HOURS AND TRACK ACCESS of the CalMod Design-Build Electrification Services and all the restrictions there mentioned.

  The only effect on traffic will be a limitation of the speed of the railway traffic during the time of action on the track.

- **Lateral displacements of the track between 0 and 1 ft. and lowering.**

  The impact on the existing traffic in this case is greater than in the case of raising of the track. Depending on the thickness of the existing ballast layer, it is likely the existing railway subgrade will be modified, so the construction activities carried out will be greater and require substantial time to complete.

  As in the previous case, the works will be carried out during nighttime periods or the weekend, with the restrictions mentioned above.

  The only effect on traffic will be a limitation of the speed of the railway traffic during the time of action on the track.

- **Lateral displacements of the track between 1 and 10 ft.**

  In this case, the relocation of the track will require the extension of the railway subgrade and removal of the catenary poles, with the following effects on traffic conditions:

  - Speed limits on railway traffic over the affected track, during the time of action.
  - The existing track and future one will share ties, so the extension of the existing railway subgrade and the lateral displacement of the track itself will be carried out during railway traffic cuts, at night or during the weekends.

When the future track is lower the railway subgrade is affected, so the construction activities will be drawn out for a longer time causing a greater impact on the current railway traffic.

Maintaining service requires the setup of a provisional electrification system, suitable for the current and future situation.

- **Lateral displacements of the track between 10 and 21.34 ft.**

  As in the previous case, the relocation of the track will require the extension of the railway subgrade and removal of the catenary poles. In addition, the maintaining service will require the assembly of a provisional electrification system.

  In this case, the work will be carried out outside the safety area, so it is possible to extend the existing railway subgrade and to build a new track without affecting the railway traffic. Only the establishment of speed limits due to the presence of construction will be necessary.

  Therefore, the only limitation to traffic will be during the execution of the connections with the existing track that must be made during railway traffic cuts in nighttime periods.

- **Lateral displacements of the track greater than 21.34 ft.**

  Since in this case the future track is more than 21.34 ft from the previous position, the execution of the new railway subgrade is completely independent of the old one. It is not necessary to remove the existing catenary poles in this case.

  Therefore, the only limitation to traffic will be during the execution of the connections with the existing track that must be made during railway traffic cuts in nighttime periods or during the weekend.

3.3 Turnouts

Along the route between Scott Boulevard and Gilroy, there are a large number of turnouts. Because of the track adaptation for high speed, the existing turnouts may be removed, displaced or kept in their position. Construction related to turnouts can be categorized as follows:

- **Removal of an old turnout**. It is the simple elimination of a turnout present in the current track and the subsequent track replacement.

- **Insertion of new turnout**. It consists of the insertion of a new turnout on the existing track.
- **Replacing a turnout**. In this case it is a matter of replacing one turnout with different type of turnout, even if the horizontal and vertical layout does not suffer any modification.
- **Relocation of a turnout**. It is the opposite case, in which the same device (same model) is still valid, but due to modifications in the horizontal and vertical layout, its relocation is necessary.

All the activities that affect turnouts will be carried out during extraordinary traffic cut periods. In order to reduce the impact period, pre-assembly of turnouts will be made at assembly bases. Once pre-assembled, they will be carried by special track machinery to the permanent location.

While the assembly work takes place, the speed limits will be maintained.

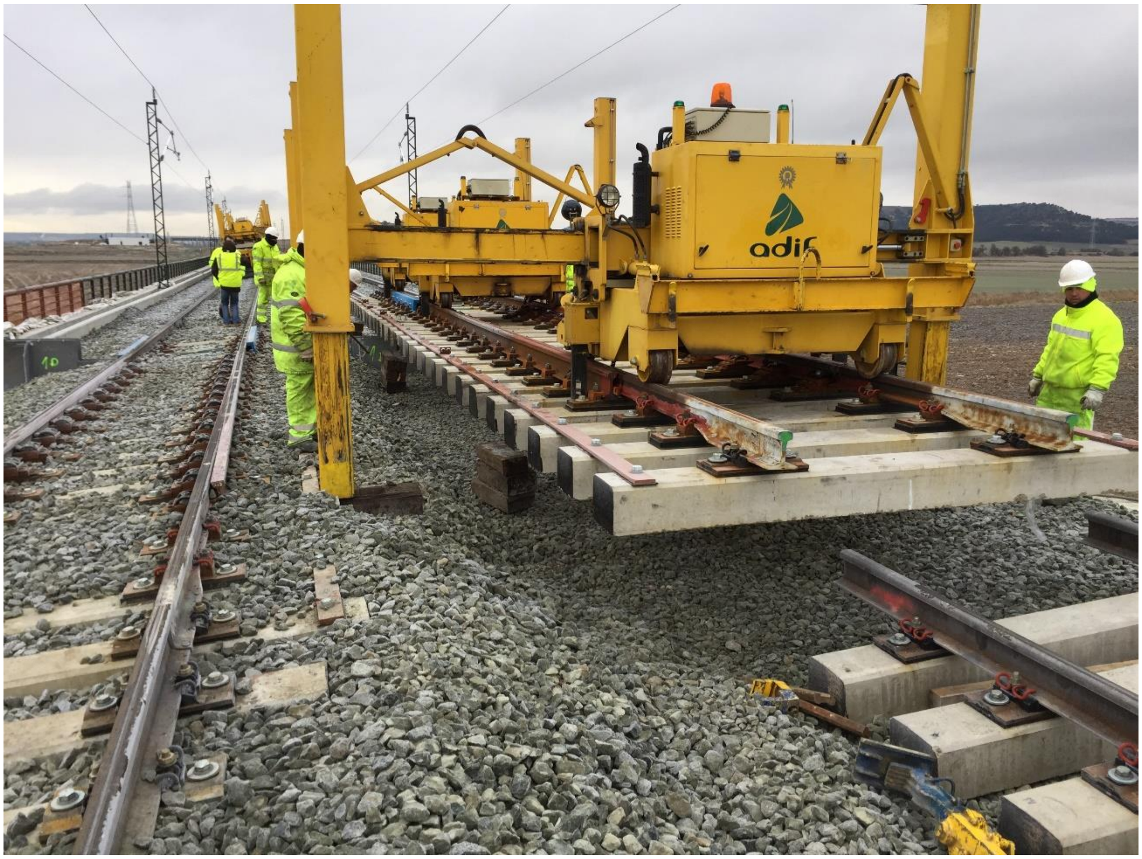

Figure 9. Assembly on the track of a pre-assembled turnout

In the event that the geometry of the track sections adjacent sections to a turnout undergoes modifications, it will be necessary to place the track in its definitive position to allow the turnout to be interested in its' final position during an extraordinary traffic-cutting period.

If it is necessary to move a track turnout either in horizontal or in elevation, it is recommended to disassemble it and replace it with a provisional track. This provisional track along with the adjacent sections will be placed in their definitive position and later the turnout will be assembled in its final location. This working cycle assumes the rail traffic diversion will be suspended while the provisional track is installed.

