

APPENDIX D: TRACK SHIFTS WORKS REPORT AND EXHIBITS

**SAN FRANCISCO – SCOTT BOULEVARD
CONSTRUCTABILITY ANALYSIS**

APPENDIX D. TRACK SHIFTS WORKS REPORT AND EXHIBITS

March 2019



APPENDIX D. TRACK SHIFTS WORKS REPORT AND EXHIBITS

INDEX

| | |
|--|----|
| 1. WORKING APPROACH..... | 1 |
| 1.1 Purpose..... | 1 |
| 1.2 Existing Operational Assumptions..... | 1 |
| 1.3 Regulations Applied | 3 |
| 1.4 Analysis Assumptions | 3 |
| 1.5 Input data | 3 |
| 2. CURRENT SITUATION..... | 4 |
| 3. FUTURE ACTIONS..... | 4 |
| 3.1 Actions in the horizontal layout..... | 5 |
| 3.1.1 Classification..... | 5 |
| 3.2 Actions in elevation | 9 |
| 3.2.1 Impacts on the Existing Traffic..... | 12 |
| 3.3 Actions on the Catenary | 14 |
| 3.3.1 Classification..... | 14 |
| 3.3.2 Impacts on the Existing Traffic..... | 16 |
| 3.4 Turnouts..... | 16 |
| 3.5 Actions on At-Grade Crossings..... | 20 |
| 4. SPECIAL CASES..... | 21 |
| 5. SAN FRANCISCO – SAN JOSE CONSTRUCTABILITY ANALYSIS..... | 21 |

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 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 Francisco to San Jose Corridor is operated by Caltrain. Caltrain provides commuter services between both cities. In the future, this corridor will be used by high-speed and commuter 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 match the operation profile under electrified line. 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 San Francisco to Scott Boulevard and the OCS is in service in the corridor prior to construction.
- The track realignment construction will be carried out according to track possession work windows, work zones and work segment criteria:
 - 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.

- Work zones. One work zone will be considered for each of the following work segments.
- Work segments. The line is divided into three overall work segments:
 - WS1: 7.8 miles (MP 0.2 to MP 8.0)
 - WS2: 21.1 miles (MP 8.0 to MP 29.1)
 - WS3: 13.7 miles (MP 29.1 to MP 42.8)

Work may be performed concurrently in only two work segments. Work may not occur in two adjacent work segments.

- 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 San Francisco to San Jose 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 San Jose Caltrain corridor is not electrified, but it is assumed to be for the purposes of this study.

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:
 - Alternative A
 - Layout file: X-FJ-TT-ALGN-PROP-MATH.alg
 - File dgn: X-FJ-TT-PROP-NARROW.dgn
 - Alternative B
 - Layout file: TT-Wide Alignment.alg
 - File dgn: X-FJ-TT-PROP-WIDE.dgn

- Future situation Brisbane workshop area alternative B West:
 - File dgn: X-FJ-TT-ALGN-PROP-ALTB-BRIS.dgn
- Future situation Passing Tracks Area:
 - Layout file: X-FJ-TT-ALGN-PROP-SM4T.alg
 - File dgn: X-FJ-TT-ALGN-PROP-ALTB-SM4T.dgn

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 22 existing railway stations, the main ones being:

- San Francisco (northern terminus)
- Millbrae (connection point with BART and access point to San Francisco International Airport)
- Mountain View (connection point with VTA LRT)

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 Francisco and Millbrae stations will be equipped with exclusive high-speed platforms with lengths of 1,400 ft.

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

Two layout alternatives have been identified. The differences between both alternatives are Brisbane workshops and environment as well as for works to be performed in the subsection named Passing Tracks Area. Passing Tracks Area comprises the stations of Hayward Park, Hillsdale, Belmont and San Carlos, in which one alternative only makes adjustments on the existing tracks, and the other provides two new tracks to facilitate overtakings. These two alternatives will be referred hereafter as Alternative A and Alternative B.

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.



Figure 2. 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 3. Lateral Displacements of the track between 1 and 10 ft

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

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 4. Lateral Displacements of the track between 10 and 21.34 ft

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

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



Figure 5. Lateral Displacements of the track greater than 21.34 ft

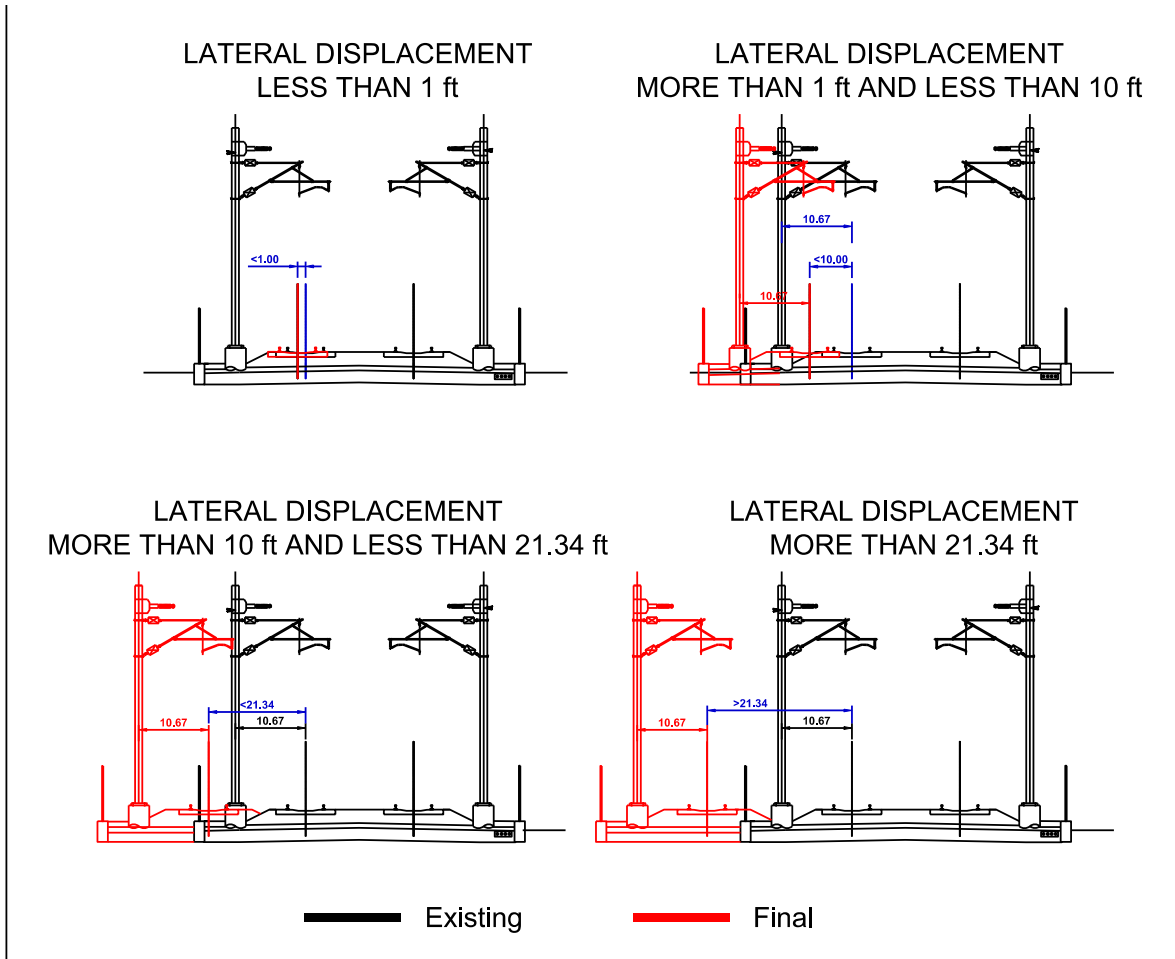


Figure 6. Classification of actions in the horizontal layout

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: Lateral displacements of the track 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 elevations between 0.01 and 0.05ft.
- Rebuilding of the entire section, including the trackbed and the rest of the layers, for greater descents.

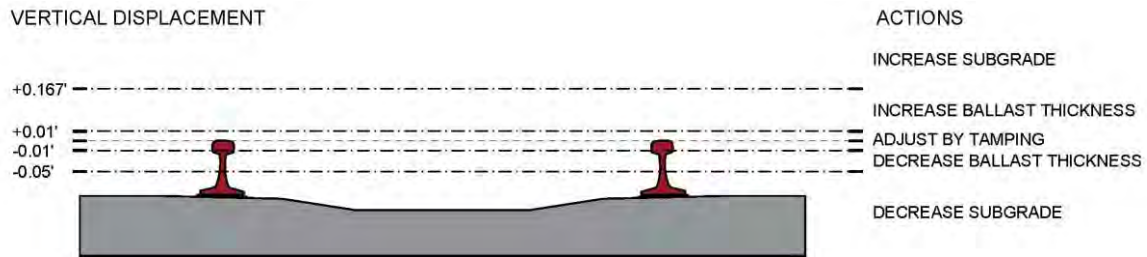


Figure 7. Actions in section for variations in vertical alignment

- **Case 2: Lateral displacements of the track between 1 and 21.34 ft.**

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.

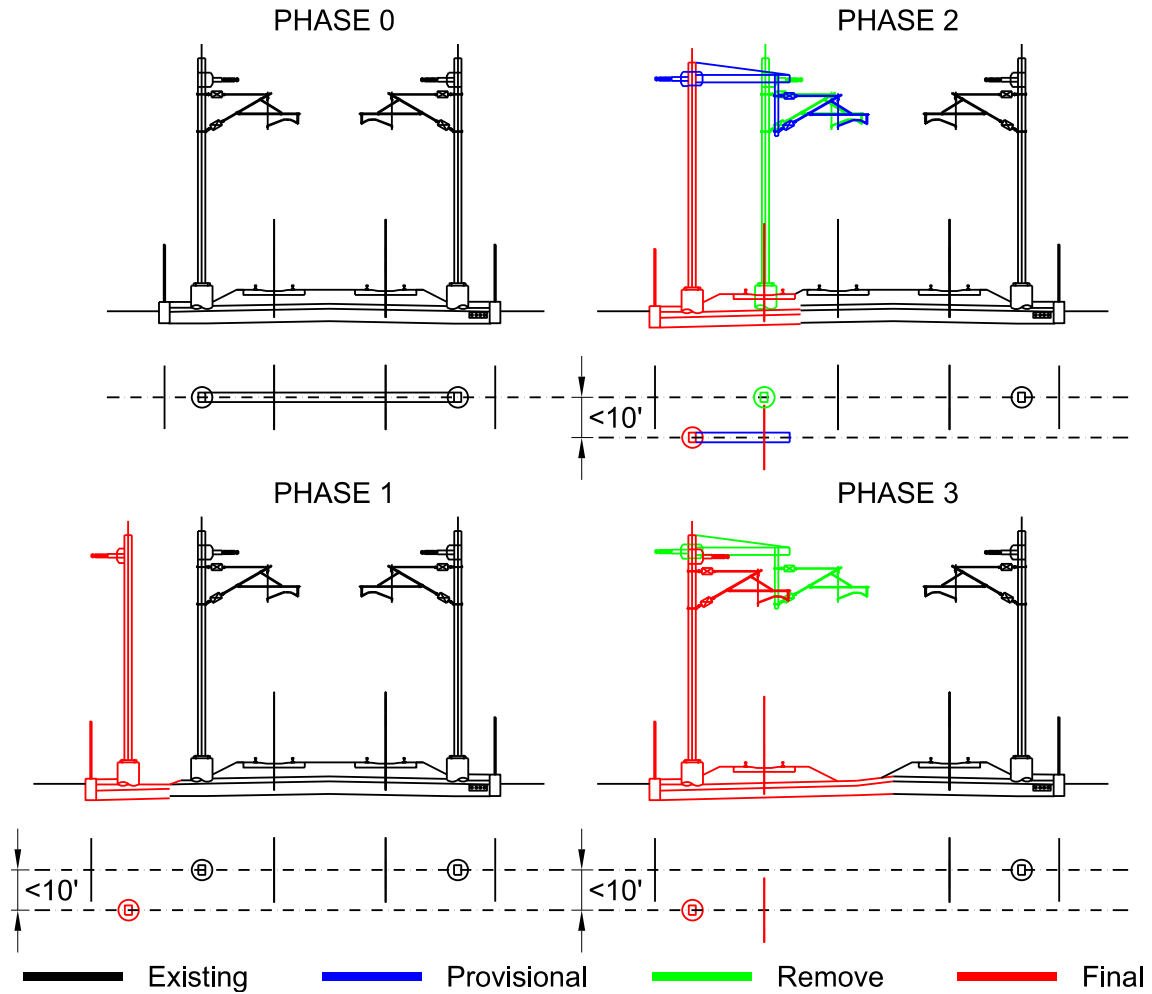


Figure 8. Phases of works for the ascent of the longitudinal profile

- *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.

