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STATE OF CALIFORNIA
HIGHWAY TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

FINAL REPORT OF PERFORMANCE OF EXPERIMENTAL BRIDGE APPROACH SLABS IN DISTRICT 07

67-63

April, 1967

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Materials & Research Dept.

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State of California
Department of Public Works
Division of Highways
Materials and Research Department

April 5, 1967

Mr. J. C. Womack
State Highway Engineer
Division of Highways
Sacramento, California

Dear Sir:

Submitted for your consideration is:

FINAL REPORT

of

PERFORMANCE OF EXPERIMENTAL

BRIDGE APPROACH SLABS

in

DISTRICT 07

Study made by ..... Foundation Section
Under general direction of ..... Travis Smith
Work supervised by ..... W. S. Maxwell
Report prepared by ..... W. S. Maxwell

Very truly yours,

JOHN L. BEATON
Materials and Research Engineer

Attach
cc:LR Gillis
JF Jorgensen
AC Estep

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Introduction

This report completes a study of experimental structure approach pavement slabs constructed during the years 1956-57 on the San Bernardino and Harbor Freeways in District 07.

Inspections and Reports

An initial progress report reviewing the project and findings to date was issued on May 3, 1961. A subsequent inspection of the slabs was performed in August 1962 and the sketches of the initial report identified as Figures III and IV, respectively, were revised to include the findings of this inspection. A later inspection was conducted in November 1964 and a final inspection was accomplished in July 1966.

There has been confusion in the minds of some recipients between the initial progress report and the report containing the sketches with the 1962 revisions. This is understandable because the revision was not noted on the cover of the reports. To avoid future misunderstanding and to minimize repetition of data, a complete reprint of the initial progress report with Figures III and IV revised to incorporate bridge numbers, post mile data and the performance findings of all inspections has been combined with this final report. All prior reports may be discarded.

With the exception of the 1958 instrument survey mentioned in the attached progress report, inspections were restricted to observations from the shoulder for the reason the traffic flow precluded entering the traveled way. It was found particularly difficult to ascertain with any degree of certainty the vehicle

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bounce adjacent to the paving notches. The only location on the San Bernardino Freeway where the bounce was distinct was at Hoyt Ave. There also appeared to be a sag from about 5' to 10' from the paving notch in the third lane from the shoulder. When this was noted in November 1964 it was thought the condition would worsen but there was not a discernible change by July 1966. At Slauson Ave. on the Harbor Freeway the bounce in the northbound lanes at both ends of the structure appeared to be definitely greater in July 1966 than prior thereto. It is, of course, debatable if the bounce is attributable to the bridge deck surface, or to the approach slab surface, or to a combination of the two surfaces. On the San Bernardino Freeway a decided increase in spalling, chipping and minor cracking adjacent to the paving notches during the inspection period years was obvious. Hairline surface cracking at the locations denoted in Figure III and the surface abrasion at Durfee Ave. also seemed to be more noticeable in July 1966. But other than the patched areas at Slauson Avenue on the Harbor Freeway and Lexington Avenue on the San Bernardino Freeway which were first noted in the July 1960 and March 1961 inspections, respectively, indications of distress of consequence were not observed in July 1966 in the special or the conventional design slabs on either freeway.

Errors in the joint locations on the San Bernardino Freeway appearing in the sketch from which Figure III was initially prepared have not been corrected in the revisions of Figure III, nor has consideration been given to a fourth lane added in each direction of travel in the median area several years after the

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original construction. It is not believed that either of these items influenced the pavement performance under study. However, the appearance of the added fourth lane has been noted with each inspection and as would be expected there has been no manifestation of distress. The major portion of any foundation settlement or embankment consolidation occurring at the structure approaches should have taken place prior to the placement of the fourth lane, and since its construction it has accommodated for the most part only passenger vehicle type traffic.

Summary and Conclusions

On the San Bernardino Freeway 1 of 60 standard slabs required patching whereas patching was not required on any of the 30 special slabs. In contrast, on the Harbor Freeway 1 of 20 special slabs was patched while an equal number of standard slabs did not require patching in any instance.