Figure 10. Transportation of a pre-assembled turnout

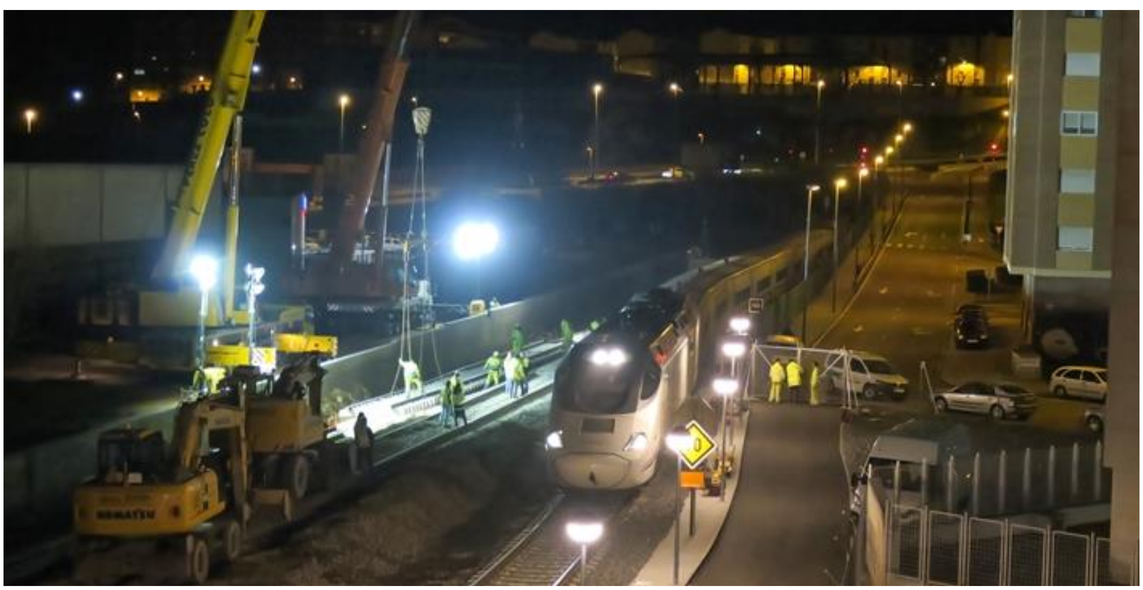

Figure 11. Assemble of a pre-assembled turnout with cranes

3.4 Actions on Platforms.

The modification of the main track and yard track alignments in stations, require corresponding modification in the platforms.

Any little track displacement, either in horizontal, elevation or in both, implies a corresponding one in the platforms, due to the need for keeping the safety and functional distances.

Figure 12. Modifications to platforms

3.5 Actions on At-Grade Crossings.

Throughout the corridor, a series of at-grade crossings allow connection between the adjacent areas and populations located on either side of the corridor. Modifications to the track require these crossings be studied, verifying the need of their adaptation to the new tracks and modification of existing horizontal layout and longitudinal profile.

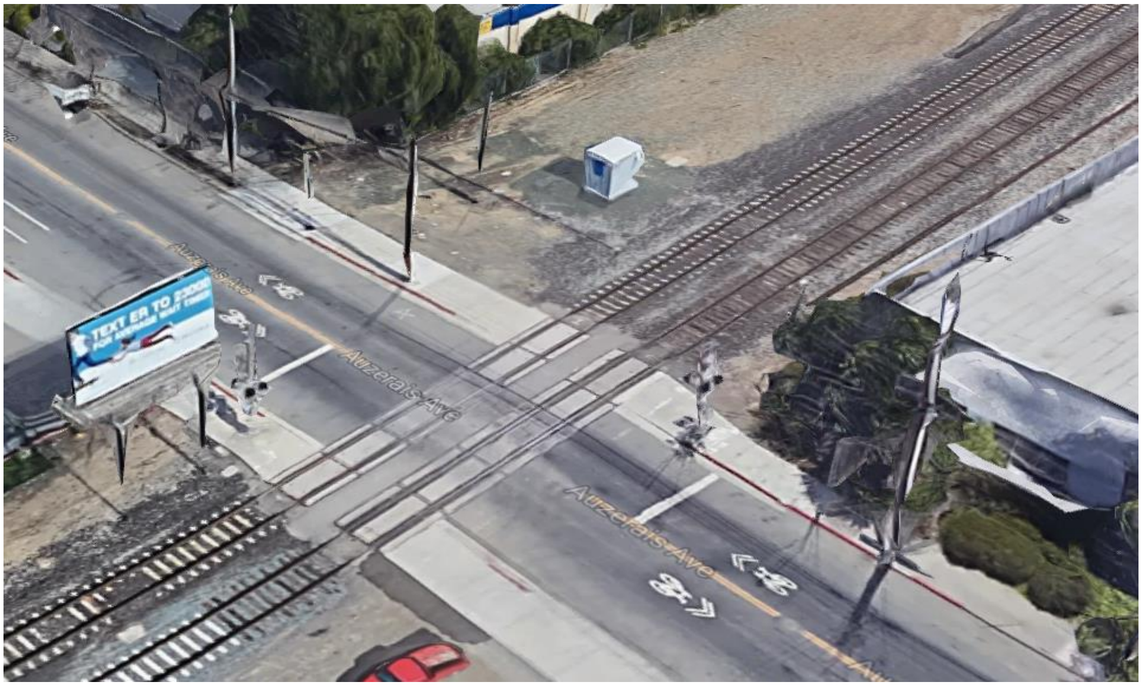

Figure 13. Typical at-grade crossing in railway line San Jose to Gilroy

The at-grade crossings that must be modified are those that will be affected by additional tracks and/or displacement of the existing track exceeding the following limits:

- Lateral displacements of the track between 0 and 0.02 ft.
- Variation of the longitudinal profile (either raising or lowering) between 0 and 0.01 ft.

Figure 14. Construction of at-grade crossing

4. SPECIAL CASES

There are seven special cases in Scott Boulevard to Gilroy constructability analysis who completed the tracks adaptation:

- Appendix A Electrification
- Appendix B Jacked box undercrossing
- Appendix C Micropiles wall undercrossing
- Appendix D Wildlife crossing under Monterey Rd
- Appendix E Grade crossing analysis
- Appendix F Alternative 4 Constructability analysis
- Appendix G Track shift works Scott Boulevard to CP Lick

These special cases are developed in seven independent appendix.

CALIFORNIA HIGH SPEED TRAIN PROJECT
CONSTRUCTABILITY ANALYSIS

APPENDIX A. ELECTRIFICATION

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The purpose of this document is to describe the different procedures available to adapt the electrification of railway lines in use to modifications of their. The proposed methods start from the premise of not interrupting railway traffic.

In general, the catenary has a greater capacity for transverse displacements than the track itself. This is due to the existence of a series of tolerances that are listed below:

- Tolerance of the catenary supports
- Decentralization of the contact wire to avoid localized wear of the pantograph
- Pantograph tolerances

The sum of these tolerances, as a general rule, is estimated at one foot. This margin can be used to carry out transverse displacements of the track without being necessary to modify poles and gantries to re-electrify the railway line. In this case it would only be necessary to adjust the position of the contact wire.

When the displacement of the track is greater than one foot, it is necessary to move the supports inside the frames or construct new structures for the catenary adaptation. Figures provided in this document show the adaptation of the catenary system. They do not include the intermediate subphases of partial displacements of both the track and the contact wire.

The existing corridor is not electrified, but construction of the CalMod project in the near future will install electrification and control systems. Subsequently, the main tracks (currently used exclusively by Caltrain) will be adapted for High Speed services. This adaptation will mean changes in the existing track configuration, requiring relocation of both tracks and catenary system elements.

As a starting point, the section between Scott Boulevard and San Jose station are fully electrified and the stretch between San Jose and CP Michael only the main right track and the refuge tracks are electrified. In the future, all tracks will be electrified except MT-1 (UPRR track).

There are apparent benefits to coordinating the CalMod and High-Speed Rail projects, so that locations were fixed elements (poles and gantries) can be designed compatible for both projects would be the most economically beneficial and ensure the least amount of railway service interruption during construction. The approach means that when High-Speed Rail is implemented the gantries will be perfectly valid and only an intermediate period it will be necessary to relocate the track and the catenary supports. This case is called as process 0.

For the remaining situations the following describes potential construction processes:

Process 1. The first procedure is where the OCS portals are not able to house both track distributions (existing and future) so the portals must be enlarged. Depending on portal structural resiliency, it could be enlarged or directly substituted.

The process of portal enlargement is as follows:

Phase 1: New OCS pole placement. It must be aligned with the existing one.

Phase 2: Portal beam, temporary support installation.

Phase 3: Removal of the existing OCS pole. Portal beam enlargement and connection with the new pole.

Phase 4: Commissioning of the railway line.

Phase 5: Displacement of the tracks and of the OCS supports to their final location.

Phases 2, 3 and 4 must be made in the same night-time period with traffic cut. The temporary support used in phases 2 and 3 can be replaced for a crane.