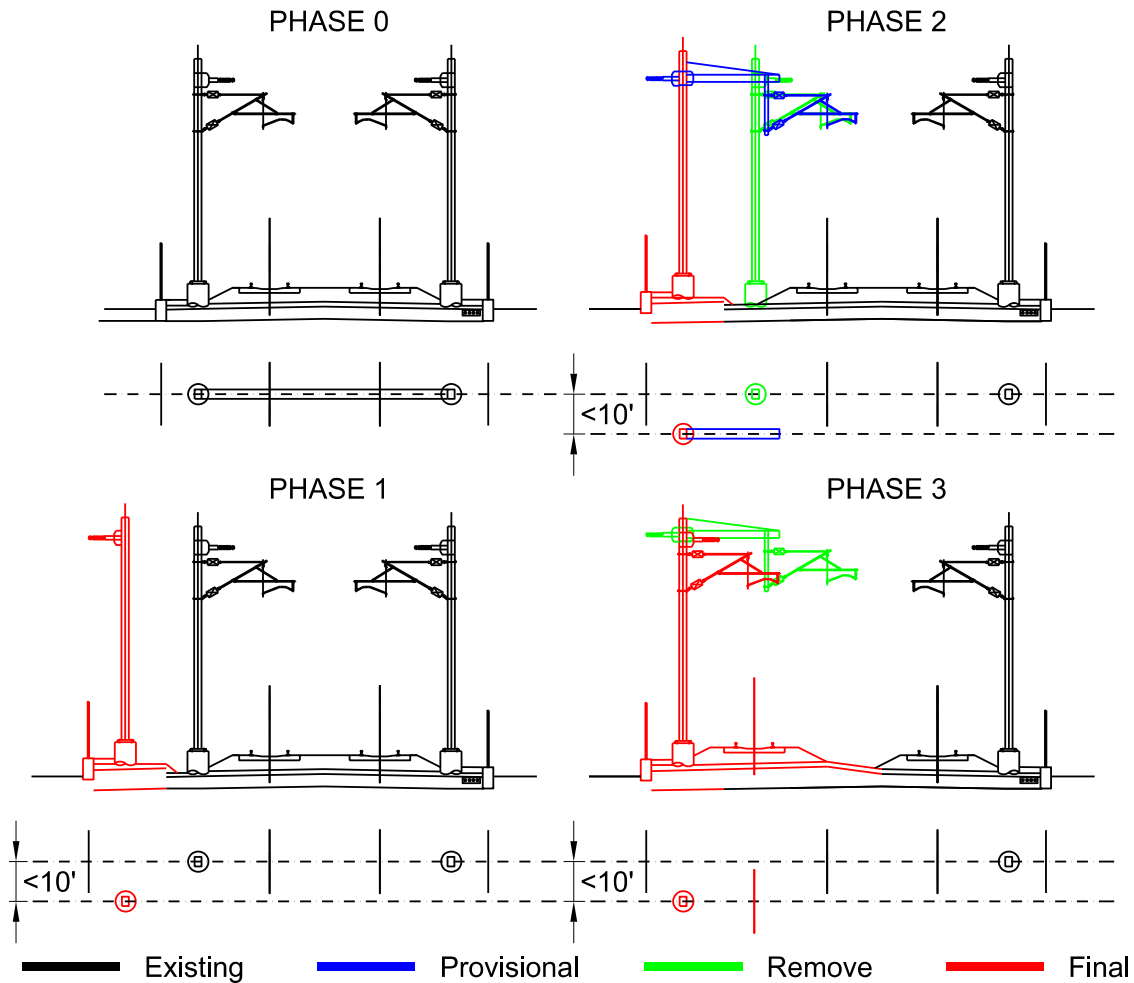


Figure 9. Phases of works for the descent of the longitudinal profile

- **Case 3: Lateral displacements of the track greater than 21.34 ft.: No influence:**

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 be 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 Actions on the Catenary

3.3.1 Classification

As already mentioned previously, both the horizontal and vertical variation of the track requires the necessary adaptation of the catenary poles in several ways.

The horizontal tolerances in the catenary are as follows:

- The difference of horizontal position between the axis of the future track and the current one must not exceed 1ft, so that it is possible to adapt the cantilevers of the catenary.

Regarding the elevation, the restrictions of the catenary poles are the following:

- The difference between the elevation of the catenary and the rail level of the future track cannot exceed the difference between the elevation of the catenary and the rail elevation of the old track by more than 1ft.

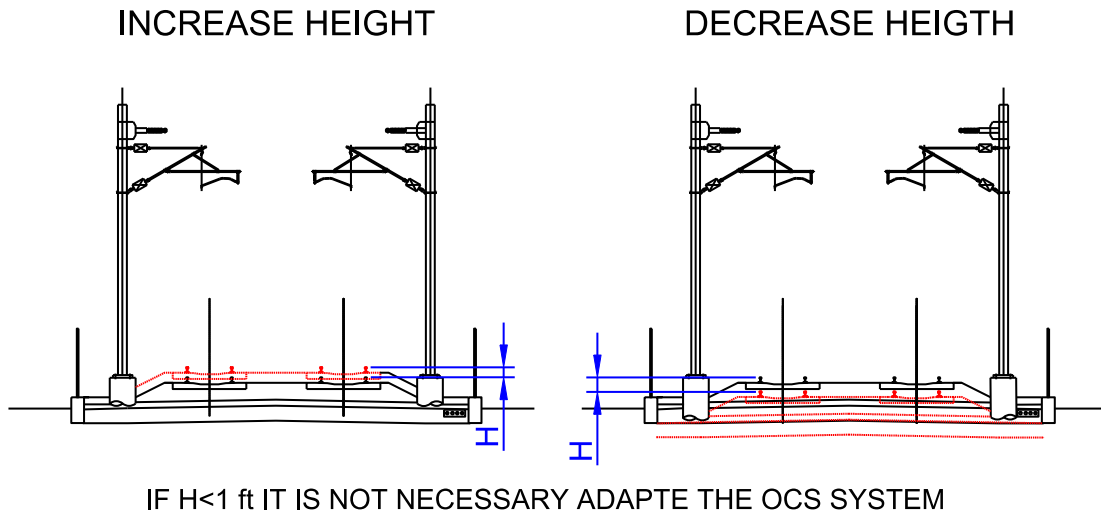


Figure 10. Elevation restrictions on the catenary

- Likewise, the difference between the gradient of the longitudinal profile of the current track and that of the future one cannot be greater than 0.2%, assuming that the current track and the catenary are parallel. This limit, 0.2%, is the value established in the Design Criteria Manual for speeds up to 125 mph.

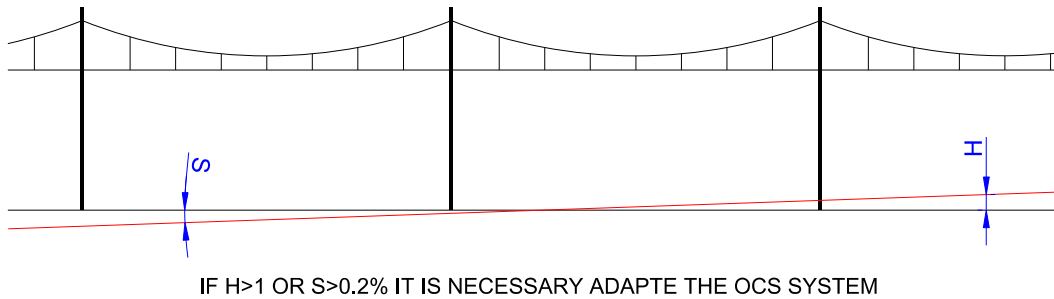


Figure 11. Gradient restrictions on the catenary

Any other assumption that requires a vertical displacement that does not comply with the criteria described above, requires the replacement the old poles for adaptation to the new longitudinal profile.

As a summary, the classification of the necessary actions in this area would be the following:

- **Negligible lateral displacements, with variations of the longitudinal profile of the future track greater than 1ft with respect to the current one or that the gradient variation between both is greater than 0.2%:**

Vertical adjustment of contact wire.



Figure 12. Horizontal and Vertical adjustment of contact wire

- **Lateral displacements of the track between 0 and 1 ft.:**
Contact wire adjustments without modifying the poles position.
- **Lateral displacements of the track between 1 and 21.34 ft. :**
Relocation of poles
- **Lateral displacements of the track greater than 21.34 ft.:**
No influence on existing poles, since new poles will be installed.

3.3.2 Impacts on the Existing Traffic

When construction activities require the interruption of the power supply to the catenary, construction will be carried out during cut-offs in nighttime periods in order to minimize the impact on the usual railway traffic.

However, when foundations of the poles are located at a distance greater than 10 ft. from the track centerline, power cuts will not be required and activities will be located in the safety zone, so they may be executed during the day without affecting the daily traffic.

3.4 Turnouts

Along the route between San Francisco and Scott Boulevard, 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 13. 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 14. Transportation of a pre-assembled turnout



Figure 15. Assemble of a pre-assembled turnout with cranes

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 track horizontal layout and longitudinal profile.



Figure 17. Typical at-grade crossing in railway line San Francisco to San Jose

The at-grade crossings that must be modified are those that will be affected by a displacement of the 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 18. Construction of at-grade crossing

4. SPECIAL CASES

There are three special cases in San Francisco – Scott Boulevard constructability analysis who completed the tracks adaptation:

- Appendix A Special Case 1 – Electrification (OCS Adjustments)
- Appendix B Special Case 2 – Jacked box undercrossing
- Appendix C Special Case 3 – Micropiles wall undercrossing

These special cases are developed in three independent appendix.

5. SAN FRANCISCO – SAN JOSE CONSTRUCTABILITY ANALYSIS

As noted above, two alternatives have been defined for the San Francisco - San Jose section. Both alternatives are essentially identical to each other. Their differences can be found in the Brisbane rolling stock maintenance facilities (LMF) area, next to the current Bayshore station, and in the treatment of the area called Passing Tracks Area. Two alternatives are defined, A and B, which are characterized by:

- Alternative A: Brisbane LMF is on the east side of the line.
- Alternative B: Brisbane LMF is located at the west side of the current track and the current double track is extended to four tracks in the "Passing tracks area segment".

In both alternatives, the layout adaptation in common areas will be identical and will mainly consist in small adjustments on the plan and elevation of the current tracks, except for Millbrae station, where a station with differentiated platforms is considered for the Caltrain and for high speed line, so in this area an independent study will be carried out.

An independent study is equally necessary for accesses to Brisbane workshop, and the difference between both is their location on the east or on the west side of the current track.

This document analyzes Alternative A and B dividing these alternatives in a series of appendix, where a memory report and a series of drawings describing works to be performed.

Appendices for each alternative are:

Alternative A would comprise the following alternative subsection alignments and elements (from north to south):

- San Francisco – Scott Boulevard. Track shift works. Alternative A (Appendix D.1)
- Brisbane LMF (East) Alternative A Report and Exhibits (Appendix D.3)
- Millbrae station Report and Exhibits (Appendix D.5)

Alternative B would comprise the following alternative subsection alignments and elements (from north to south):

- San Francisco – Scott Boulevard. Track shift works. Alternative B (Appendix D.2)
- Brisbane LMF (West) Alternative B Report and Exhibits (Appendix D.4)
- Millbrae station Report and Exhibits (Appendix D.5)
- Passing Tracks Alternative B Report and Exhibits

APPENDIX D.1: TRACK SHIFTS WORKS REPORT AND EXHIBITS – ALTERNATIVE A

CALIFORNIA HIGH SPEED TRAIN PROJECT

CONSTRUCTABILITY ANALYSIS

**APPENDIX D.1. TRACK SHIFTS WORKS ALTERNATIVE A REPORT AND
EXHIBITS**

March 2019



APPENDIX D.1. TRACK SHIFTS WORKS ALTERNATIVE A REPORT AND EXHIBITS.

Index

1. ACTIONS ON THE SAN FRANCISCO TO SCOTT BOULEVARD SECTION 1

1. ACTIONS ON THE SAN FRANCISCO TO SCOTT BOULEVARD SECTION

The collection of construction drawings that accompanies this document shows graphically the different degrees of impact to main tracks in the San Francisco to Scott Boulevard railway corridor. In them, the scope of the adaptation work for horizontal and vertical layout, impact on the catenary, turnouts, stations and at-grade crossings is shown.

In the present analysis, the San Francisco station does not undergo any modification, so it is assumed that there is no impact of the elements previously indicated.

As it is shown on the plans, the **changes in the horizontal** are localized, but require a great number of actions, with the largest amount of work needed at the following locations:

- Brisbane workshop-Bayshore station - Project Brisbane -
- South San Francisco station
- I-380 crossing near San Bruno station
- Millbrae station - Project Millbrae -
- Atherton station

These actions stand out either because of the length of their modification or because of the size of their lateral displacement.

There are other minor actions that can be resolved by using track machinery and without having to provide new catenary poles.

The actions in the **longitudinal profile** have been classified by whether the track is raised or lowered.

The number of sections where the track is raised, is greater than the ones where a descent occurs, and may be solved by the addition of ballast and the use of track machinery, so the impact on the railway traffic will be minimal.

For the case when the track is lowered, the importance of this will be given by the degree of impact on the existing railway grade.

The impact on the **electrification system** due to a change in position of the contact wire in elevation varies along the corridor and are of greater importance those associated with the lateral displacement.

Due to the large number of stations and diversions existing along the track, impacts to the existing **track turnouts** is significant. Changes to turnouts can be classified as those that will remain on the track but that will be adjusted in their horizontal and vertical position, those that will be dismantled and the installation of new turnouts.

All the adjustments that have to do with the turnouts will be carried out in parallel with the actions on the track where it is located. Generally, the actions in turnouts are made during the weekend, since these operations are complex and if any adversity occurs there is more time available to solve it.

There is a large number of turnouts where profile changes are required. The major changes in the horizontal plane are associated with the disassembly and assembly of new turnouts. All changes in the position of the turnouts have associated changes in the catenary.

The modification of the main layout and the remodeling of the track yard in stations, require corresponding modifications in the **platforms**, either in horizontal, vertical, or both.

These modifications affect every platform of all the stations in the San Francisco to Scott Boulevard corridor. The degree of impact varies, going from little adjustments in platforms to its complete rebuilding.

Regarding the at-grade crossings within the corridor, due to changes in the existing horizontal and vertical layout and the existing crossing characteristics that allow little tolerances to displacements, it is necessary to rebuild almost every at-grade crossings, except for Villa Terrace and Bellevue. The degree of modification can lead to adjustments in the corresponding road. This is especially true in profile, as is the case, at the 4th Avenue level crossing with vertical displacements close to 1 ft.

