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Decision No. 14421

BEFORE THE RAILROAD COMMISSION OF THE STATE OF CALIFORNIA

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In the Matter of the Investigation of a rear-end collision on the Key Route fill of the Key System Transit Company, in the City of Oakland, County of Alamoda, State of California.

Case No. 2085

ORIGINAL

BY THE COMMISSION.

O P I N I O N

On December 4, 1924, at about 7:54 A. M. a rear end collision occurred in Oakland on the Key System fill of the Key System Transit Company between San Francisco-Sacramento Railroad train No. 15 and Key System Transit Company Twelfth Street Line train No. 725, at a point approximately opposite Signal 104 W. resulting in the death of 10 passengers, serious injury to 29 passengers, slight injury to 8 passengers, injury to 2 employees and equipment damage estimated at $4100.

The Commission, in accordance with its usual procedure, instructed Examiner Handford who is in charge of its Service Department, to make a full and complete investigation of the causes of the accident together with recommendations as to suggested preventative measures should such be developed in the course of the investigation.

The result of the investigation was presented to the Commission in Examiner Handford's report dated December 22,

1924 and a copy of said report is attached hereto and is hereby made a part hereof.

In the absence of direct testimony of the motorman who was operating train No. 15, the conclusions of the Commission from the testimony of others and from the substantial evidence as to the causes of the accident are as follows:-

I. Failure of motorman of San Francisco-Sacramento Railroad train No. 15 to comply with the provisions of special rule in time table of Key System Transit Company which requires that on passing an automatic block signal in caution position the speed of the train shall be reduced so that a stop may be made prior to passing the next signal should same be in stop position.

II. Improper spacing of signals in automatic block signal territory under conditions where high speed trains have been injected into operation under control of signals designed for a maximum speed of 36 miles per hour, resulting in inadequate distance being available in which the effect of automatic emergency application of brakes can function should a signal in stop position be passed by a motorman.

III. As contributing causes, lack of proper and definite supervision of trains operating on joint track under contract and general laxity as to the importance of train rules, operating regulations and time table requirements and special instructions

relating thereto.

The circumstances surrounding this accident are fully and completely set forth in the report of investigation which is hereto attached and as such report has been made a part of this opinion and order, it appears unnecessary to review in detail the causes and conditions surrounding the accident.

We have given careful consideration to conditions now existing and the possibility of preventing a similar accident. It is apparent from tests conducted and referred to in the attached report of investigation that a hazard of accident now exists if high speed operation is to be continued and the present automatic block signal system on the Key System fill and pier is depended upon to ensure safe operation. We are, therefore, of the opinion and hereby find as a fact that the permissive speed now allowed in such territory is excessive and unsafe and should be reduced and that the block spacing be increased in accordance with the conditions set forth in the following form of order.

O R D E R

The Railroad Commission having directed that an investigation be made into the cause of the rear-end collision as occurring on December 4, 1924, on the Key System fill in Oakland on the railroad of Key System Transit Company, said investigation having been made and report thereon having been adopted and approved as the report of this Commission, the Commission being now fully advised and basing its order on the findings as appearing in the opinion which precedes this order,

IT IS HEREBY ORDERED that Key System Transit Company, a corporation, be and same hereby is directed to conduct its operation of interurban trains on its Key Division in accordance with the following instructions which are supplemental to rules and regulations and time table schedules now in effect.

I. Immediately reduce the speed of all trains operating within automatic block signal limits between San Pablo Avenue and the Key System Pier Terminal to a maximum of thirty-five (35) miles per hour.

II. Immediately issue a special time table rule requiring all motormen to reduce speed at a block signal indicating "caution" to a maximum of fifteen (15) miles per hour and to proceed thereafter with train under such control that a stop may be made before passing the next signal.

III. Frequent checks to be made as to compliance by all motormen of speed restrictions as hereinbefore ordered.

IV. As a temporary condition, operation in the block signal territory between San Pablo Avenue, Oakland, and the Key System Pier Terminal is to be conducted on the basis of two stop signals, one caution and two clear signals to be in the rear of a train, the second clear signal behind a signal indicating "caution" to be observed by motormen as a cautionary signal and to be fully observed in the same manner as if the signal was in "caution" position.