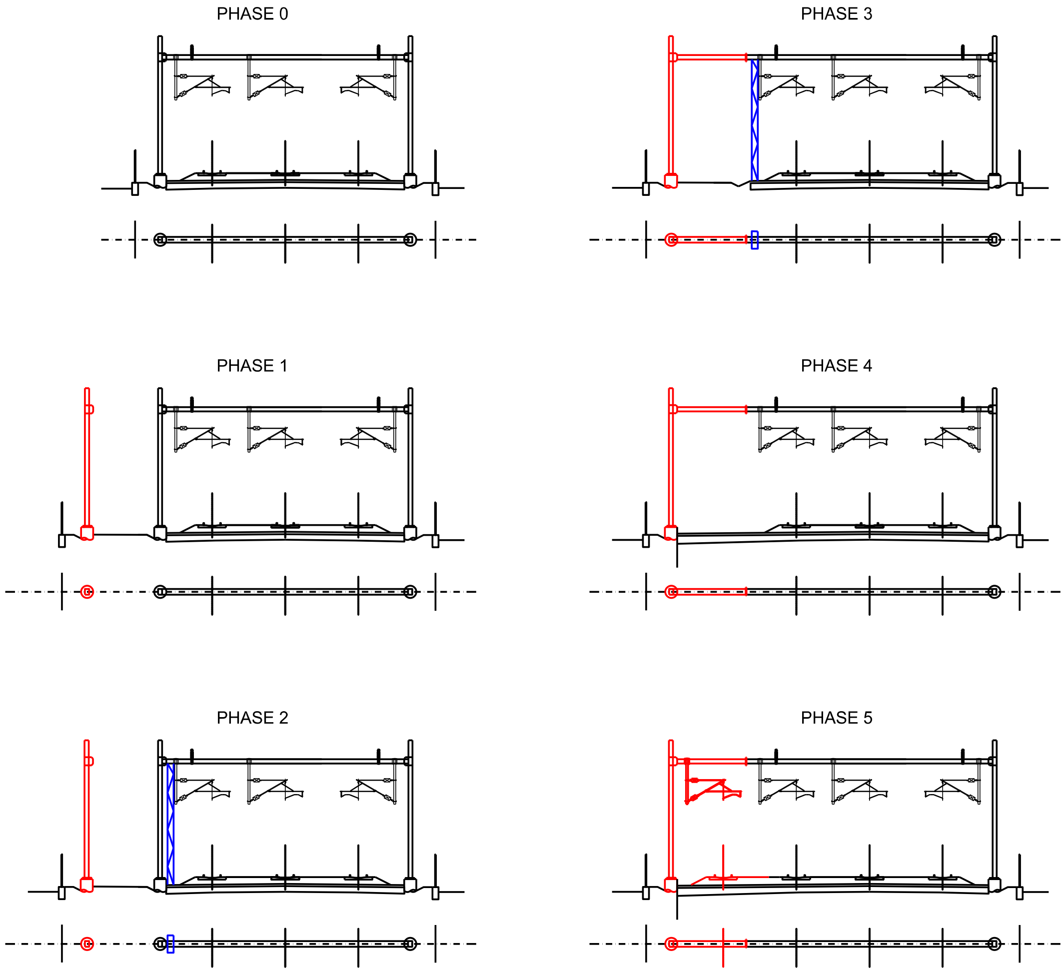

Figure 1. OCS portal beam extension

Process 2. The second process consists of designing enough long OCS portals that are able to house both track distributions (existing and future). In this case, it is necessary to build a flexible gantry located between temporary poles. This example is also suitable for the replacement of the portal beam. The working stages are:

Phase 1: Install temporary poles, outside of existing.

Phase 2: Flexible gantry is laid between temporary poles.

Phase 3: OCS and flexible gantry are linked. Existing OCS supports removed.

Phase 4: Existing OCS portals removed.

Phase 5: Placement of the new tracks in its final location.

Phase 6: Placement of the new portal in its final location.

Phase 7: Temporary flexible, gantry removed.

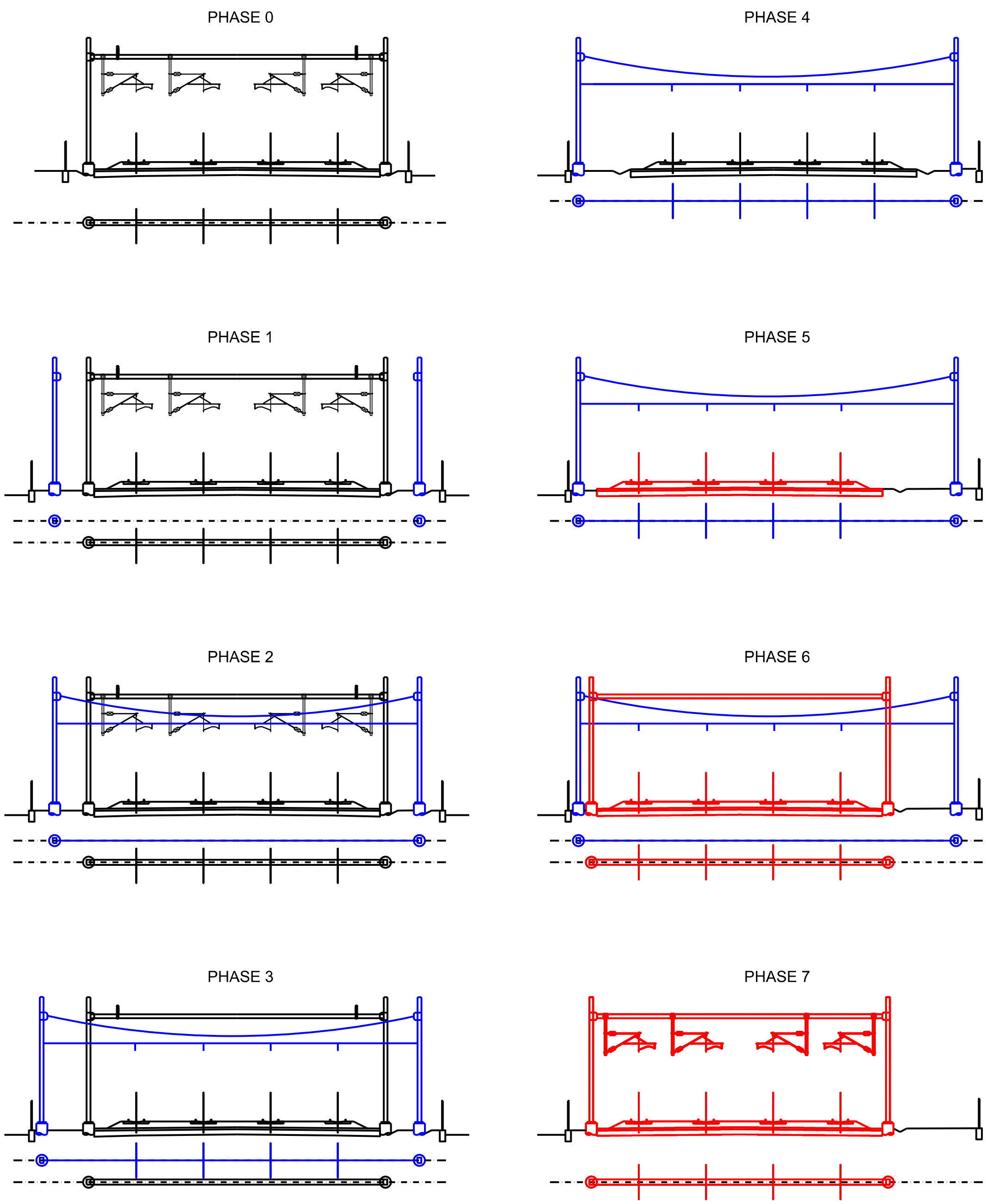

Figure -2. OCS portal replacement

Process 3. OCS portal assembly

Phase 1: Placement of the final, parallel pole and track.

Phase 2: Placement of the final OCS support.

Phase 3: Placement of the OCS portal in its final location. Placement of temporal OCS wire.

Phase 4: Placement of the final OCS wire. Removal of the existing OCS pole and temporal OCS wire.