Exhibits

LEGEND

-  CALTRAIN PLATFORM
 -  HSR PLATFORM
 -  MT-1
 -  MT-2
 -  SIDING TRACK
 -  OVERHEAD BRIDGE
 -  MAJOR UNDERPASS
 -  CREEK UNDERPASS
 -  TUNNEL
 -  GRADE CROSSING
 -  AREA OF ACTIVITY FOR LATERAL DISPLACEMENT
-
- LATERAL DISPLACEMENT
 -  LESS THAN 1 ft.
 -  MORE THAN 1 ft. AND LESS THAN 10 ft.
 -  MORE THAN 10 ft. AND LESS THAN 21,34 ft.
 -  MORE THAN 21,34 ft.
-
- PROFILE
 -  INCREASE SUBGRADE
 -  DECREASE SUBGRADE
 -  INCREASE BALLAST THICKNESS
 -  DECREASE BALLAST THICKNESS
-
- OCS
 -  NEW OCS SYSTEM
 -  DISPLACEMENT OF OCS POLE
 -  DISPLACEMENT OF CONTACT WIRE
 -  VERTICAL DISPLACEMENT OF CONTACT WIRE
-
- ACTIONS ON PLATFORMS
 -  MODIFICATION OF EXISTING PLATFORM
-
- ANALYSIS OF SPECIAL EQUIPMENT
 -  REMOVE
 -  REMAIN VERTICAL ADAPTATION
 -  NEW EQUIPMENT
-
- GRADE CROSSING TREATMENT
 -  ADAPT
 -  USABLE

\$FILES
 \$PDRVS\$
 \$PENTBLS\$
 \$TIME\$
 \$DATES\$
 \$USERS\$

| REV | DATE | BY | SUB | APP | DESCRIPTION |
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| IN CHARGE | |
| DATE | MAR/2019 |

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 11th Floor
 Madrid, SP 28036

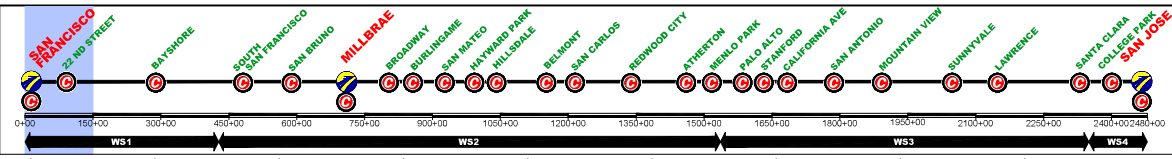
 1111 Broadway
 9th Floor
 Oakland, CA 94607

 CALIFORNIA
 High-Speed Rail Authority

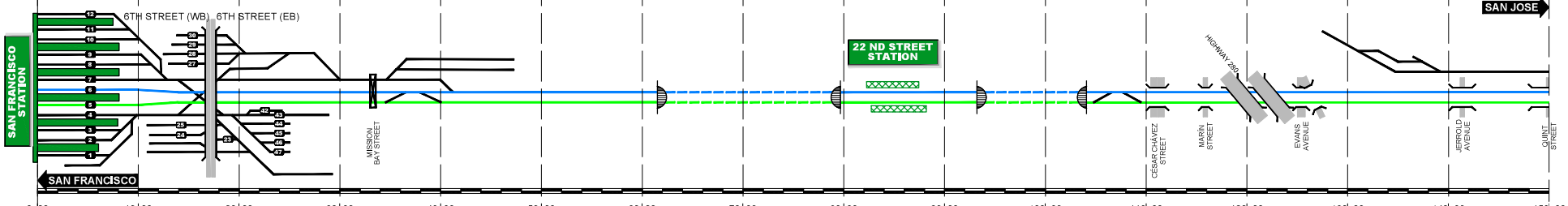
CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO TO SAN JOSE
 SAN FRANCISCO TO SCOTT
 TRACK SHIFTS WORKS
 LEGEND
 ALTERNATIVE A

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| CONTRACT NO. | |
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| SHEET NO. | 1 OF 17 |

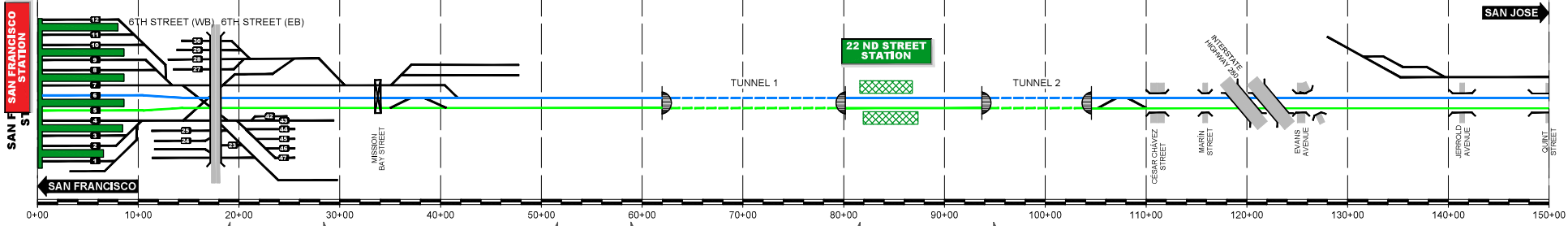
- LATERAL DISPLACEMENT**
- LESS THAN 1 ft.
 - MORE THAN 1 ft. AND LESS THAN 10 ft.
 - MORE THAN 10 ft. AND LESS THAN 21.34 ft.
 - MORE THAN 21.34 ft.
- PROFILE**
- INCREASE SUBGRADE
 - DECREASE SUBGRADE
 - INCREASE BALLAST THICKNESS
 - DECREASE BALLAST THICKNESS
- OCS**
- NEW OCS SYSTEM
 - DISPLACEMENT OF OCS POLE
 - DISPLACEMENT OF CONTACT WIRE
 - VERTICAL DISPLACEMENT OF CONTACT WIRE
- ACTIONS ON PLATFORMS**
- MODIFICATION OF EXISTING PLATFORM
 - ANALYSIS OF SPECIAL EQUIPMENT
 - REMOVE
 - REMAIN VERTICAL ADAPTATION
 - NEW EQUIPMENT
- GRADE CROSSING TREATMENT**
- ADAPT
 - USABLE



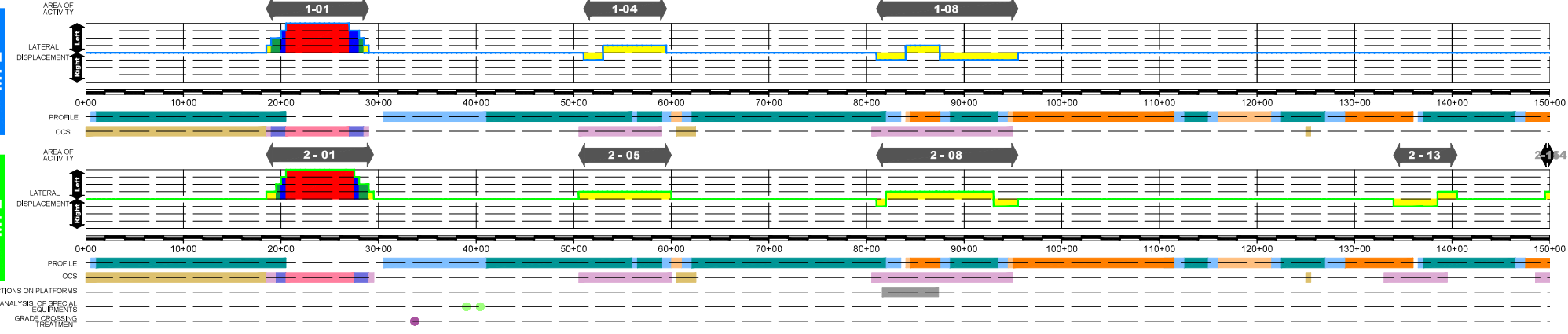
EXISTING SF TO SJ SCHEME



PROPOSED SF TO SJ SCHEME



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\$PDRVS\$
\$PDRVS\$
\$TIME\$
\$REV\$



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| CHECKED BY | |
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| DATE | MAR/2019 |

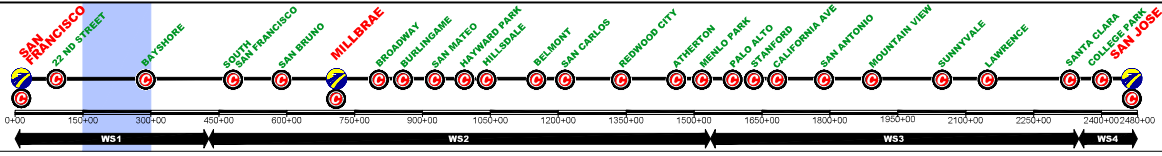
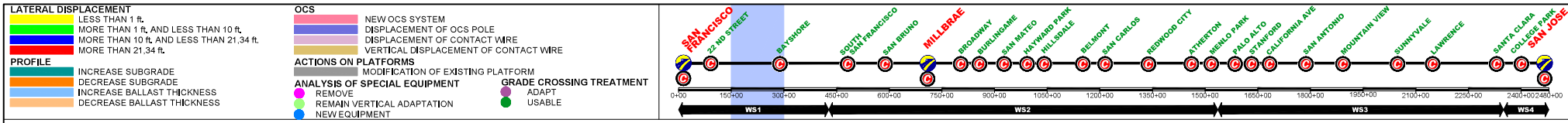
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USE ONLY

NOT FOR
CONSTRUCTION

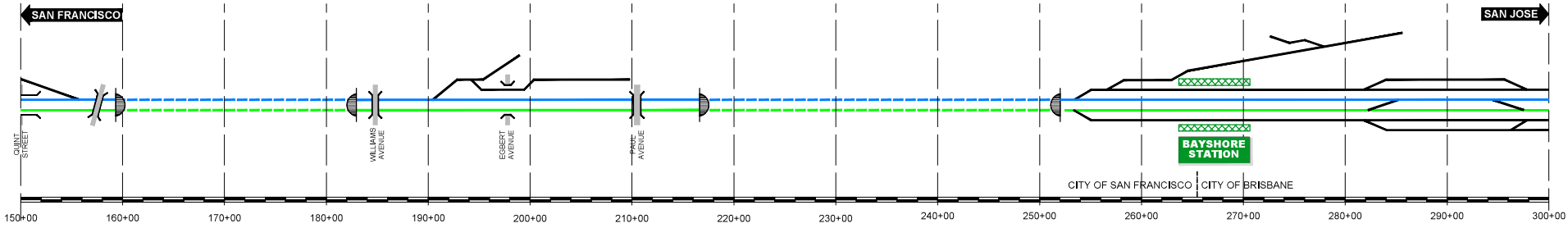


CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO TO SAN JOSE
SAN FRANCISCO TO SCOTT
TRACK SHIFTS WORKS
ALTERNATIVE A

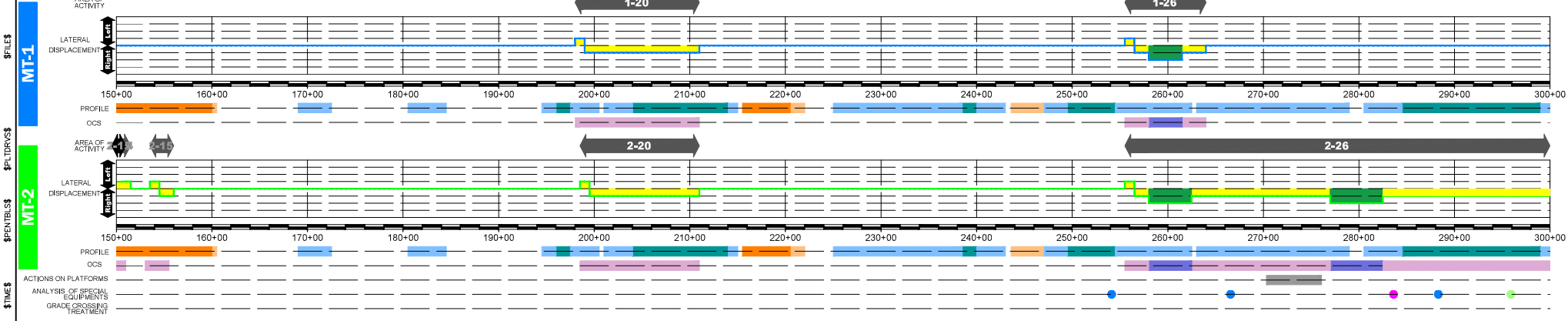
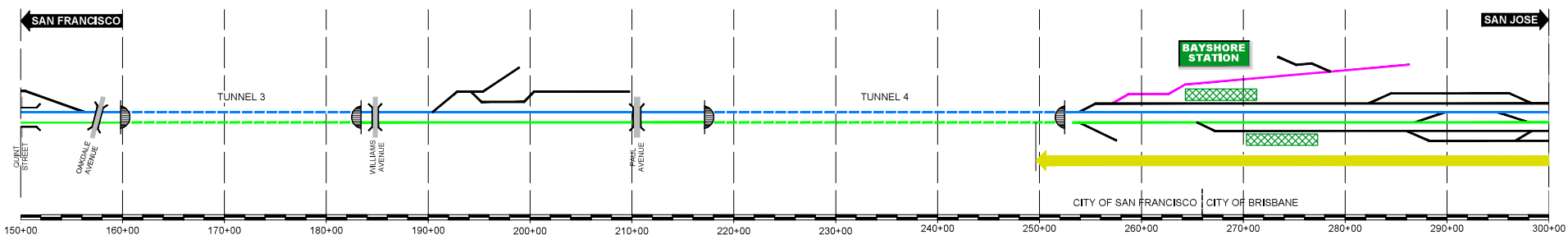
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| SHEET NO. | 2 OF 17 |



EXISTING SF TO SJ SCHEME



PROPOSED SF TO SJ SCHEME



| REV | DATE | BY | SUB | APP | DESCRIPTION |
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| DRAWN BY | |
| CHECKED BY | |
| IN CHARGE | |
| DATE | MAR/2019 |

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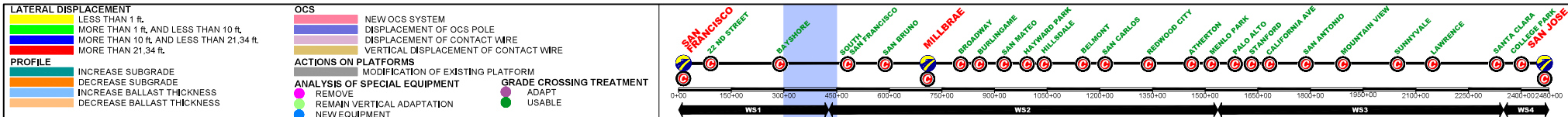
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Madrid, SP 28035

HNTB 1111 Broadway
9th Floor
Oakland, CA 94607

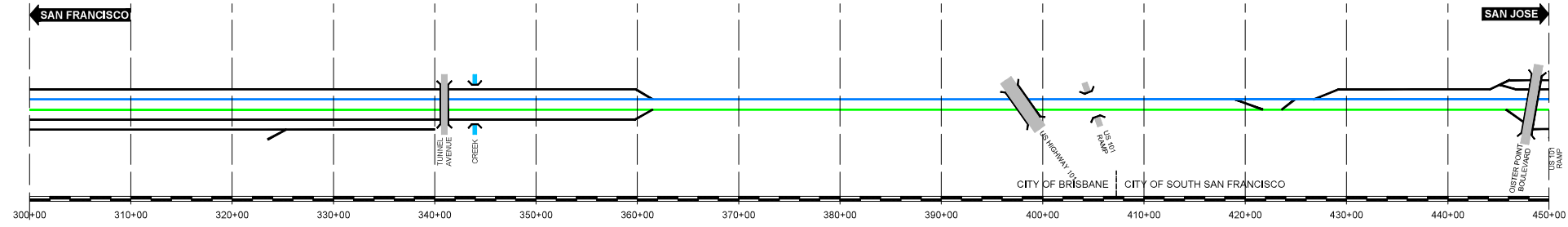
CALIFORNIA
High-Speed Rail Authority

CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO TO SAN JOSE
SAN FRANCISCO TO SCOTT
TRACK SHIFTS WORKS
ALTERNATIVE A