V. Time tables of Key System Transit Company to include schedules for operation of San Francisco-Sacramento Railroad Company cars and trains and such express trains of Key System Transit Company as are not now shown. Time tables of San Francisco-Sacramento Railroad Company to show schedules between 40th and Shafter, Oakland, and Key System Pier Terminal and intermediate points as for information only, and to contain a foot-note or special rule to the effect that the current Key System Transit Company's time table and operating rules govern the operation while on Key System tracks.

VI. The Key System Transit Company is hereby directed to prepare a plan of spacing of the automatic block signals within the territory between San Pablo Avenue, Oakland, and the Pier Terminal for the consideration and approval of this Commission, such plan to fully provide for the adequate spacing of trains and the variable speeds possible by the use of both San Francisco-Sacramento Railroad and Key System Transit equipment.

The Commission reserves the right to make such other and further orders in this proceeding as to it may appear just and proper or as the safety and convenience of the public may require.

Dated at San Francisco, California, this 31st day of December, 1924.

C. A. Deasy

Irving Martin

J. T. Whittlesey

COMMISSIONERS

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San Francisco, California,
December 22, 1924.

To the Honorable,

Railroad Commission of the State of California.

Gentlemen:

On December 4, 1924 at about 7:54 A.M. a rear end collision occurred on the Key Division tracks of the Key System Transit Company at a point near Pole 104 on the fill between the subway under the Southern Pacific tracks and the trestle leading to the Key System Pier, in which were involved the consolidated Twelfth Street train, No. 725, of the Key Division and Train No. 15 of the San Francisco-Sacramento Railroad Company, the latter train running into the rear of the consolidated Twelfth Street train and telescoping the last car of the Key Division train for a distance of about 12 feet. The accident resulted in ten fatalities to passengers, 29 passengers seriously and 8 passengers slightly injured and injuries to two employees of the San Francisco-Sacramento train, and equipment damage estimated at $4100.

OPERATING RESPONSIBILITY

The trains of the San Francisco-Sacramento Railroad operate over the tracks of the Key System Transit Company's Key Division from the junction at 40th Street and Shafter Avenue, Oakland, to the Key Route Pier and are operated over the double track of the latter Company on 40th Street to Spring Street, thence along Spring Street to and across Adeline Street, thence along private right-of-way to and across San Pablo Avenue, thence along Yerba Buena Avenue to private right-of-way extending under Southern Pacific Company's Western Division main line

tracks and along a dirt fill to the trestle leading to the Key System pier.

The operation of the San Francisco-Sacramento trains over this portion of the Key System tracks is conducted under the provisions of an agreement dated January 30, 1911, between San Francisco, Oakland and San Jose Consolidated Railway, (predecessor in interest to the Key System Transit Company) and Oakland and Antioch Railway, (predecessor in interest to San Francisco-Sacramento Railroad Company). The specific portions of the agreement which are of interest in establishing the definite authority for the supervision of the joint operation over the tracks hereinbefore mentioned are as follows:-

"SEVENTH: Under conditions and terms herein contained Key Route Company agrees to handle the electric passenger trains or passenger cars of the Antioch Company upon and over the tracks of the Key Route between the point of interchange on the 40th Street Line to and through Oakland via the route on its said line, to and from the Station at the end of the present Key Route Pier, with the rights, liberty and privileges of the train crews and passengers of the Antioch Company to the ordinary use of said Pier, Station and facilities thereof. All equipment, train crews and passengers of the Antioch Company while upon the tracks of the Key Route Company shall be entirely under the control of, and be governed by the rules and regulations of the Key Route Company and the officials thereof."

" All Antioch Company employees delivering cars to or receiving cars from the Key Route tracks, or operating cars of any description over Key Route tracks, shall be familiar with all rules, time-tables, signals and other requirements of Key Route governing the operation of cars over its lines"

Portion of NINTH Section:

" The Key Route Company reserves the right and same is hereby agreed to by Antioch Company to operate, at its option the electric passenger trains or passenger cars of Antioch Company over Key Route Company's tracks as separate units in charge of Antioch Company employees, or coupled to and with the cars and trains of Key Route Company in charge of Key Route Company employees."