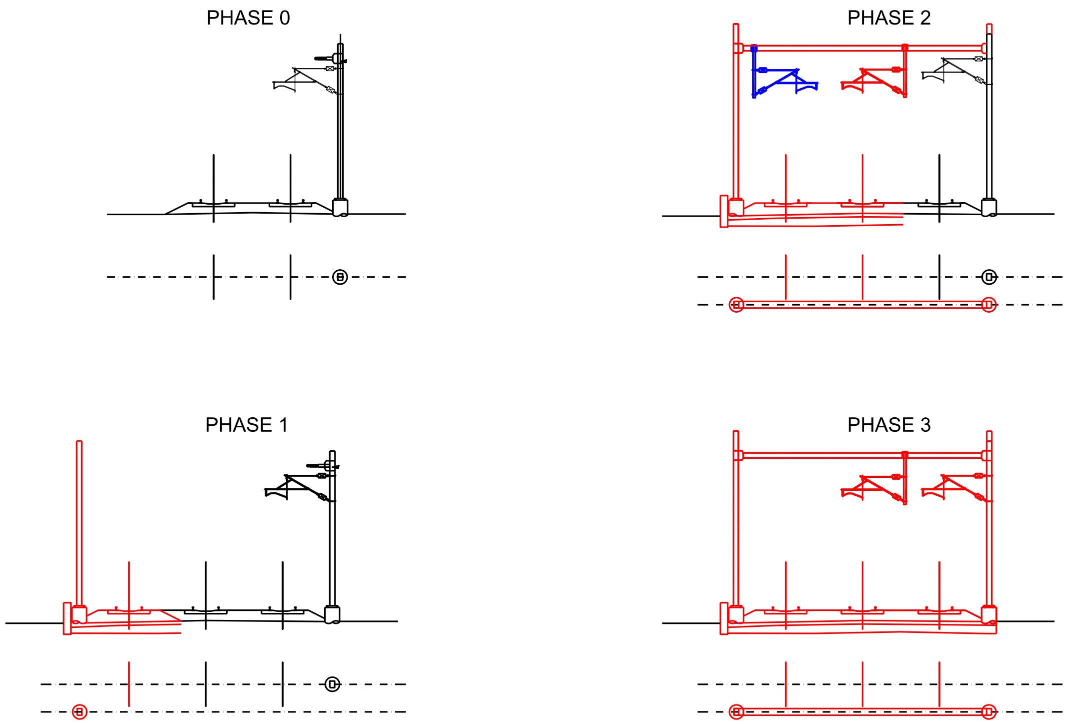

Figure 3. OCS portal assembly

Process 4. Displacement of poles outside the future clearance and displacement of two tracks.

Phase 1: Assembly of a new, parallel pole in a temporary placement

Phase 2: Removal of the existing OCS pole. Positioning of the support for two cantilevers and placement of the cantilever next to the pole.

Phase 3: Removal of the cantilever to displace and assembly of the second cantilever over its support.

Phase 4: Removal of the existing pole. Assembly of two, new parallel poles in their permanent location.

Phase 5: Placement of cantilevers. Removal of the temporary pole.

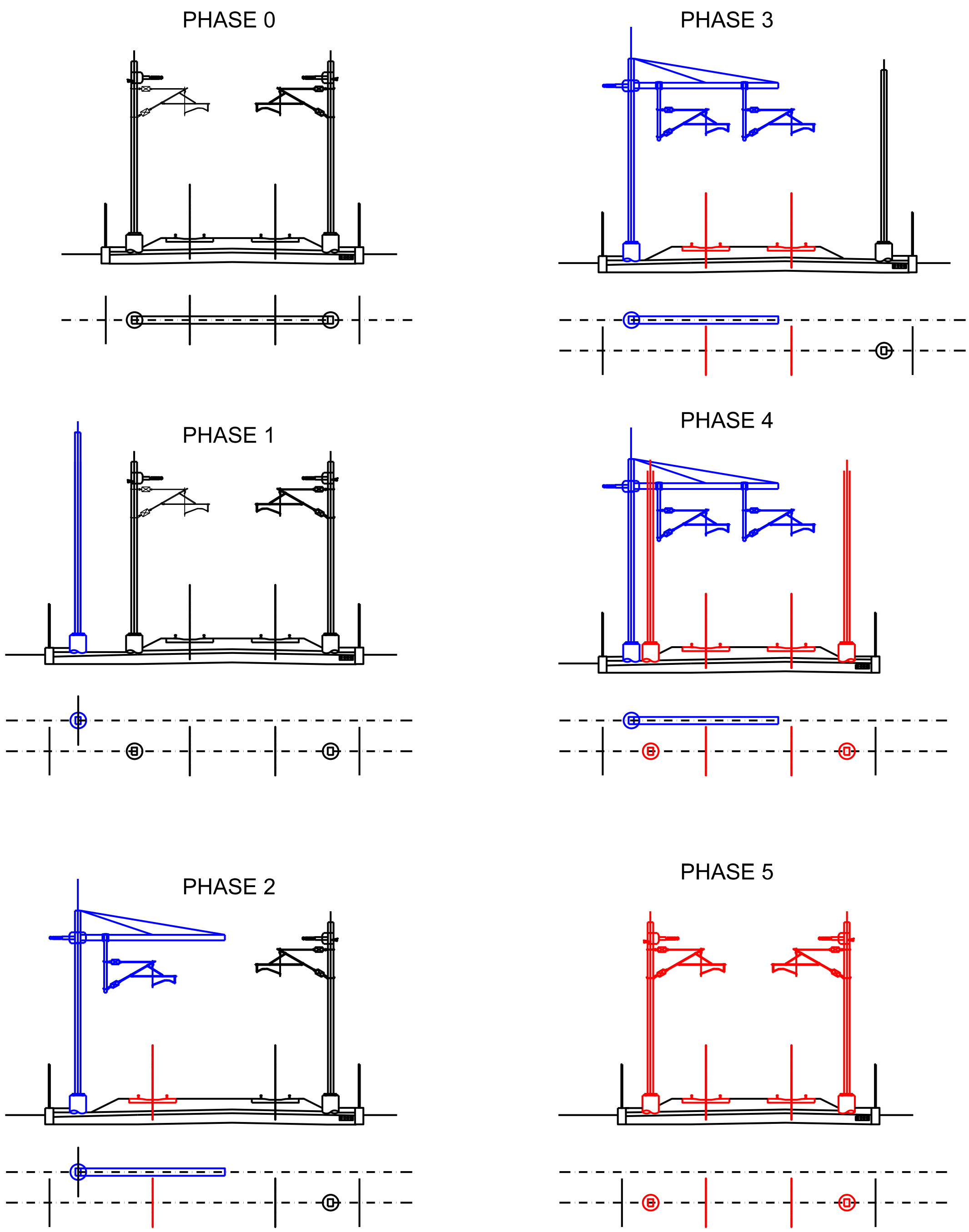

Figure 4. OCS poles displacement

In the cases described above, temporary elements are used. The foundations of these temporary elements can be made in the same way as a permanent element (using a pile) or using a temporary foundation simply supported on the existing ground.

Figure 5. OCS temporary foundation

CALIFORNIA HIGH SPEED TRAIN PROJECT
CONSTRUCTABILITY ANALYSIS

APPENDIX B. JACKED BOX UNDERCROSSING

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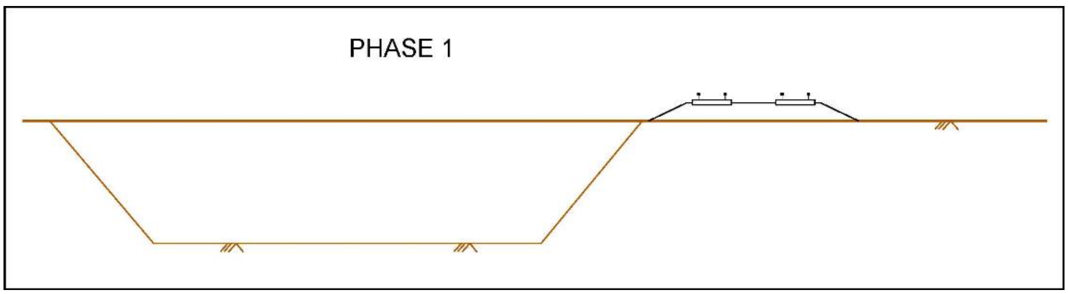
APPENDIX B. JACKED BOX UNDERCROSSING

The method of constructing an underpass by continuous jacking generally consists of the construction of the structure in an area adjacent to the installation site and then hydraulically pushing the structure into its final position at right angles to the track, with minimum disturbance to both rails and train circulations.