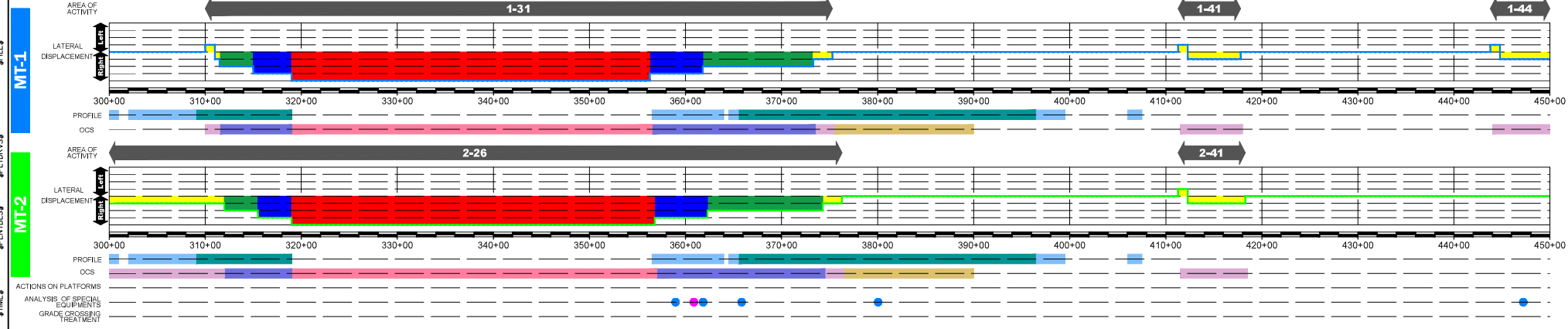
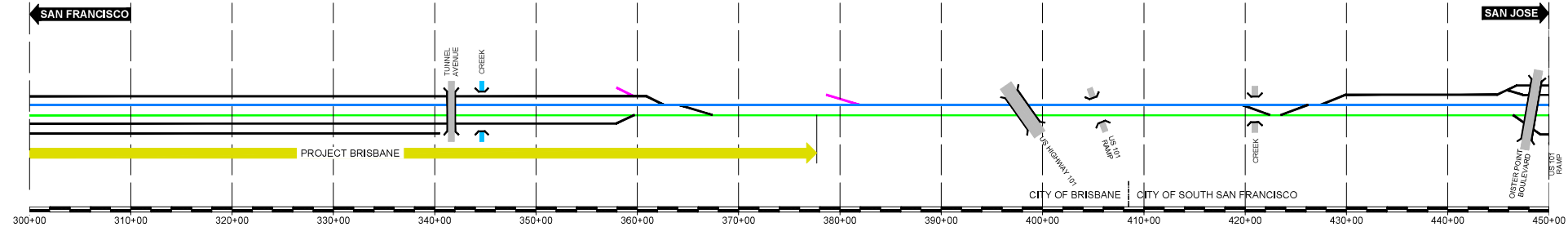
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| SHEET NO. | 3 OF 17 |



EXISTING SF TO SJ SCHEME



PROPOSED SF TO SJ SCHEME



| REV | DATE | BY | SUB | APP | DESCRIPTION |
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| IN CHARGE | |
| DATE | MAR/2019 |

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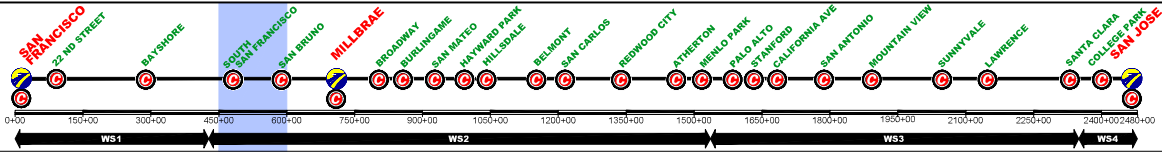
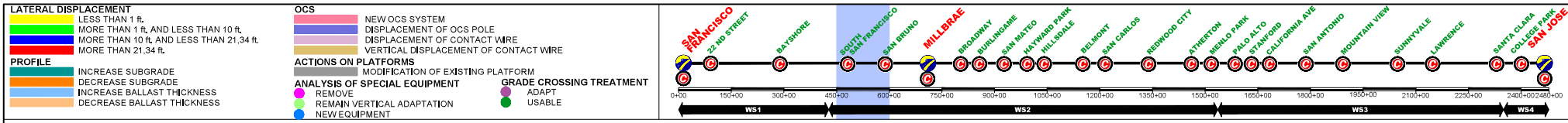
prontec 12 Burgos Ave.
11th Floor
Madrid, SP 28035

HNTB 1111 Broadway
9th Floor
Oakland, CA 94607

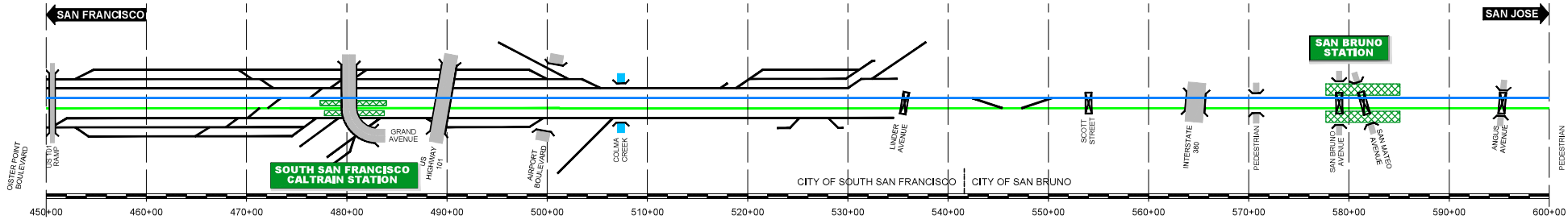
CALIFORNIA
High-Speed Rail Authority

CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO TO SAN JOSE
SAN FRANCISCO TO SCOTT
TRACK SHIFTS WORKS
ALTERNATIVE A

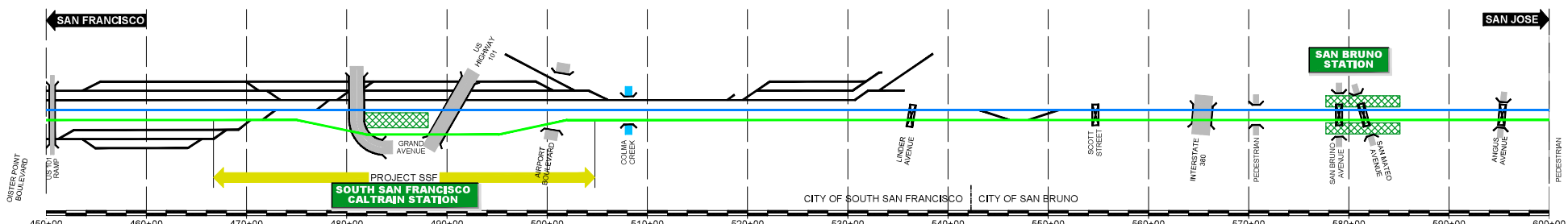
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| SHEET NO. | 4 OF 17 |



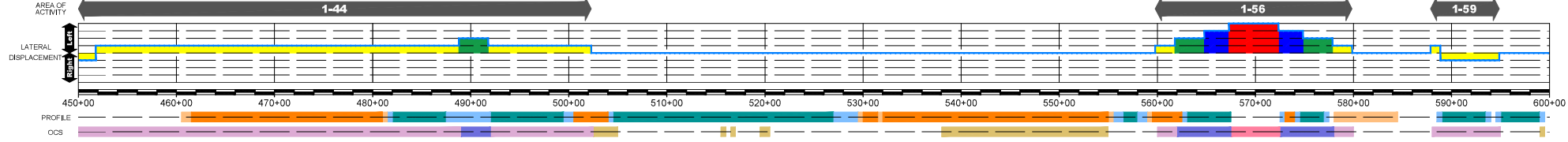
EXISTING SF TO SJ SCHEME



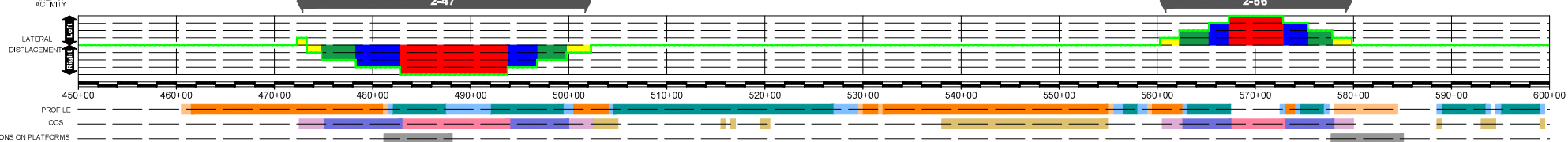
PROPOSED SF TO SJ SCHEME



MT-1



MT-2



| REV | DATE | BY | SUB | APP | DESCRIPTION |
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| CHECKED BY | |
| IN CHARGE | |
| DATE | MAR/2019 |

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CONSTRUCTION

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11th Floor
Madrid, SP 28035

HNTB 1111 Broadway
9th Floor
Oakland, CA 94607

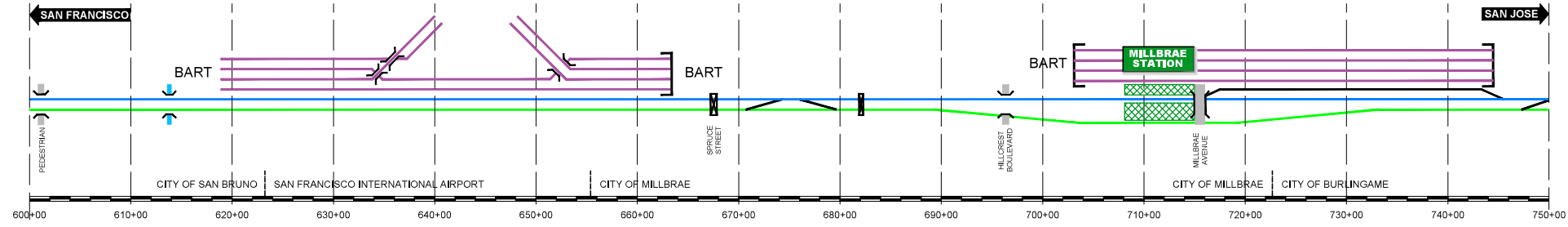
CALIFORNIA
High-Speed Rail Authority

CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO TO SAN JOSE
SAN FRANCISCO TO SCOTT
TRACK SHIFTS WORKS
ALTERNATIVE A

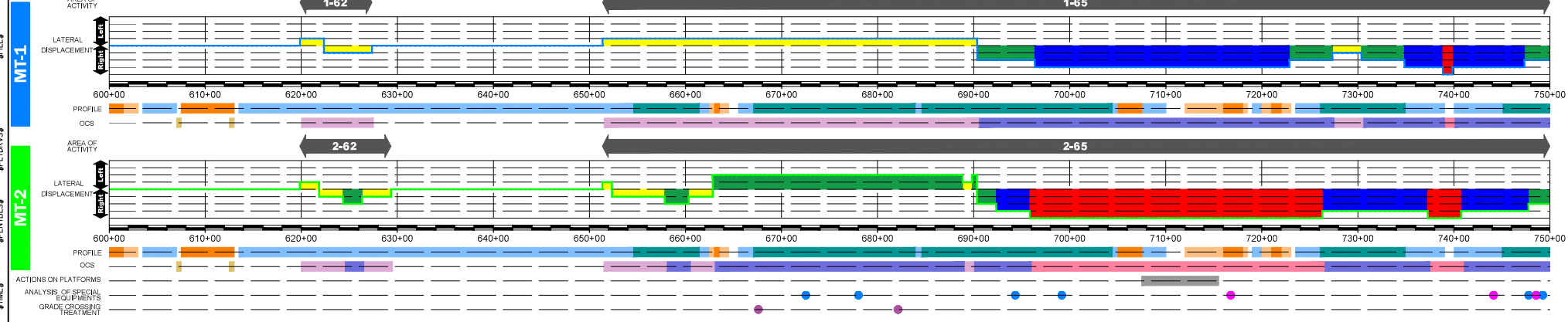
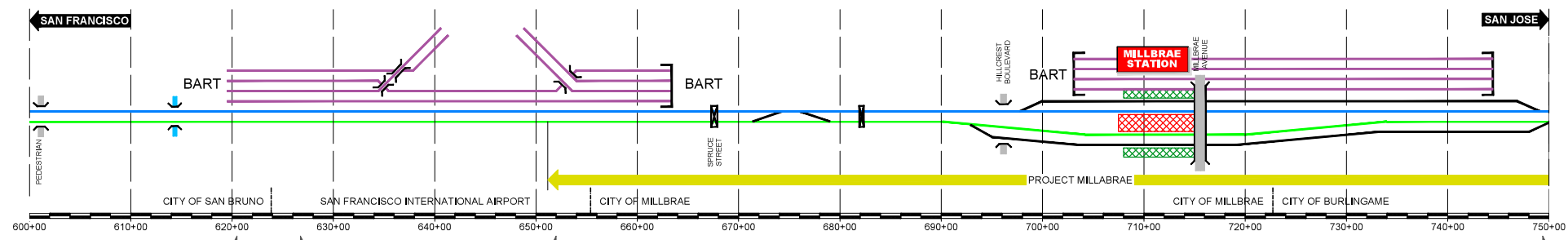
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| SHEET NO. | 5 OF 17 |