Trains of the San Francisco-Sacramento Railroad Company while operating over the Key System tracks heretofore mentioned are under the supervision entirely of Key System Transit Company officials and although operated by San Francisco-Sacramento train employees such employees are, while operating on Key System tracks, under the sole direction of Key System officials, rules and regulations, and all employees are required to pass examinations and receive the approval of Key System officials before being used in such service. The foregoing outline is necessary to establish the operating supervision and responsibility for the use of the joint trackage upon which the collision occurred.

DESCRIPTION OF ACCIDENT

On the morning of December 4th, 1924, Train No. 15 of the San Francisco-Sacramento line originating at Concord arrived at the station at 40th Street and Shafter Avenue, Oakland, cut off one car and procoeded toward the Key Route pier with one car (No. 1014). The train proceeded without stop until reaching the home signal of Key System Tower No. 2 at the junction of the main line and the route used by the Twelfth Street and Twenty-second Street lines of the Key System Transit Company. At this point the San Francisco-Sacramento train was stopped by reason of the home signal being in stop position, the towerman having the clear route lined for the consolidated Twelfth Street line train to proceed to the Key Route Pier. After the departure of the Twelfth Street Line train toward the pier the route was lined for the San Francisco-Sacramento train and it proceeded toward the pier after receiving a clear signal at the home board of the interlocking plant. Proceeding westerly

through the limits of the interlocking plant and through the subway under the Southern Pacific tracks the train ran along the Key Route fill until it collided with the rear end of Train No. 725 of the Key System Transit Company, such train having stopped with the end of its rear car at a point approximately opposite automatic block signal 104W. the Sacramento train telescoping into Car No. 665 of the standing train. Automatic block signals govern the operation of all trains on the Key System Pier and fill and 22 signals were passed by the motorman of the San Francisco-Sacramento train No. 15 after emerging from the subway. The automatic signals are spaced in this vicinity a distance of 420 feet apart and are so designed that the signal immediately in the rear of a train indicates stop when the rear axle of the train has passed the insulating joint placed at one end of the circuit and such insulated joint is located a few feet in advance of the signal. In normal operation two danger signals and one caution signal are behind each train as it passes through the territory protected by the automatic block system. In addition to the signal indication the block signals are equipped with a rod which is so designed that when the signal is at the stop position a car running by the signal at stop position is stopped by an emergency application of the air brakes which are automatically set by reason of a tripper arm on the car striking the rod on the signal at stop position. This tripper arm is connected with a valve attached to the air braking mechanism and upon same being opened by the contact between the signal rod and the tripper arm the brakes are automatically applied in full emergency.

The cars of both the Key System Transit Company and the San Francisco-Sacramento Company are all equipped with the tripper device above referred to. The speed of trains on the

Key Route fill are not restricted, if the view of the motorman is not obscured by fog or weather conditions, except by the following portion of the rule appearing in San Francisco-Oakland Terminal Railways, Key Division Timetable No. 16, effective October 15, 1912, under special instructions as applicable to Automatic Block Signals:

> " COLOR AND MEANING OF SIGNALS- Automatic signals are of the upper quadrant indication and have three positions, excepting those which govern the approach to a semi-automatic signal or interlocking signal, which are adjusted to two or three positions as conditions require. When the arm is extended horizontally, and in addition a red light is displayed, it means stop. When the arm is extended upward at an angle of 45 degrees, and in addition a yellow light is displayed it means proceed with caution-prepared to stop at the next signal. When the arm is extended upward at an angle of 90 degrees, and in addition a green light is displayed (normal position) it means proceed."

At the time of the accident there was an automatic signal set at stop at signal 104 W., such signal being opposite the rear of the last car (No. 665) of the standing Twelfth Street Train (No. 725), also a stop signal at signal 108 W., and a caution signal at signal 112 W. The motorman of San Francisco-Sacramento train No. 15 passed the caution signal at 112 W. and after so doing made an application of the air brake, such application having been distinctly felt by the conductor of his train. Approximately 30 seconds after this application was made the brakes went on in full emergency by reason of the tripper arm on the car engaging with the tripper rod on signal 108 W. and approximately 30 seconds thereafter the rear end collision occurred. The reason that the motorman passed signal No. 108 W. without having his train under control so that a stop could be made before the tripper arm engaged with the tripper rod on signal 108 W. is unknown, the motorman upon advice of his attorney having refused to answer any inquiries

or to give any statement as to his version of the circumstances connected with the accident. It is apparent, however, from the information secured from other witnesses that the motorman of San Francisco-Sacramento train No. 15 did not comply with the instructions contained in the special time table rules regarding automatic block signals as hereinabove quoted and that his application of the air brakes was not sufficiently heavy to bring his car to a stop within the required distance as established by the timetable special rule. This failure on the part of the motorman of San Francisco-Sacramento train No. 15 was the primary cause of the accident.