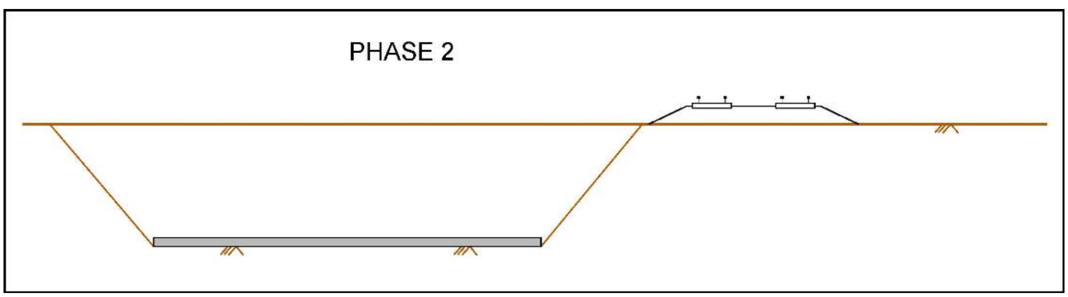
The structure is built on a concrete launch pad in the vicinity of the track and on obtaining suitable strength, is then jacked by hydraulic cylinders; which transfer the stresses to a reaction frame or the ground itself. The excavation is simultaneously carried out from within the structure or box and there is, subsequently, no risk to track stability.

The construction process is:

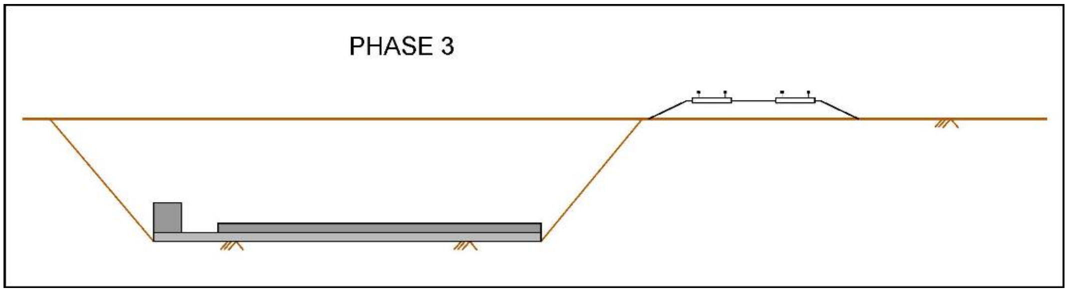
Phase 1: Ground excavation adjacent to the structure's permanent location.



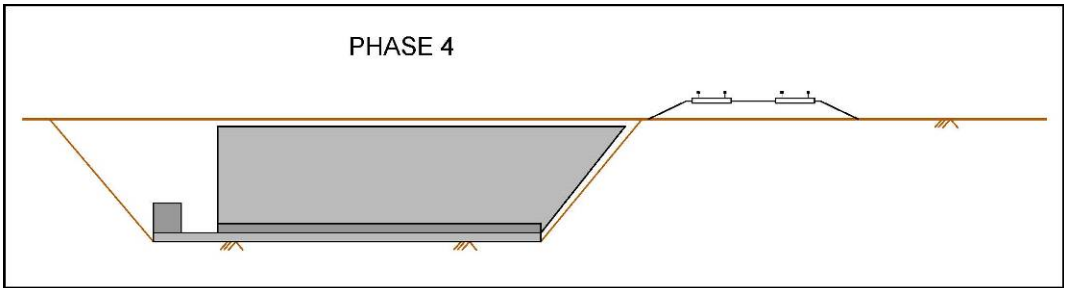
Phase 2: Concrete slab and launch pad construction. The main goal of this slab is to support box movement. This slab must be smooth and covered with a polyethylene sheet to ease the movement of the structure (Figure 1, 2 and 3).



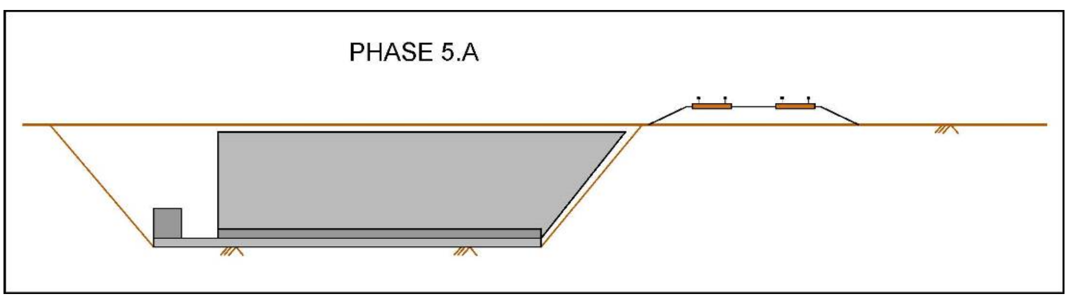
Phase 3: Construction of guiding walls. These are needed to assist with box alignment while jacking (Figure 4 and 5).

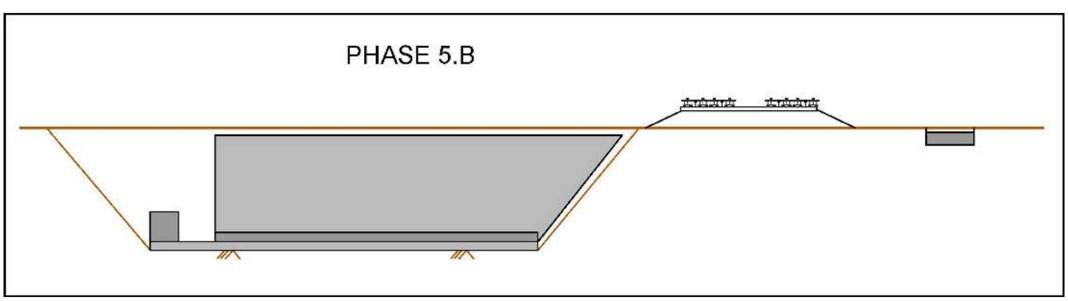


Phase 4: Reinforced concrete box construction. Box should be shaped as shown in the following figure to the jacking process (Figure 6, 7 and 8).

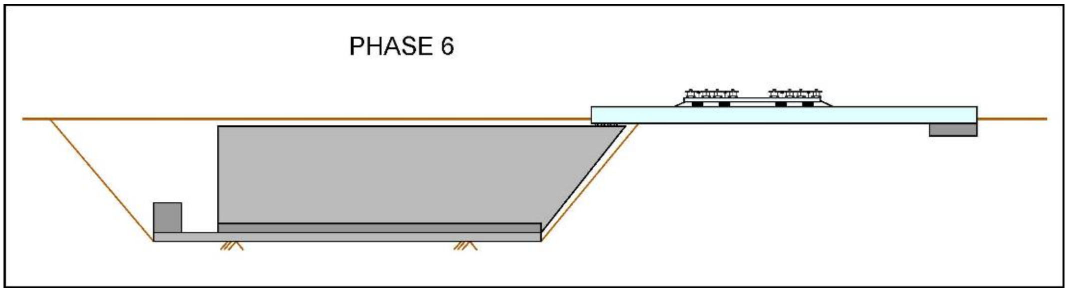


Phase 5: The subgrade will suffer limited deformations during the box movement, so it is necessary to change concrete ties to wooden ties, to provide flexibility. Additionally, a reinforcement of the track, parallel to the box movement, will designed by a special fastening system to unify rails with adjacent steel profiles to add inertia. (Figure 9, 10 and 11). Construction of a provisional foundation parallel to tracks.





Phase 6: Steel beams should be placed parallel to the track ties and placed every 6 feet. These beams are supported by the box, the provisional foundation and the existing ground. Support over the box is made by a roll in order to maintain the beam placement during works. Traffic is maintained in this stage but speed is limited (Figure 12, 13, 14 and 15).