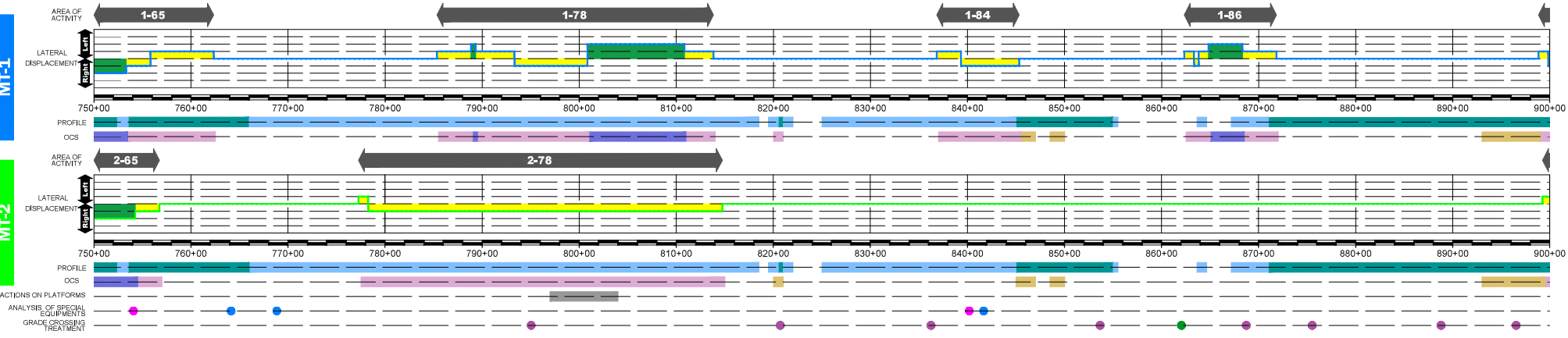
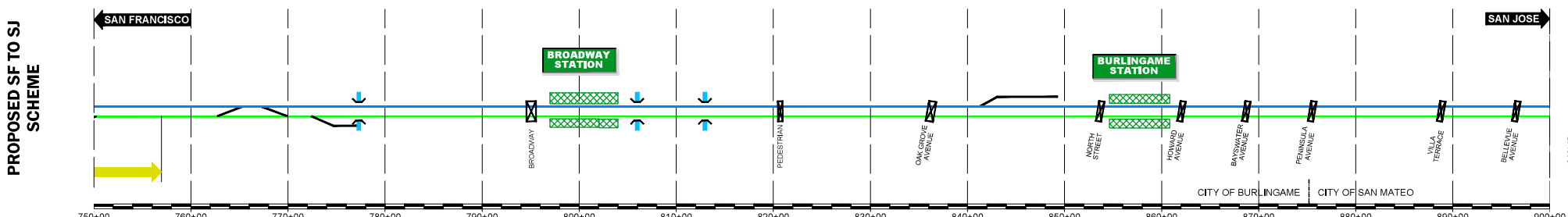
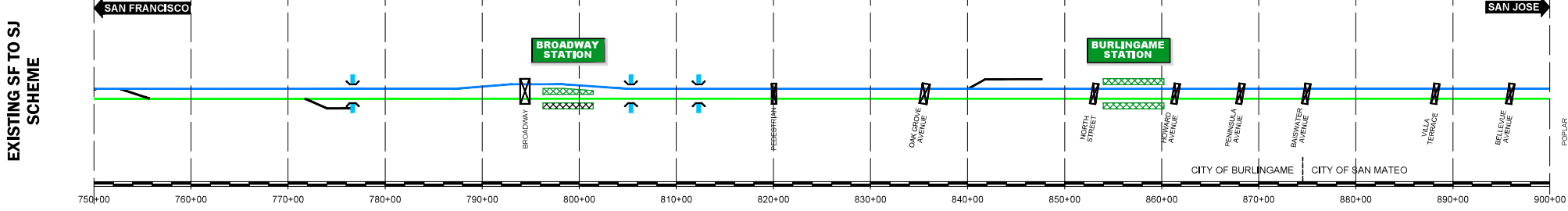
EXISTING SF TO SJ SCHEME



PROPOSED SF TO SJ SCHEME

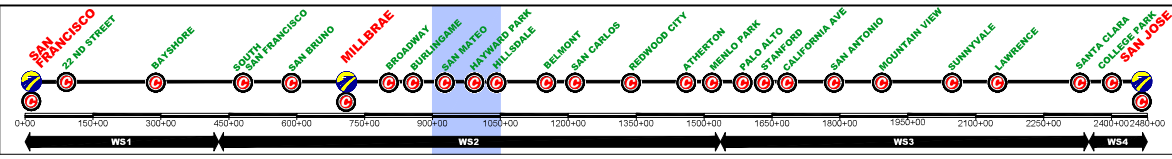


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| DESIGNED BY | DRAFT PEPP | 12 Burgos Ave. 11th Floor Madrid, SP 28035 1111 Broadway 9th Floor Oakland, CA 94607 | | CALIFORNIA HIGH-SPEED TRAIN PROJECT SAN FRANCISCO TO SAN JOSE SAN FRANCISCO TO SCOTT TRACK SHIFTS WORKS ALTERNATIVE A | CONTRACT NO. |
| DRAWN BY | SUBMITTAL FOR INTERNAL USE ONLY | | | | DRAWING NO. |
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| DATE | MAR/2019 | | | | 6 OF 17 |

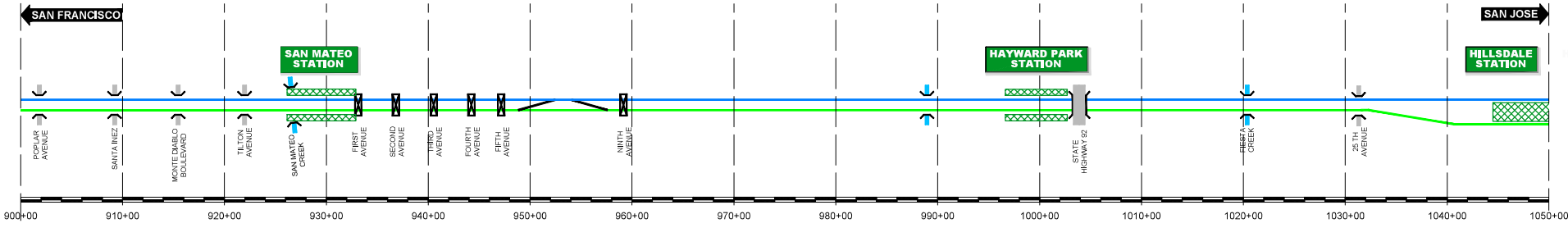


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| DESIGNED BY | DRAFT PEPP | 12 Burgos Ave. 11th Floor Madrid, SP 28035 1111 Broadway 9th Floor Oakland, CA 94607 | | CALIFORNIA HIGH-SPEED TRAIN PROJECT SAN FRANCISCO TO SAN JOSE SAN FRANCISCO TO SCOTT TRACK SHIFTS WORKS ALTERNATIVE A | CONTRACT NO. | |
| DRAWN BY | SUBMITTAL | | | | DRAWING NO. | |
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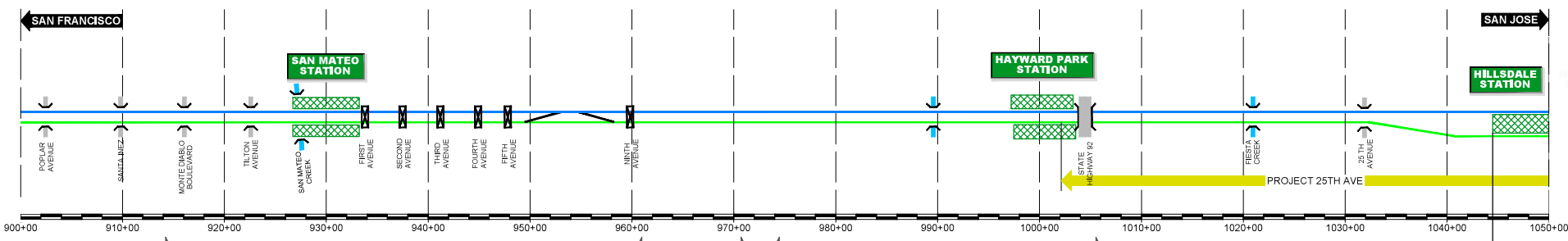
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- LESS THAN 1 ft.
 - MORE THAN 1 ft. AND LESS THAN 10 ft.
 - MORE THAN 10 ft. AND LESS THAN 21.34 ft.
 - MORE THAN 21.34 ft.
- PROFILE**
- INCREASE SUBGRADE
 - DECREASE SUBGRADE
 - INCREASE BALLAST THICKNESS
 - DECREASE BALLAST THICKNESS
- OCS**
- NEW OCS SYSTEM
 - DISPLACEMENT OF OCS POLE
 - DISPLACEMENT OF CONTACT WIRE
 - VERTICAL DISPLACEMENT OF CONTACT WIRE
- ACTIONS ON PLATFORMS**
- MODIFICATION OF EXISTING PLATFORM
 - ANALYSIS OF SPECIAL EQUIPMENT
 - REMOVE
 - REMAIN VERTICAL ADAPTATION
 - NEW EQUIPMENT
- GRADE CROSSING TREATMENT**
- ADAPT
 - USABLE



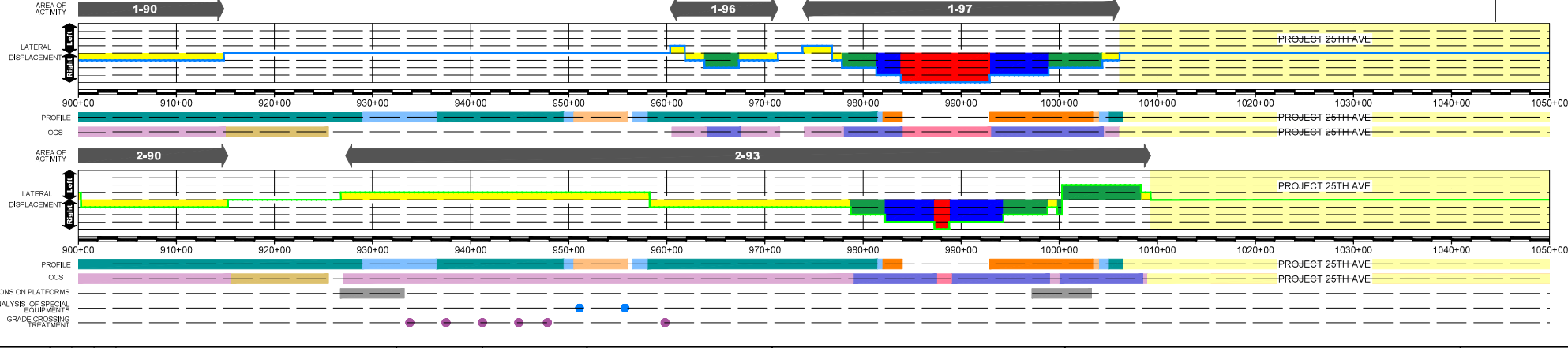
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PROPOSED SF TO SJ SCHEME



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DATE
MAR/2019

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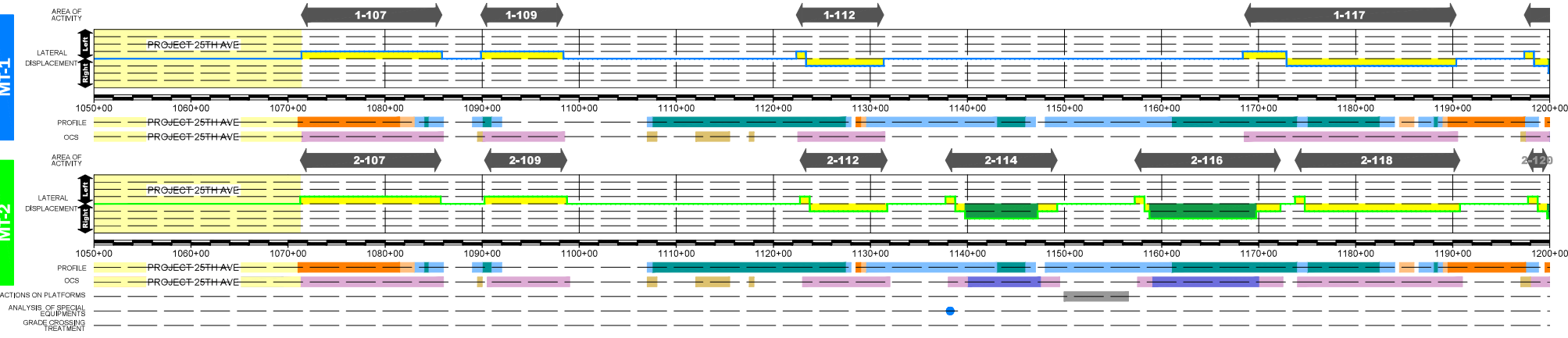
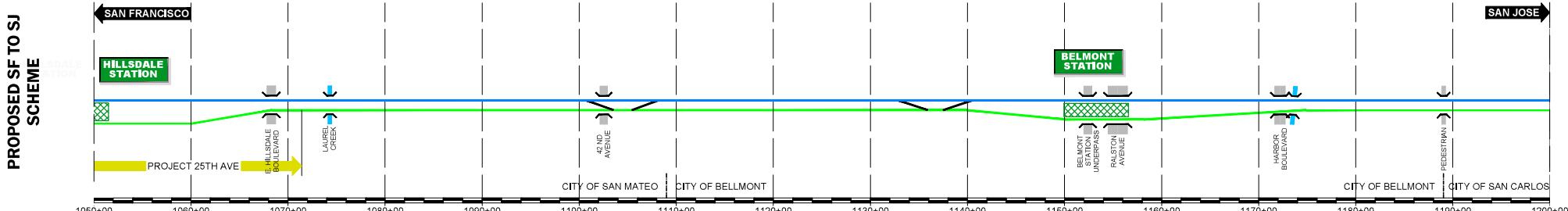
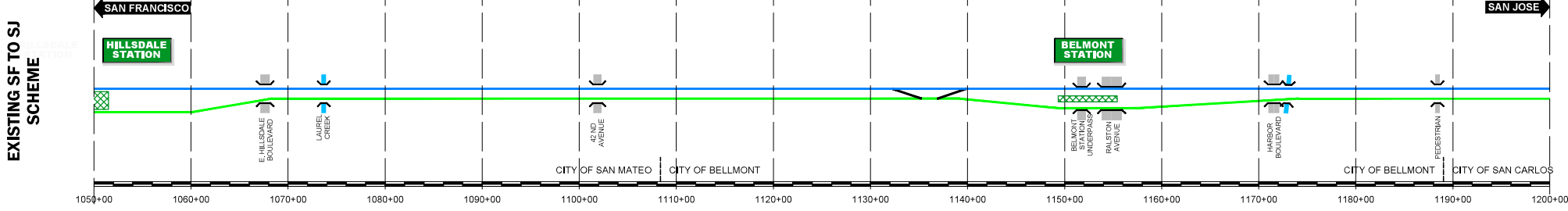
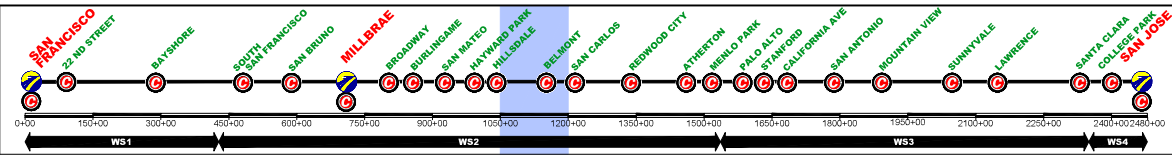
prontec
12 Burgos Ave.
11th Floor
Madrid, SP 28035