In addition to the foregoing primary cause of man-failure regarding the observance of rules and regulations there were other contributing causes which require consideration and correction if the accident hazard is to be minimized and safety of operation is to be ensured.

AUTOMATIC BLOCK SIGNAL SYSTEM

The present automatic block signal system between San Pablo Avenue and the west end of the Key System pier is operated by electricity and uses alternating current. The electric power operating the signal circuit is entirely independent from the power used for train operation, the latter being direct current at 600 volts. The system was designed for operation of trains spaced on a 45 second headway when operating at a speed of 36 miles per hour. This operation would result in a spacing of approximately 1680 feet between trains as normally proceeding, with clear signals. The system is so designed that under normal conditions there are at all times two singals at stop and one at caution at the rear of a train, and

the signals being spaced 420 feet apart there would be 840 feet in which the automatic stop feature of the signals would be operative and brakes set in emergency by the action of the tripper arm contacting with the rod on the signal in stop position. In addition there is a distance of 420 feet between the caution signal and the first stop signal in which distance motormen are required by rule to so reduce their speed upon passing a caution signal that they may be prepared to stop before reaching the next signal should same be in stop position. It is obvious that the train must be stopped before passing a signal at stop position otherwise the tripper arm on the car will strike the rod on the signal in stop position and the brakes on the train will be automatically set in emergency. In the present case, however, it clearly appears that the Twelfth Street train of the Key System Transit Company had stopped with a portion of its rear car extending east of signal 104 W. and therefore there was but one stop signal east of the train and one caution signal. This condition, therefore, meant that the motorman of San Francisco-Sacramento train No. 15 had a distance of 420 feet between the caution signal at signal 112 W. in which to reduce speed before passing signal 108 W. which was in stop position, and a distance of 420 feet less the overhang of car No. 665 of the Twelfth Street Key System train in which to stop to avoid the collision. The motorman reduced his speed by a service application before passing signal 108 W. but had not brought the speed down to a stop as the emergency brake was set by the contact between the tripper arm and the rod on signal 108 W.

It is clearly evident that the protective measures

provided to ensure the emergency application of brakes by the action of the tripper arm in case the motorman failed to bring the train to a stop before passing an automatic block signal in stop position failed in this instance by reason of insufficient distance being present in which the emergency action of the brakes could be effective. This is a serious defect in the system and is accentuated by the fact that the cars and trains of the San Francisco-Sacramento Railroad as operated by the Key System Transit Company over this fill and pier are capable of attaining speeds as high as 55 miles per hour. The trains of the Key System Transit Company are limited by the character of their electrical equipment to a speed not exceeding 35 miles per hour and the hazard of accident under similar conditions is considerably less, although same exists as has been shown by a series of tests which have been conducted since the accident and are hereinafter referred to. The inclusion of cars or trains which are capable of attaining a speed of 55 miles per hour in operative track protected by an automatic block signal system designed to function at a maximum train speed of 36 miles per hour and where conditions as prescribed by operating rules allow but 840 feet in which a stop can be made without colliding with a preceding train has created a hazard of accident which should receive immediate correction.

RESULT OF SPEED TESTS

Tests were made on the Key Route fill at a point near the scene of the accident to determine the distance in which trains and cars could be stopped by the manual operation of brake valve and by the emergency application by the "tripper arm". These tests were made with Key Division trains and cars,

and with a car of the San Francisco-Sacramento Railroad of a similar type to that involved in the collision. The results of these tests are as follows:-