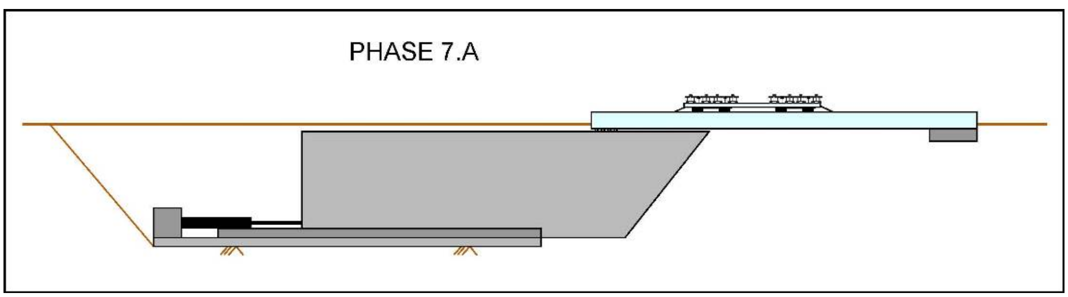
Phase 7: Box jacking by a hydraulic jacks series. This stage is subdivided into:

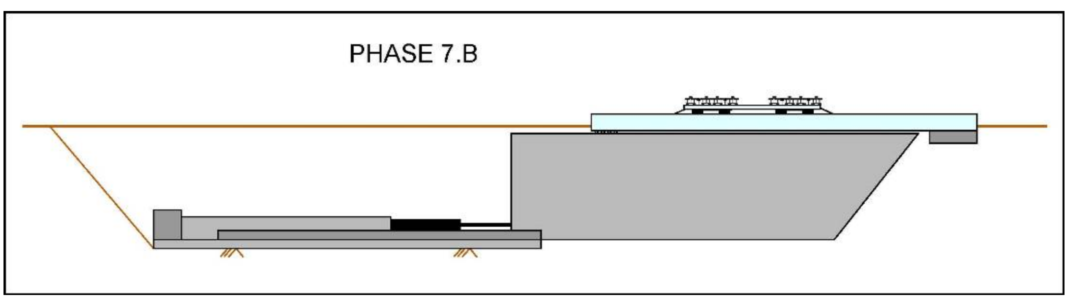
a. Excavation under the existing tracks during nighttime closures, for tie and beam placement.

b. In-box excavation. Rate of excavation is directly related with daily rate of box jacking (Figure 16 and 17).

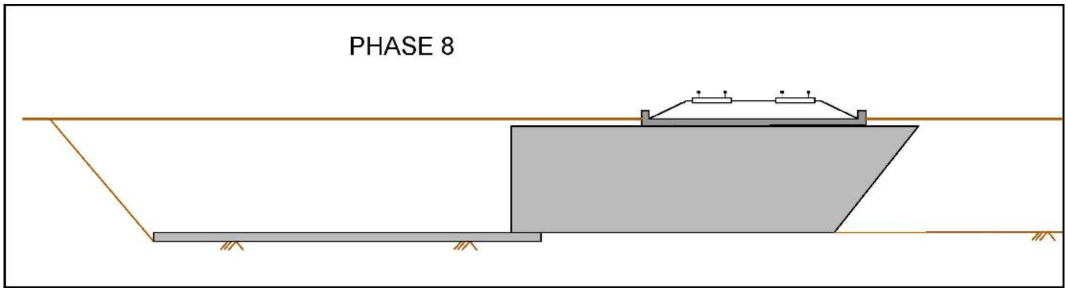
c. Jacking. Hydraulic jacks transfer homogeneous pressure to the box; which slips along the concrete slab and hammers itself in the soil (Figure 18, 19, 20, 21 and 22).

d. Left space concreting to support jacks when box has moved enough.

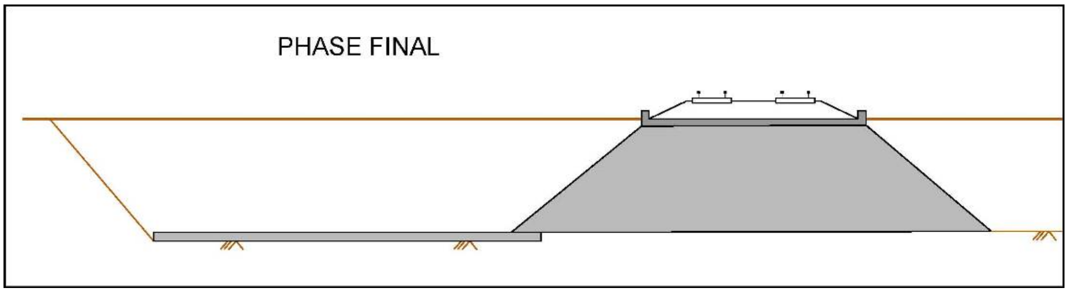




Phase 8: Material spreading between railway superstructure and box.



Phase final: Reshape the box to its final shape and landscape (Figure 23, 24 and 25).



Following pictures show several generic stages during works and the final result.

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

Figure 9

Figure 10

Figure 11

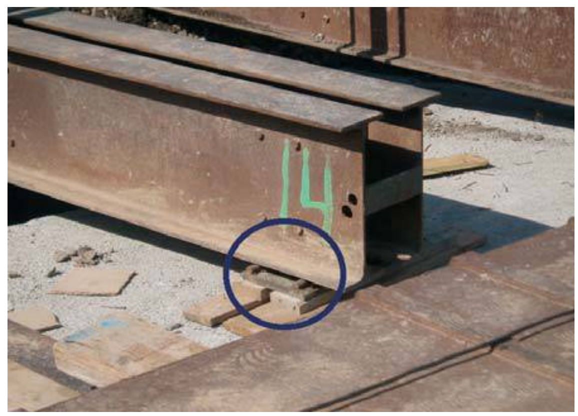


Figure 12

Figure 13

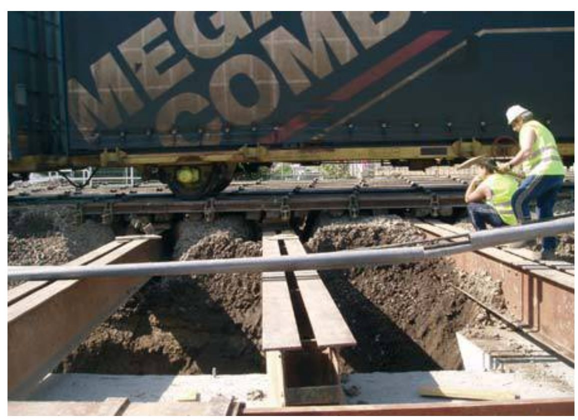


Figure 14

Figure 15

Figure 16

Figure 17

Figure 18

Figure 19

Figure 20


Figure 21


Figure 22


Figure 23


Figure 24


Figure 25

CALIFORNIA HIGH SPEED TRAIN PROJECT
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APPENDIX C MICROPILES WALL UNDERCROSSING

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APPENDIX C MICROPILES WALL UNDERCROSSING

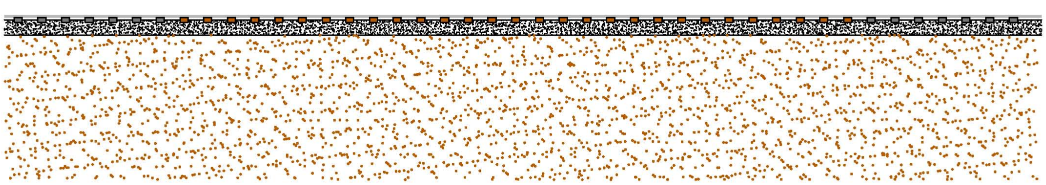
An alternative method to build an underpass without affecting the railway traffic is based on the execution of two groups of two parallel micropiles walls from the track. The object of these walls is to achieve two safe working places without needing a railway traffic cut for the execution of the lateral walls of the underpass. When the lateral walls are built, it is possible the positioning of the precast top slab during an extraordinary traffic-cut that may take time during a weekend time.

Working processes are:

Phase 0: Current situation

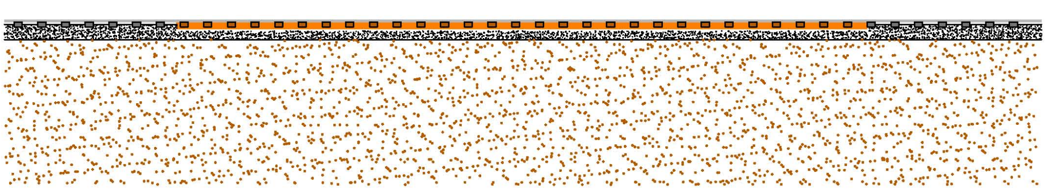
Phase 1. Replacement of the concrete sleepers for wooden sleepers. This activity will be carried out in a night traffic interruption period and when the railway traffic is restored a speed limit of 20 mph will be established.