HNTB
1111 Broadway
9th Floor
Oakland, CA 94607

CALIFORNIA
High-Speed Rail Authority

CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO TO SAN JOSE
SAN FRANCISCO TO SCOTT
TRACK SHIFTS WORKS
ALTERNATIVE A

CONTRACT NO.
DRAWING NO.
FJ-CV-16FS-TSA-08
SCALE
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SHEET NO.
8 OF 17



| REV | DATE | BY | SUB | APP | DESCRIPTION |
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DATE
MAR/2019

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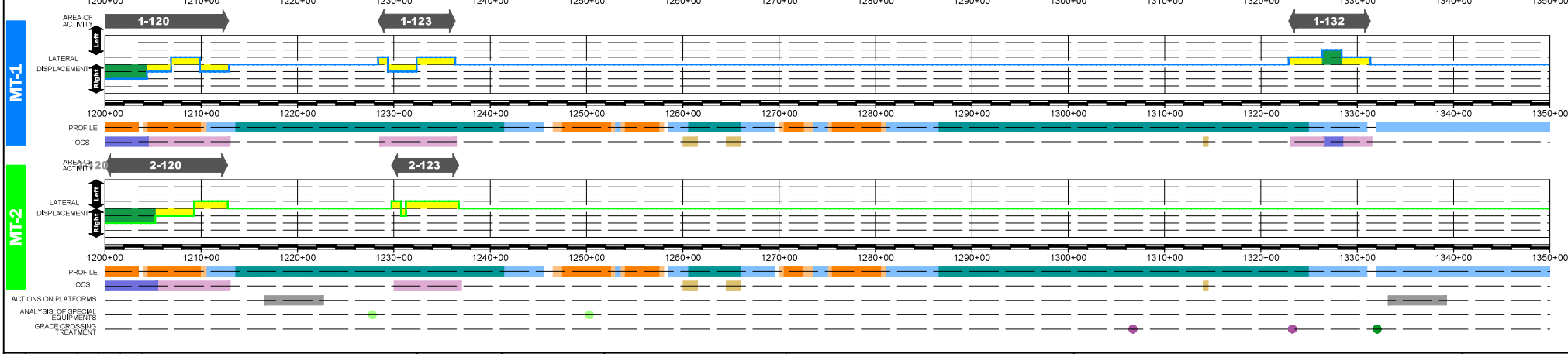
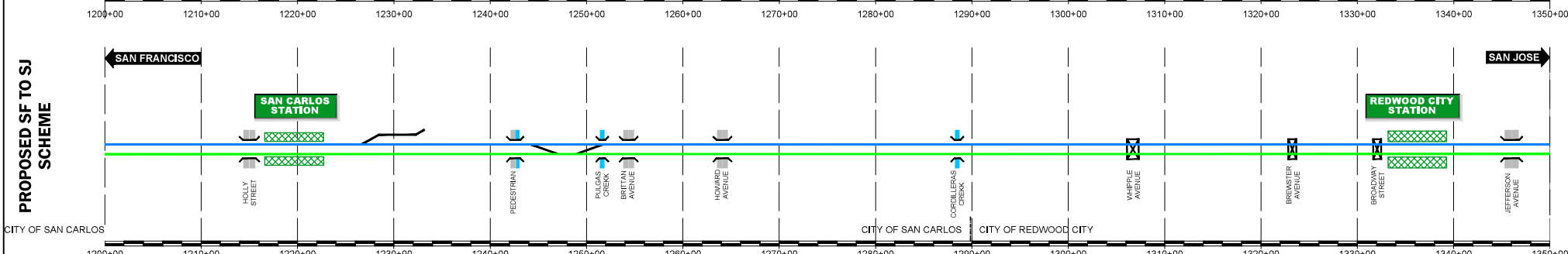
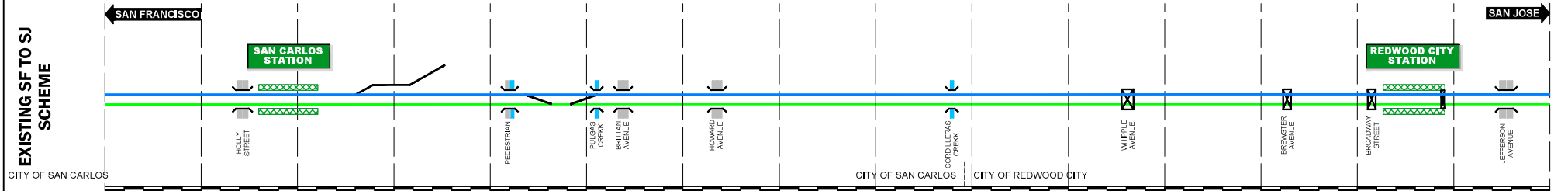
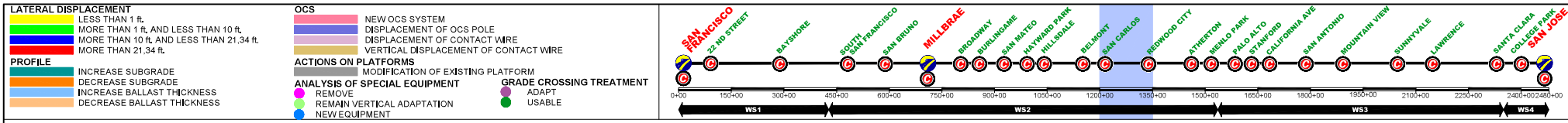
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12 Burgos Ave.
11th Floor
Madrid, SP 28035
HNTB
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9th Floor
Oakland, CA 94607



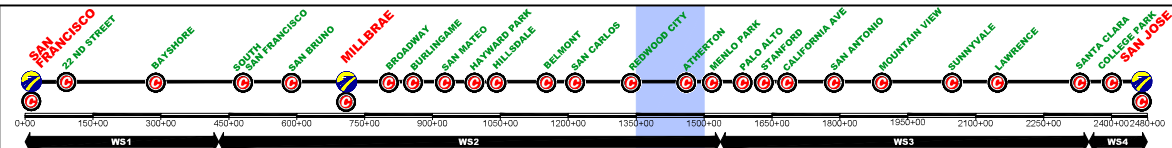
CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO TO SAN JOSE
SAN FRANCISCO TO SCOTT
TRACK SHIFTS WORKS
ALTERNATIVE A

CONTRACT NO.
DRAWING NO.
FJ-CV-16FS-TSA-09
SCALE
NOT TO SCALE
SHEET NO.
9 OF 17

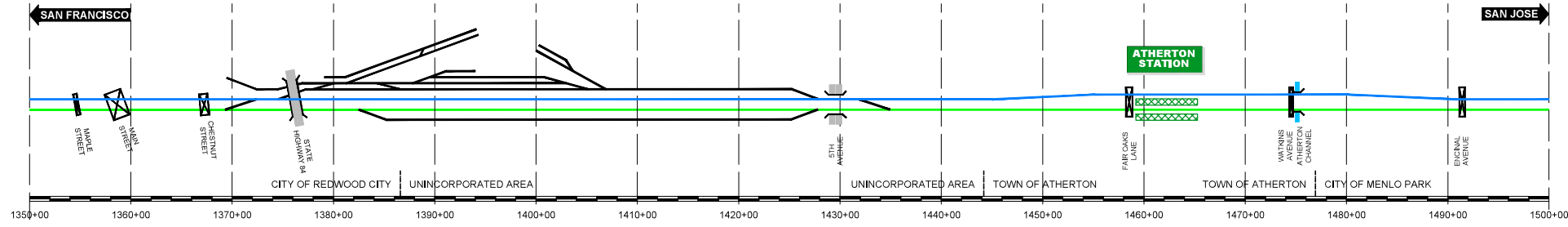


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| DESIGNED BY | DRAFT PEOP | 12 Burgos Ave. 11th Floor Madrid, SP 28035 1111 Broadway 9th Floor Oakland, CA 94607 | | CALIFORNIA HIGH-SPEED TRAIN PROJECT | | CONTRACT NO. |
| DRAWN BY | SUBMITTAL | | | SAN FRANCISCO TO SAN JOSE | | DRAWING NO. |
| CHECKED BY | FOR INTERNAL USE ONLY | | | SAN FRANCISCO TO SCOTT | | FJ-CV-16FS-TSA-10 |
| IN CHARGE | NOT FOR CONSTRUCTION | | | TRACK SHIFTS WORKS | | SCALE |
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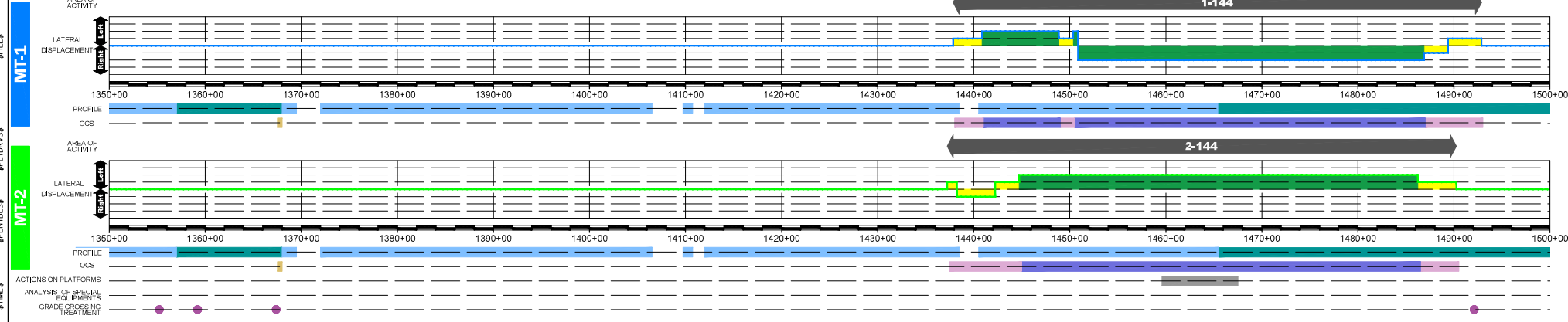
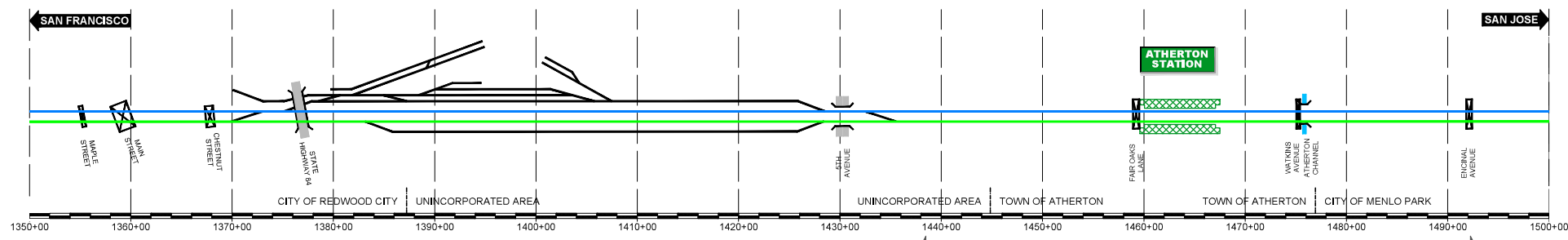
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- LESS THAN 1 ft.
 - MORE THAN 1 ft. AND LESS THAN 10 ft.
 - MORE THAN 10 ft. AND LESS THAN 21.34 ft.
 - MORE THAN 21.34 ft.
- PROFILE**
- INCREASE SUBGRADE
 - DECREASE SUBGRADE
 - INCREASE BALLAST THICKNESS
 - DECREASE BALLAST THICKNESS
- OCS**
- NEW OCS SYSTEM
 - DISPLACEMENT OF OCS POLE
 - DISPLACEMENT OF CONTACT WIRE
 - VERTICAL DISPLACEMENT OF CONTACT WIRE
- ACTIONS ON PLATFORMS**
- MODIFICATION OF EXISTING PLATFORM
- ANALYSIS OF SPECIAL EQUIPMENT**
- REMOVE
 - REMAIN VERTICAL ADAPTATION
 - NEW EQUIPMENT
- GRADE CROSSING TREATMENT**
- ADAPT
 - USABLE



EXISTING SF TO SJ SCHEME



PROPOSED SF TO SJ SCHEME



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| CHECKED BY | |
| IN CHARGE | |
| DATE | MAR/2019 |

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prontec 12 Burgos Ave.
11th Floor
Madrid, SP 28035

HNTB 1111 Broadway
9th Floor
Oakland, CA 94607

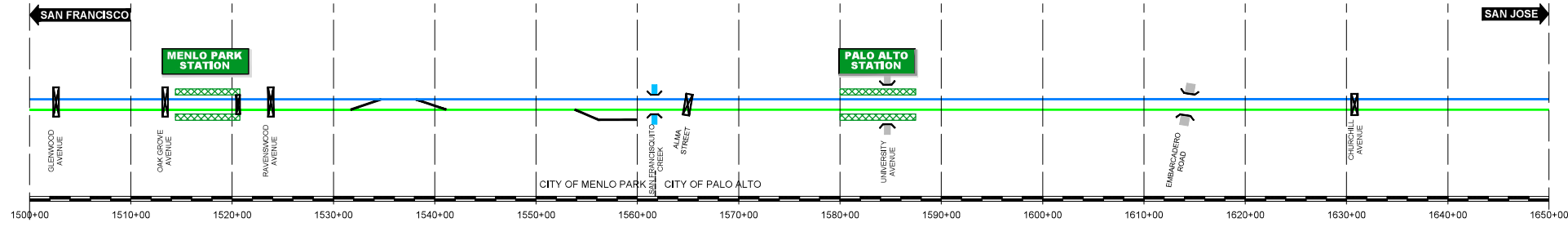
CALIFORNIA
High-Speed Rail Authority

CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO TO SAN JOSE
SAN FRANCISCO TO SCOTT
TRACK SHIFTS WORKS
ALTERNATIVE A