Test No.	Cars in Train	Kind of Test	Speed Miles Per hour	Time Required for Stop	Distance Required for Stop
	K.S.F.Co.				
1	667,664 659,661	Hand emergency	-	11 seconds	333' 8"
2	667,664 659,661	Hand emergency	33.04	10 seconds	326' 4"
3	667,664 659,661	Tripper arm	32.52	14 seconds	507' 11"
4	667,664 659,661	Tripper arm	33.66	15 seconds	545' 2"
5	659,661	Tripper arm	33.66	14 seconds	458' 5"
6	659,661	Tripper arm	33.04	13½ seconds	440'0"
7	661	Tripper arm	32.54	12 seconds	366' 10"
	SP-Sac.				
8	1012	Hand emergency	37.68	15 seconds	563' 3"
9	1012	Tripper arm	38.35	21 seconds	782' 7"
10	1012	Tripper arm	39.41	21½ seconds	856'6"
11	1012	Tripper arm	39.41	21½ seconds	879' 7"

NOTE: In test No. 4 the tripper arms on the first two cars did not make the stop, the emergency being applied from the third car from the front end

As the maximum speed of the San Francisco-Sacramento cars is an important factor to be considered in the circumstances surrounding this accident, such cars being geared at a ratio which develops higher speed than is possible with the Key System Transit Company's cars and trains, tests were made on the line of the San Francisco-Sacramento Railroad between Las Juntas and Meinert with a car of the same type as that involved in the accident. These tests were made under normal conditions with dry rail, no wind or weather conditions being adverse to normal operating conditions. The result of these tests is as follows:

Car used:- San Francisco-Sacramento Car 1012.

Test made by starting from derail at Las Juntas and running east to Mile Post 31, at which point emergency stop was initiated.

Acceleration distance - approximately 7100 feet.

Speed by Speedometer reading	Time elapsing from application of brakes to complete stop	Distance traversed from application of brakes to complete stop	Brake application by
51½ miles per hr.	20 seconds	918 feet	Hand application
- *	24 seconds	1114 feet	Tripper
50 miles per hr.	26 seconds	1171 feet	Tripper

NOTE: (*) Speedometer inoperative, pinion failing to contact during test.

From the above tests it is apparent first, that the application of the brakes in emergency by the tripper arm, and as regards the equipment of both railroads, is not as effective in producing a stop as is the hand application in emergency position; and secondly, that the distance of 420 feet (which was the

distance between signal 108 W. and 104 W.) is not a sufficient spacing to ensure the stopping of the trains or cars of either company by either the application of the brakes by hand emergency or tripper emergency, such distance having been exceeded in four out of seven tests with Key System Transit Company equipment, and in all of the seven tests of the San Francisco-Sacramento Railroad equipment. It will also be noted that if two complete signal blocks had intervened between the rear of the Key System Transit train and Signal 104 W. that the speed tests show that a hazard of accident was present in five of the tests made with the San Francisco-Sacramento equipment two of which were at speeds less than 40 miles per hour.

CONDITION OF EQUIPMENT

Complete and careful inspection of the equipment involved in this accident has been made and tests of the braking apparatus on the San Francisco-Sacramento car No. 1014. Nothing is revealed by the inspection and tests which would indicate that improper or faulty equipment was a contributing cause to the accident. Especial attention was given to the testing of the tripper arm and tripper valve on the San Francisco-Sacramento car No. 1014 and same was found to be in proper operative condition at the time of test and that when applied to another car of the same type that it operated properly. It is my conclusion that the condition of airbrake and other car equipment had no contributing cause to the accident.

EMPLOYEES INVOLVED

All employees of both the San Francisco-Sacramento Railroad and the Key System Transit Company were experienced men with long service with the respective companies. None of them had been on duty over the hours prescribed by the "Hours of Service Law" and all had had the required rest period before reporting for duty on the date of the accident.

The motorman of the San Francisco-Sacramento train had been in railroad service since February 1907. He was employed by the Oakland, Antioch and Eastern Railway (predecessor of the San Francisco-Sacramento Railroad Company) on August 17, 1918 and has been continuously in the employment of such company until the date of the accident. He had passed all the required examinations on train operating and timetable rules of his employing company and was also qualified to operate over Key System tracks as evidenced by a certificate so certifying under date August 17, 1918, and signed by Mr. E. E. Thornton, Superintendent of the Key Division of the now Key System Transit Company. His personal record averages good there being but 5 demerits standing against him on the discipline record as of December 3, 1924. The reason for his failure to respect the caution signal at Signal 112 W. to an extent permitting him to come to a full stop before passing Signal 108 W is not known and as he has, on the advice of his legal counsellor, refused to answer questions his version of his failure to comply with the special time table rule cannot be secured. It is evident, however, and without his testimony that the primary cause of the accident was his failure to comply

with a rule upon which he had been examined and of which he had knowledge.