PHASE 1

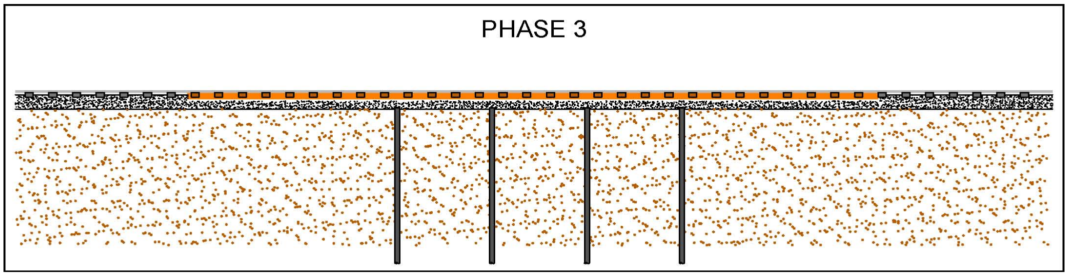


Phase 2: Track planking. In this phase, a track planking is placed in the space between rails. The aim is build a workable building surface for the micropile-driving equipment without disturbing the railway traffic and without affecting the existing rail track components. This activity will be carried out in a night traffic interruption period and when the railway traffic is restored a speed limit of 20 mph will be established.

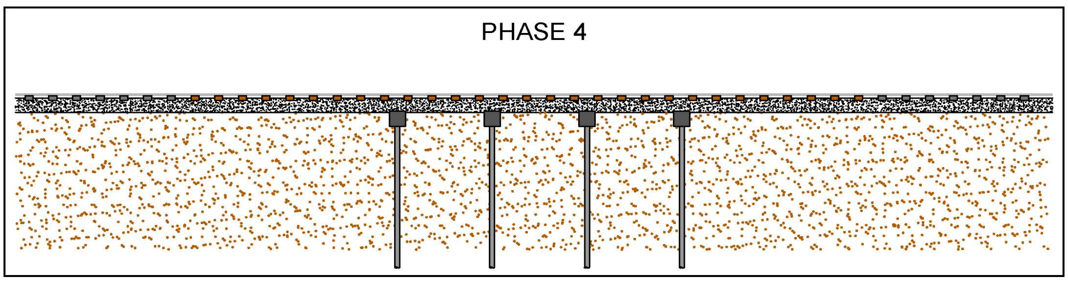
PHASE 2



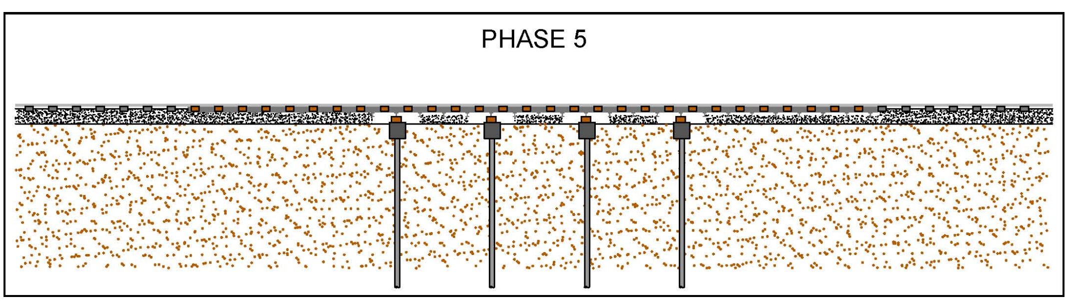
Phase 3: Construction of two groups of two micropiles retaining walls. Micropiles will be installed from the construction plank, through the ballast bed. Micropiles outside of safety area can be made when railway traffic is active. Micropiles inside of the safety area must be installed during a traffic interruption period and when the rail traffic is restored, a speed limit of 20-mph will remain in place.



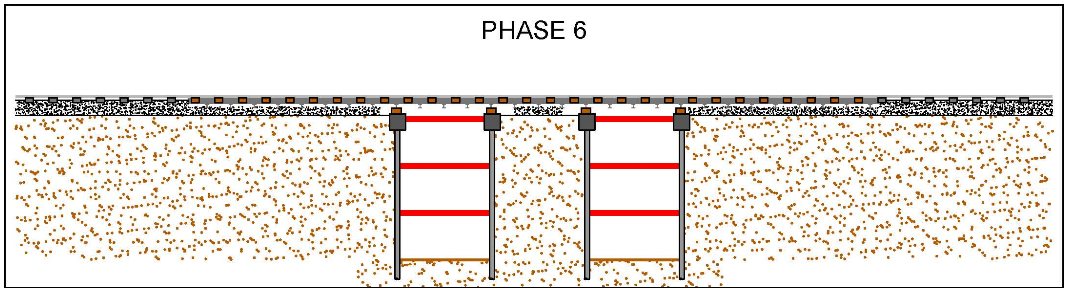
Phase 4: Building of cap beams between the micropiles. In this phase, it is necessary to remove some of the ballast for building the cap beams. This activity will be carried out during a night traffic interruption period and when the railway traffic is restored a speed limit of 20-mph will remain in place.



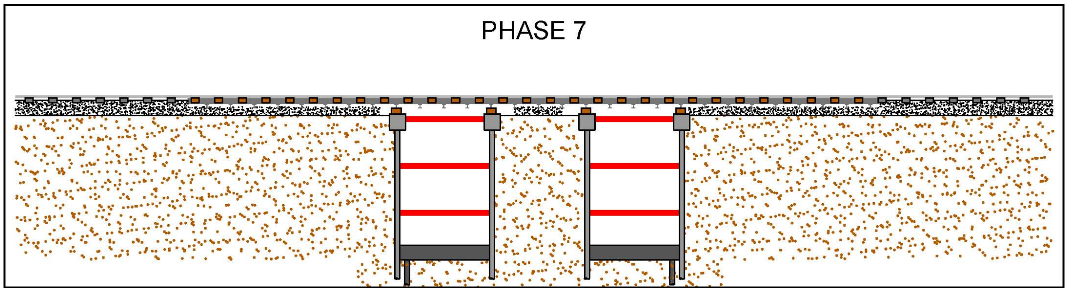
Phase 5: Reinforcing of the existing tracks. After the completion of the cap beams between the micropiles, the rails are reinforced by the grouping of rails. These groups of rails are supported over the cap beams. This reinforcement allows small segments of track to remain active without ballast (at maximum 6' section) but with restrictions in traffic speed. This activity will be carried out during a night traffic interruption period and when the railway traffic is restored a speed limit of 20 mph will remain in place.



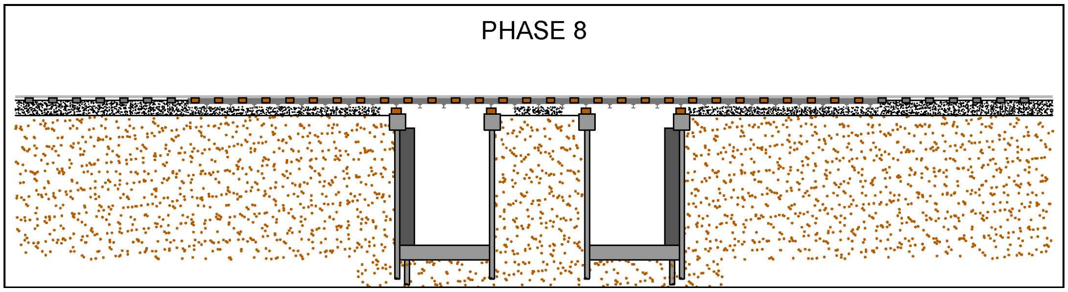
Phase 6: Excavation between retaining walls and positioning of provisional struts between retaining walls. This activity is compatible with railway traffic if safety measures are implemented. The 20-mph speed limit will remain in place.