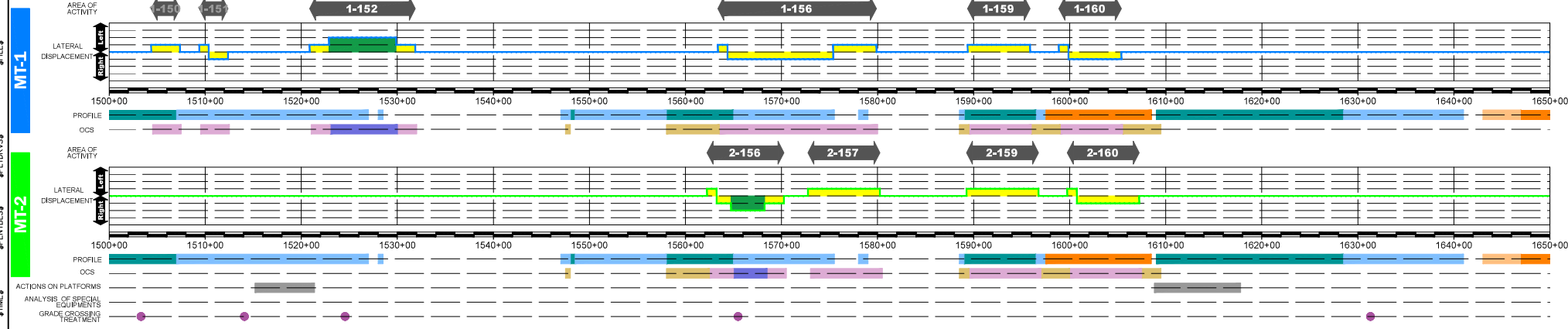
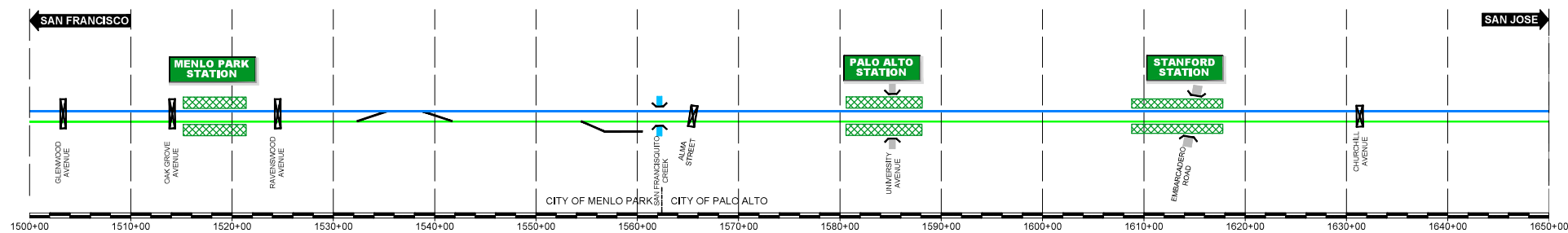
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| SCALE | NOT TO SCALE |
| SHEET NO. | 11 OF 17 |



EXISTING SF TO SJ SCHEME



PROPOSED SF TO SJ SCHEME



| REV | DATE | BY | SUB | APP | DESCRIPTION |
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CHECKED BY
IN CHARGE
DATE
MAR/2019

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11th Floor
Madrid, SP 28035

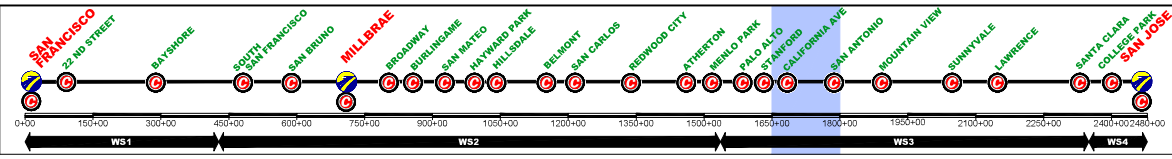
HNTB 1111 Broadway
9th Floor
Oakland, CA 94607

CALIFORNIA
High-Speed Rail Authority

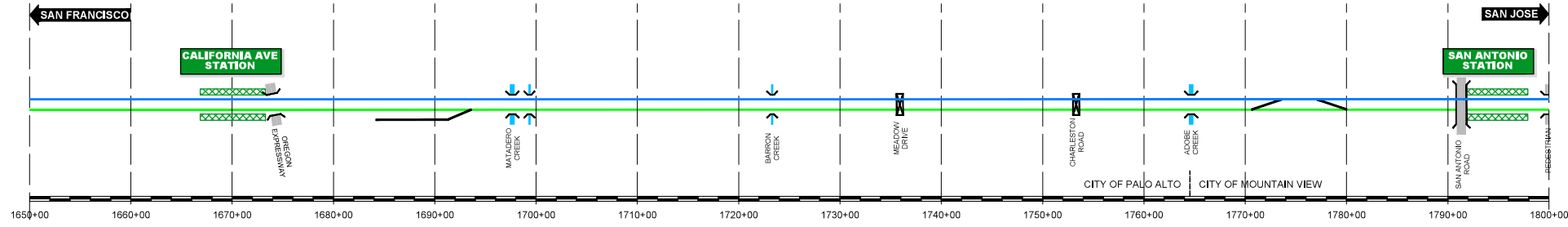
CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO TO SAN JOSE
SAN FRANCISCO TO SCOTT
TRACK SHIFTS WORKS
ALTERNATIVE A

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FJ-CV-16FS-TSA-12
SCALE
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SHEET NO.
12 OF 17

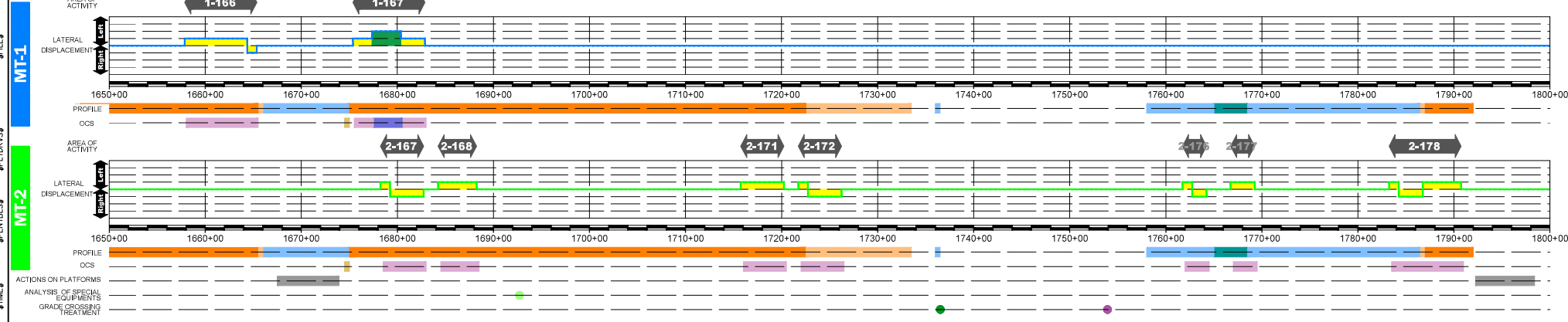
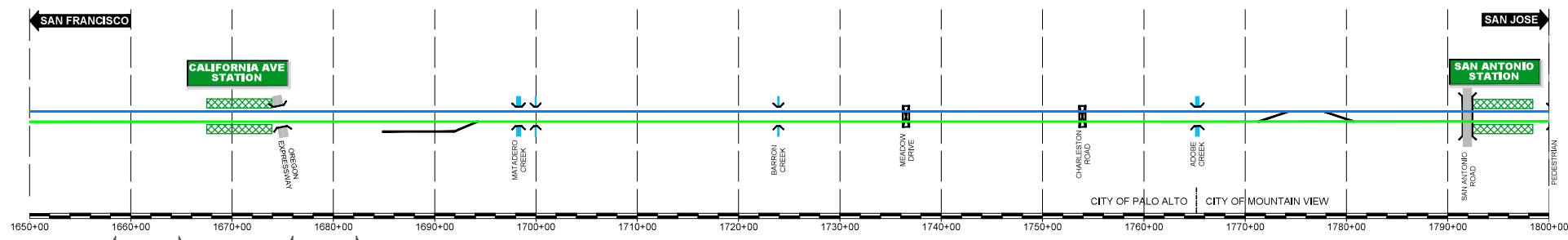
- LATERAL DISPLACEMENT**
- LESS THAN 1 ft.
 - MORE THAN 1 ft. AND LESS THAN 10 ft.
 - MORE THAN 10 ft. AND LESS THAN 21.34 ft.
 - MORE THAN 21.34 ft.
- PROFILE**
- INCREASE SUBGRADE
 - DECREASE SUBGRADE
 - INCREASE BALLAST THICKNESS
 - DECREASE BALLAST THICKNESS
- OCS**
- NEW OCS SYSTEM
 - DISPLACEMENT OF OCS POLE
 - DISPLACEMENT OF CONTACT WIRE
 - VERTICAL DISPLACEMENT OF CONTACT WIRE
- ACTIONS ON PLATFORMS**
- MODIFICATION OF EXISTING PLATFORM
- ANALYSIS OF SPECIAL EQUIPMENT**
- REMOVE
 - REMAIN VERTICAL ADAPTATION
 - NEW EQUIPMENT
- GRADE CROSSING TREATMENT**
- ADAPT
 - USABLE



EXISTING SF TO SJ SCHEME



PROPOSED SF TO SJ SCHEME



| REV | DATE | BY | SUB | APP | DESCRIPTION |
|-----|------|----|-----|-----|-------------|
| | | | | | |

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IN CHARGE
DATE
MAR/2019

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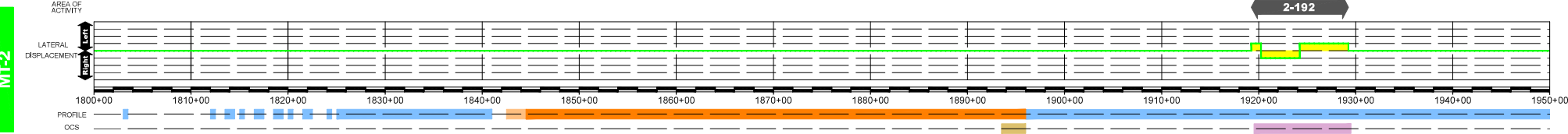
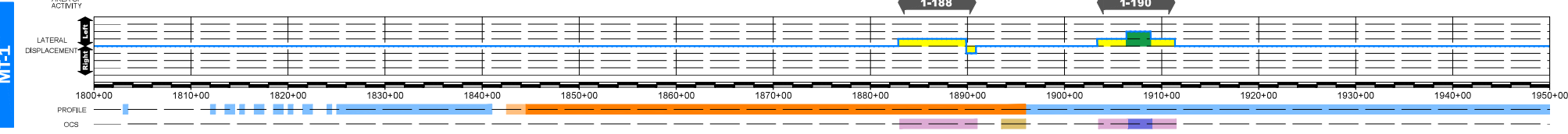
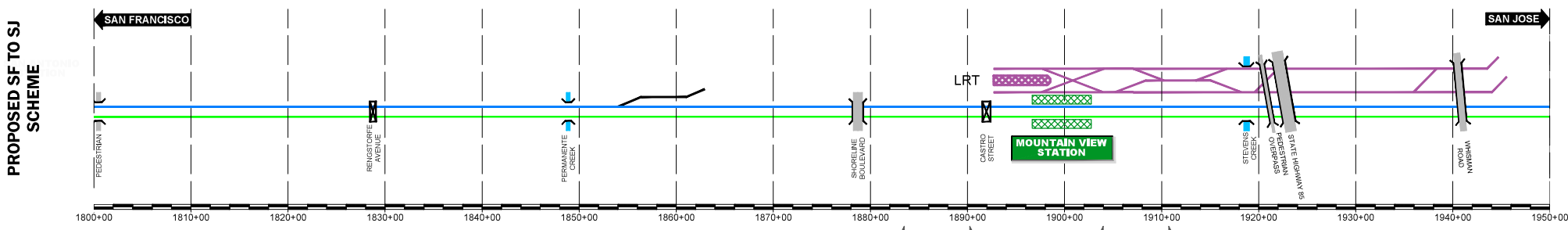
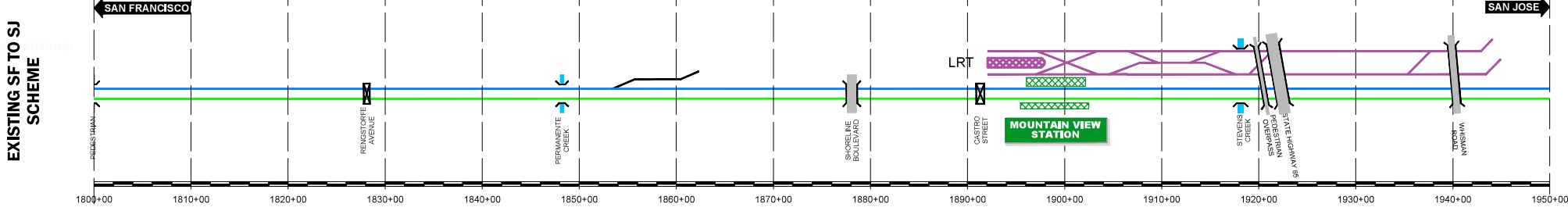
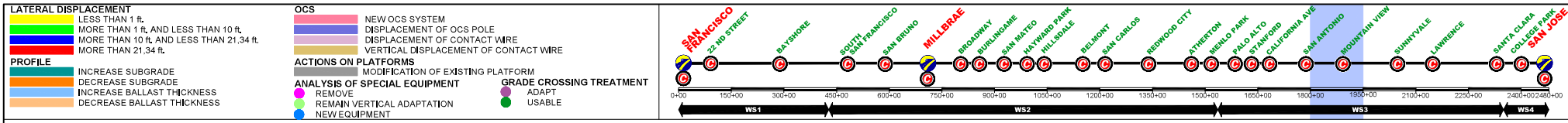
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11th Floor
Madrid, SP 28035

HNTB 1111 Broadway
9th Floor
Oakland, CA 94607

CALIFORNIA
High-Speed Rail Authority

CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO TO SAN JOSE
SAN FRANCISCO TO SCOTT
TRACK SHIFTS WORKS
ALTERNATIVE A