ADMINISTRATION OF OPERATING RULES AND TIME TABLE REGULATIONS.

Although the supervision of all San Francisco-Sacramento Railroad trains is under the jurisdiction of Key System Transit officials, and in fact such trains and cars are by the terms of the agreement heretofore referred to Key System Transit trains when operating between the junction at 40th Street and Shafter Avenue, Oakland, and the Key System pier, the proper supervision by Key System officials has not been and is not now being exercised beyond the examination that is required of San Francisco-Sacramento employees before they are certified as being eligible to operate over the Key System tracks. Trains of the San Francisco-Sacramento Railroad are not shown on the working time table of the Key System Transit Company and such timetables contain special rules as regards operation which must be observed by San Francisco-Sacramento trainmen as well as Key System Transit Company employees. Key System Transit rule books are not furnished to the employees of the San Francisco-Sacramento Railroad who use the joint tracks although many of the operating rules are pertinent and are applicable to such employees and that employees are expected to have knowledge of Key System Transit rules appears from some typical rules which follow:-

> "Employes engaged in the movement of trains must provide themselves with a copy of the current timetables of all divisions over which they are to operate and always have same with them when on duty."

> "All employes whose duties are prescribed

by these rules will be furnished with a copy, which they will be required to have in their possession at all times while on duty."

GENERAL RULES

A (1) Employes whose duties are prescribed by these rules must provide themselves with a copy.

The working timetable of the San Francisco-Sacramento Railroad (Timetable No. 3, effective Sunday, May 25; 1924) shows scheduled trains between Oakland, 40th and Shafter, and Pier Terminal as well as intermediate points. No special instructions as to operation in the block signal territory between San Pablo Avenue and the Pier Terminal is shown and employees are therefore dependent upon the Key System Transit Company's working timetable for such instructions, and they are not furnished with such timetables. All trains of the San Francisco-Sacramento Railroad should appear on a timetable of the Key System Transit Company as issued for the 40th Street (or Piedmont Line) and all trainmen operating San Francisco-Sacramento Railroad Company trains should have both the Key System Transit Company's current Book of Operating Rules and 40th Street line timetable in their possession at all times when on duty. The time schedule as appearing in the San Francisco-Sacramento Railroad working schedule as covering the time between 40th and Shafter, Oakland, and the Pier Terminal should be shown as for information only, and a special rule or instruction should appear in such working timetable to the effect that trainmen should be governed by the current timetable and book of operating rules of the Key System Transit Company while operating over the Key System Company's tracks between 40th and Shafter, Oakland, and the Key System pier terminal.

RECOMMENDATIONS

To correct the existing accident hazard and prevent the recurrance of a future accident by causes similar to those involved in this collision the following recommendations are made:-

I. Immediately reduce the speed of all trains operating within automatic block signal limits between San Pablo Avenue and the Key System Pier Terminal to a maximum of twenty-five (25) miles per hour.

II. Immediately issue a special time table rule requiring all motormen to reduce speed at a block signal indicating "caution" to a maximum of fifteen (15) miles per hour and to proceed thereafter with train under such control that a stop may be made before passing the next signal.

III. Frequent checks to be made as to compliance by all motormen of speed restrictions as herein proposed.

IV. Time tables of Key System Transit Company to include schedules for operation of San Francisco-Sacramento Railroad Company cars and trains and such express trains of Key System Transit Company as are not now shown. Timetables of San Francisco-Sacramento Railroad Company to show schedules between 40th and Shafter, Oakland, and Key System Pier Terminal and intermediate points as for information only, and to contain a foot-note or special rule to the effect that the current Key System Transit

Company's current timetable and operating rules govern the operation while on Key System tracks.

V. If in future it should be found desirable to increase speeds in automatic block signal territory between San Pablo Avenue and the Key System Pier terminal, a plan of spacing of automatic block signals within the above territory shall be presented to and be approved by the Railroad Commission, such plan to fully care for the spacing of trains and to consider the variable speeds possible by the use of both San Francisco-Sacramento Railroad and Key System Transit equipment.

Respectfully submitted,

W. J. Bamford

Examiner and Railroad Service Inspector.