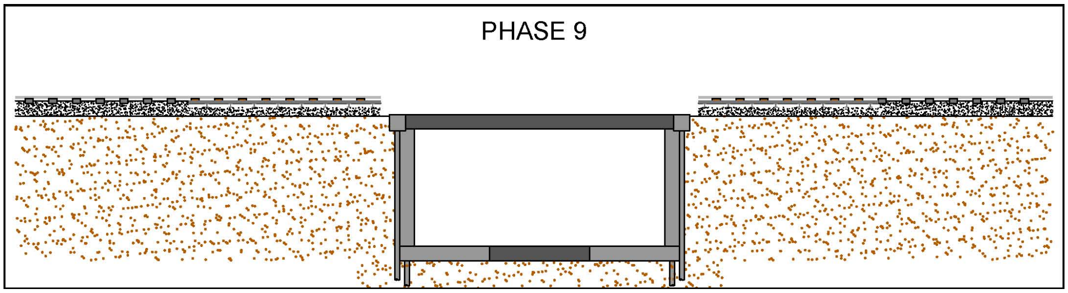
Phase 7: Partial construction of the underpass foundation slab. This activity is compatible with railway traffic if safety measures are implemented. The 20-mph speed limit will remain in place.



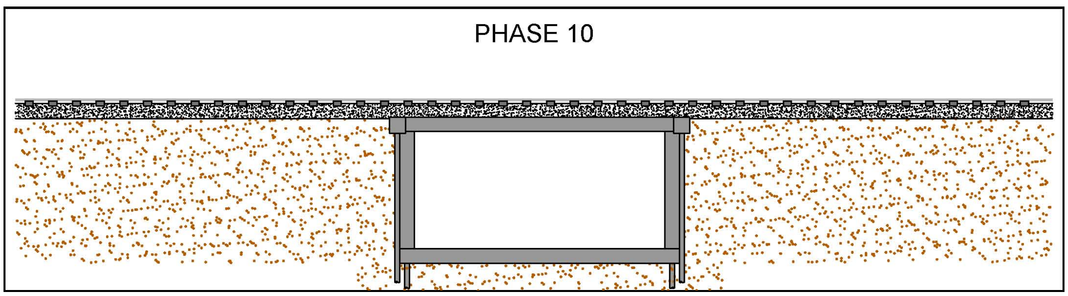
Phase 8: Erection of the underpass lateral walls. This activity is compatible with railway traffic if safety measures are implemented. The 20-mph speed limit will remain in place.



Phase 9: Track removal in the working area. Excavation of the soil between the lateral walls of the underpass. Completion of the foundation slab and positioning of the precast top slab of the underpass. This activity is incompatible with railway traffic, so it is necessary to make an extraordinary traffic-cut, anticipated to be a weekend closure.



Phase 10: Return tracks to their original state. This work must be made in a traffic interruption period. When this phase is finished, speed limits will be canceled.



CALIFORNIA HIGH SPEED TRAIN PROJECT

CONSTRUCTABILITY ANALYSIS

APPENDIX D. WILDLIFE CROSSING UNDER MONTEREY RD

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APPENDIX D. WILDLIFE CROSSING UNDER MONTEREY RD

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1. WILDLIFE CROSSING UNDER MONTEREY RD

One of the design alternatives of the HSR line between San Jose and Gilroy, uses the current corridor of the existing UPRR line. This corridor runs parallel to the Monterey Rd. The need to guarantee the transverse permeability of the future line, requires the execution of a series of wildlife crossings. These wildlife crossings will pass under the Monterey Rd and under the future HSR tracks.

The execution under the tracks will be carried out according to the dimensions of the construction element, by parts or following the methods proposed in Appendices B and C. The proposed methods for crossing under Monterey road are defined in the following appendix.

Monterey Rd is a road with 2 lanes per direction without a median. In order to maintain traffic, it is necessary to partially cut the road by reducing the traffic to a single lane or to make a temporary detour to maintain the capacity of the road. The choice of one system or another is given by the traffic intensity of the road and by the characteristics of the wildlife crossing (dimensions, precast concrete or executed on site). The proposed construction procedures are included below.

Wildlife crossings of exterior dimensions up to 10x10 ft.

In this case, for wildlife crossings with external dimensions up to 10x10 ft and with the hypothesis of a low traffic intensity. The most economic system is build the wildlife crossing by phases. Cutting a lane and placing the precast elements, once the elements are located it is possible reopening the lane of road.

The constructive phases of this process are:

1. Execution of the provisional detour of the road.
2. Excavation.
3. Concrete base.
4. Placing of the precast elements.
5. Fill.
6. Restitution of the road lane and signaling.
7. Opening of the road.

This process will be repeated as many times as necessary. The traffic detour will be adapted to the following scheme:

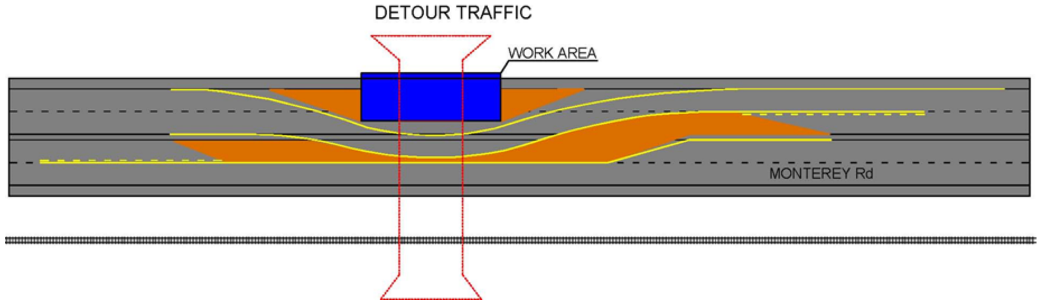

Figure 1. Detour traffic

The traffic detours will be adjusted to the progress of construction of the wildlife crossing. The direction of progress in the execution of the wildlife crossing will be from bottom to top to avoid problems with the accumulation of rainwater on the worksite.

For wildlife crossings of larger dimensions, the solution is complex. The solution to be adopted depends on multiple factors:

- Characteristics of the road. Widths, number of lanes.
- Traffic. The intensity of the traffic conditions the possibility of executing the temporary cut of one lane in each direction.
- Geotechnical characteristics of the soil.
- Height of the element to be built.
- Availability of land bordering the road for temporary detours

These factors will condition the constructive method. If it is possible to execute a traffic detour compatible with the excavation to execute, the best option is to excavate and execute the structure from bottom to top. In the case of not having enough space the alternatives go through the adoption of a constructive system that occupies the minimum. A system widely used in urban environments is known as Top-Down, the construction phases of this system are:

1. Partial cut of the road.
2. Execution of reinforced concrete diaphragm wall.
3. Execution of the upper slab.
4. Reopening the road.

These phases will be repeated the number of times necessary to form a top slab and continuous side walls. Once the upper slab of the wildlife crossing has been completed, there is no longer any impact on the Monterey Rd traffic. In order to complete the wildlife crossing the phases to be executed are the following:

5. Excavation under the upper slab
6. Execution of the lower slab

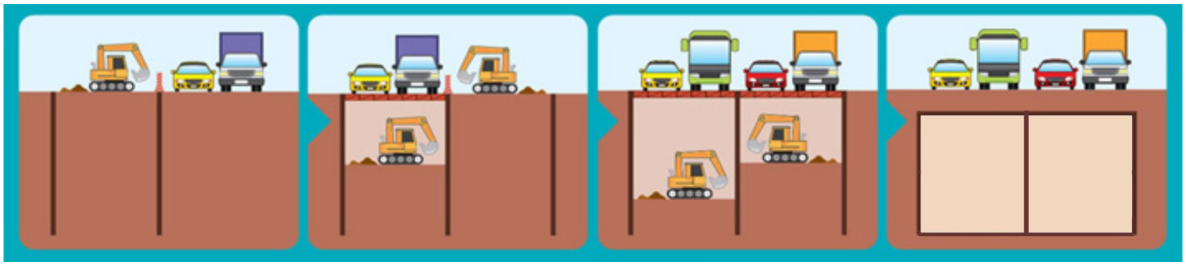

Figure 2. Top – Down Construction Phases