CONTRACT NO.
DRAWING NO.
FU-CV-16FS-TSA-13
SCALE
NOT TO SCALE
SHEET NO.
13 OF 17

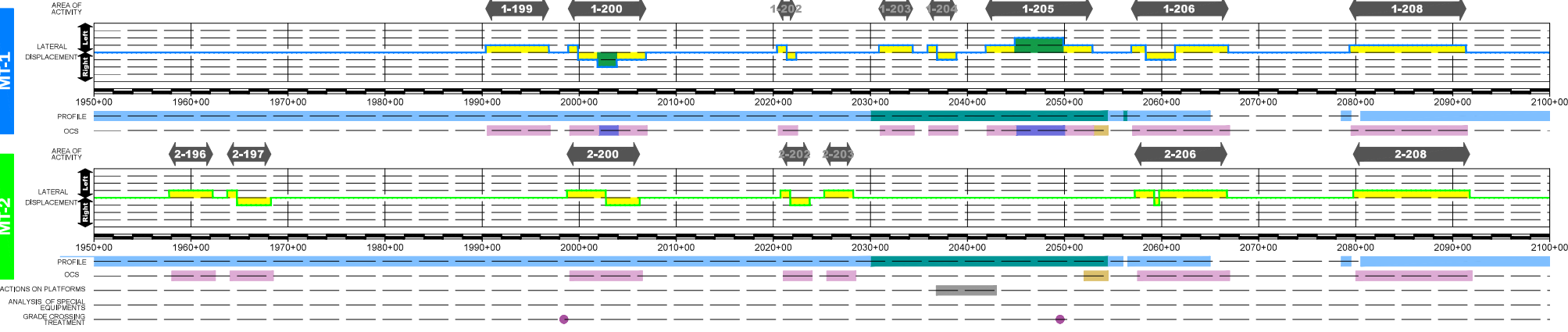
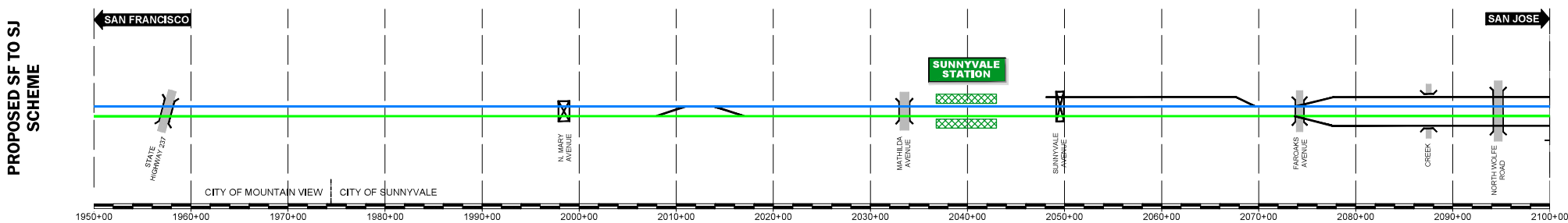
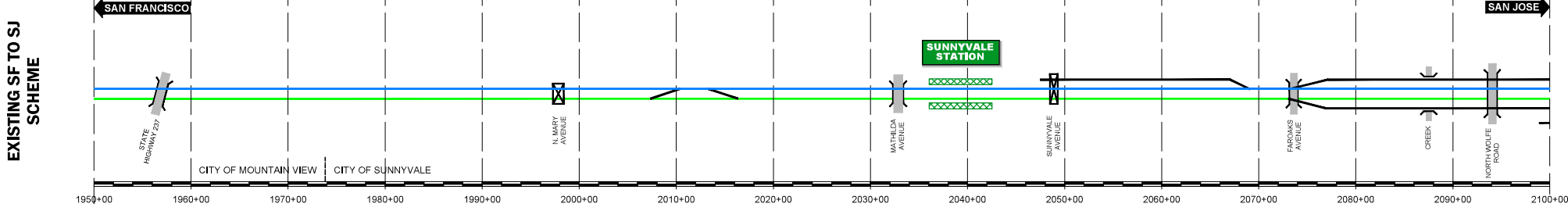


ACTIONS ON PLATFORMS

ANALYSIS OF SPECIAL EQUIPMENTS

GRADE CROSSING TREATMENT

| | | | | | | |
|-------------|-----------------------|---|-----|---|-------------------|-----------|
| DESIGNED BY | DRAFT PEOP | 12 Burgos Ave. 11th Floor Madrid, SP 28035 1111 Broadway 9th Floor Oakland, CA 94607 | | CALIFORNIA HIGH-SPEED TRAIN PROJECT SAN FRANCISCO TO SAN JOSE SAN FRANCISCO TO SCOTT TRACK SHIFTS WORKS ALTERNATIVE A | CONTRACT NO. | |
| DRAWN BY | SUBMITTAL | | | | DRAWING NO. | |
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| IN CHARGE | NOT FOR CONSTRUCTION | | | | SCALE | |
| DATE | MAR/2019 | | | | NOT TO SCALE | |
| REV | DATE | BY | SUB | APP | DESCRIPTION | SHEET NO. |
| | | | | | | 14 OF 17 |

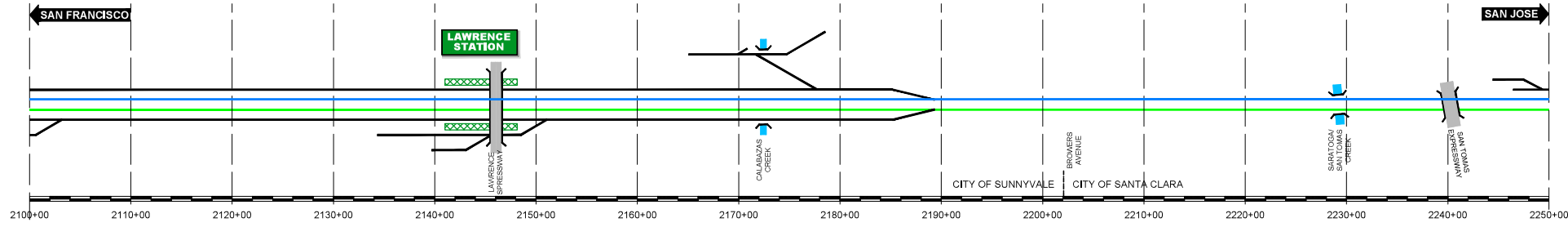


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|-------------|-----------------------|---|-----|-------------------------------------|-------------|-------------------|
| DESIGNED BY | DRAFT PEPP | 12 Burgos Ave. 11th Floor Madrid, SP 28035 1111 Broadway 9th Floor Oakland, CA 94607 | | CALIFORNIA HIGH-SPEED TRAIN PROJECT | | CONTRACT NO. |
| DRAWN BY | SUBMITTAL | | | SAN FRANCISCO TO SAN JOSE | | DRAWING NO. |
| CHECKED BY | FOR INTERNAL USE ONLY | | | SAN FRANCISCO TO SCOTT | | FJ-CV-16FS-TSA-15 |
| IN CHARGE | NOT FOR CONSTRUCTION | | | TRACK SHIFTS WORKS | | SCALE |
| DATE | MAR/2019 | | | ALTERNATIVE A | | NOT TO SCALE |
| REV | DATE | BY | SUB | APP | DESCRIPTION | SHEET NO. |
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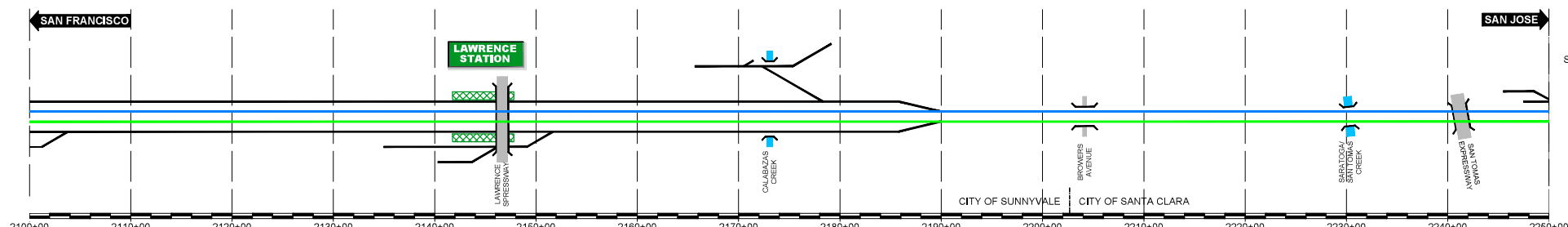
- LATERAL DISPLACEMENT**
- LESS THAN 1 ft.
 - MORE THAN 1 ft. AND LESS THAN 10 ft.
 - MORE THAN 10 ft. AND LESS THAN 21.34 ft.
 - MORE THAN 21.34 ft.
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- ACTIONS ON PLATFORMS**
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- ANALYSIS OF SPECIAL EQUIPMENT**
- REMOVE
 - REMAIN VERTICAL ADAPTATION
 - NEW EQUIPMENT
 - GRADE CROSSING TREATMENT
 - ADAPT
 - USABLE



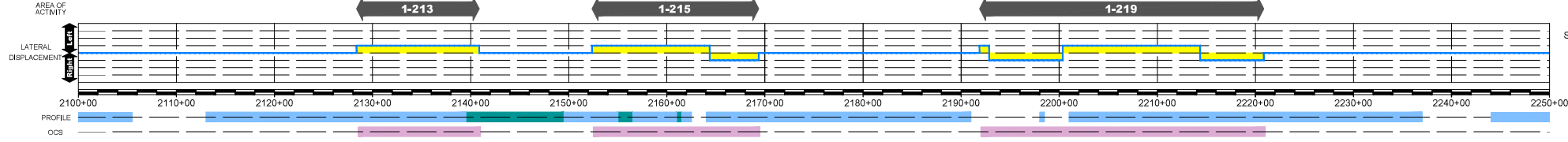
EXISTING SF TO SJ SCHEME



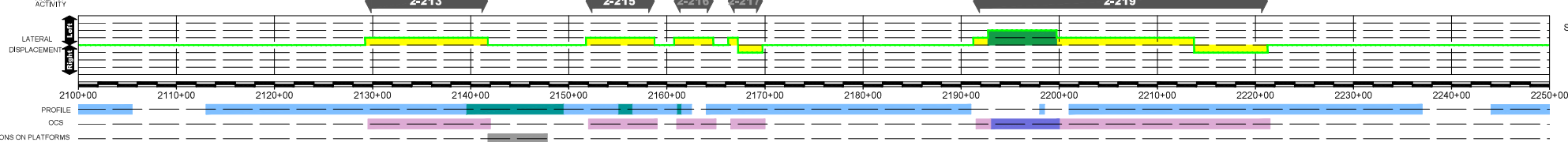
PROPOSED SF TO SJ SCHEME



MT-1



MT-2



| REV | DATE | BY | SUB | APP | DESCRIPTION |
|-----|------|----|-----|-----|-------------|
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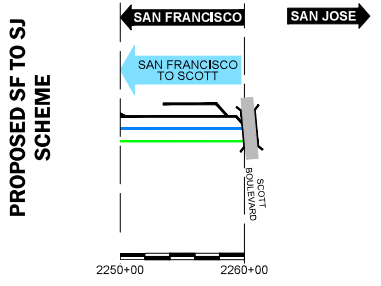
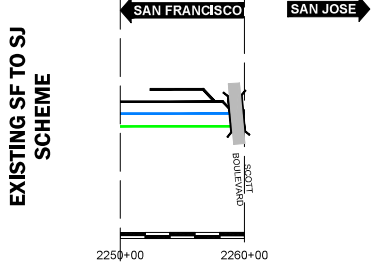
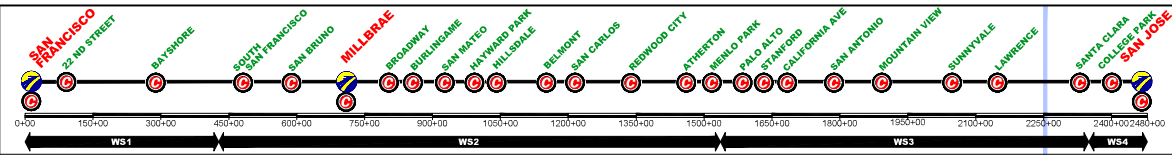
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CALIFORNIA
High-Speed Rail Authority

CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO TO SAN JOSE
SAN FRANCISCO TO SCOTT
TRACK SHIFTS WORKS
ALTERNATIVE A

CONTRACT NO.
DRAWING NO.
FJ-CV-16FS-TSA-16
SCALE
NOT TO SCALE
SHEET NO.
16 OF 17

| | |
|--|---------------------------------------|
| LATERAL DISPLACEMENT | OCS |
| LESS THAN 1 ft. | NEW OCS SYSTEM |
| MORE THAN 1 ft. AND LESS THAN 10 ft. | DISPLACEMENT OF OCS POLE |
| MORE THAN 10 ft. AND LESS THAN 21.34 ft. | DISPLACEMENT OF CONTACT WIRE |
| MORE THAN 21.34 ft. | VERTICAL DISPLACEMENT OF CONTACT WIRE |
| PROFILE | ACTIONS ON PLATFORMS |
| INCREASE SUBGRADE | MODIFICATION OF EXISTING PLATFORM |
| DECREASE SUBGRADE | ANALYSIS OF SPECIAL EQUIPMENT |
| INCREASE BALLAST THICKNESS | REMOVE |
| DECREASE BALLAST THICKNESS | REMAIN VERTICAL ADAPTATION |
| | NEW EQUIPMENT |
| | GRADE CROSSING TREATMENT |
| | ADAPT |
| | USABLE |



| | | | | | | | |
|-------------|------------------|----------------------|---------|-----|----------------------|--------------------------------|--------------------------|
| MT-1 | AREA OF ACTIVITY | LATERAL DISPLACEMENT | PROFILE | OCS | ACTIONS ON PLATFORMS | ANALYSIS OF SPECIAL EQUIPMENTS | GRADE CROSSING TREATMENT |
| MT-2 | AREA OF ACTIVITY | LATERAL DISPLACEMENT | PROFILE | OCS | ACTIONS ON PLATFORMS | ANALYSIS OF SPECIAL EQUIPMENTS | GRADE CROSSING TREATMENT |

| REV | DATE | BY | SUB | APP | DESCRIPTION |
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| DRAWN BY | |
| CHECKED BY | |
| IN CHARGE | |
| DATE | MAR/2019 |

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| | |
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| CONTRACT NO. | |
| DRAWING NO. | FJ-CV-16FS-TSA-17 |
| SCALE | NOT TO SCALE |
| SHEET NO. | 17 OF 17 |