In that it is not deemed feasible to attempt a comparison of the standard and special slabs with the data available it can only be concluded that the project failed to yield findings of value. The only analysis of the performance of the slabs that appears realistic is that the settlement of the foundations beneath the approach embankments and/or the consolidation within the embankments has been negligible with the result the subgrade is still in contact with and supporting the pavement.

The continuation of activity related to the subject installations is not considered justified by the results obtained and will be terminated with this report.

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State of California
Department of Public Works
Division of Highways
Materials and Research Department

May 3, 1961

Lab Auth 2157-25-S

Mr. George Langsner
Engineer of Design
Division of Highways
Sacramento, California

Dear Sir:

Submitted for your consideration is:

PROGRESS REPORT

of

PERFORMANCE OF EXPERIMENTAL

BRIDGE APPROACH SLABS

in

DISTRICT VII

Study made by..... Foundation Section
Under general direction of..... A. W. Root
Work supervised by..... W. S. Maxwell
Report prepared by..... W. S. Maxwell

F. N. Hveem
Materials & Research Engr.

By AWRoot
A. W. Root
Supv. Mtls. & Research Engr.

Attach
cc:LRGillis
JEMcMahon
MHarris

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A. Introduction

A series of experimental structure approach pavement slabs were constructed in Districts IV and VII during the years 1956-57, as part of a special project conducted jointly by the Design Department, the Construction Department and the Materials and Research Department.

The purpose of the project was to permit observing the performance of several types of PCC slabs under actual traffic conditions, and to provide data for the development of future slab types designed to minimize the effects of earthwork and pavement settlement adjacent to structures.

This report is limited to the installations in District VII. A similar report entitled "Report of Performance of Experimental Bridge Approach Slabs in District IV," was submitted June 20, 1960, to cover the balance of the installations included in the project.

B. Division of the Joint Project

The designs for the special slabs were agreed upon by the Design Department and the Construction Department. Selection of the sites for the special installations, the arrangement of the various slabs, and their construction under authority of Contract Change Orders were directed by the Construction Department, as was also the placement of testing devices for subsequent measurement of movement. The surveys and inspections following the completion of the construction contracts have been under the direction of the District VII Materials Department and the Materials and Research Department.

C. Testing Devices

The ability of a pavement slab to span areas of nonsupport cannot be appraised where settlement of the underlying support does not occur, i.e., where the support remains in full contact with the slab. To reveal the separation between the pavement and the subgrade devices of the type illustrated in Figure I were placed in each of the special design slabs. The initial elevations of the pavement surface and the top of the center steel rod, and the differential between these values is determined at the time of placement. Comparison with the differentials determined by periodic check readings throughout the life of the project reveals the magnitude of the separation.

To provide information on settlement or distortion of the pavement a series of surface elevation reference points were established on each special slab. Changes in elevation of any of these points may be detected at any time by conventional direct leveling procedure.

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D. Locations and Designs of Special Slabs

Design features of the specified special slabs are presented in Figure II. It will be noted that the thickness is 12" and that a uniform distribution of reinforcing steel is used in both the top and the bottom for the entire length. Slabs were of nominal centerline length of 20' and 30' but because of the skew of some structures the edge lengths were varied in many instances, as detailed in Figure III.

In addition to the specified design of Figure II length modifications of standard reinforced slabs were also constructed. The reason for these nonspecified additional installations was that a standard reinforcing mat had been fabricated for each structure approach prior to the initiation of the special slab experiment. The standard mats replaced by the special mats were used to extend the existing standard mats at three structure locations.

On the San Bernardino Freeway the special design slabs of Figure II were used at five structure locations and the extended standard design slabs were used at three locations.

On the Harbor Freeway the special design slabs were poured at three structure locations, but there were no extended standard slabs.

E. Comparison Approaches

At each structure location employing the special design slabs conventional construction design and practice was followed on 50% of the total number of approaches, to provide a performance comparison between special and standard slabs.

F. Performance Surveys and Inspections

The original intent was to perform periodic surveys of all settlement devices and elevation references. Because of the heavy traffic on both the San Bernardino and the Harbor Freeways a detailed survey entails considerable labor and expense, as well as inconvenience and hazard to the public traffic. In consideration of these factors it was later deemed advisable to conduct complete surveys only when visual inspection disclosed evidence of distress in the slabs. Three inspections have been conducted to date.

G. San Bernardino Freeway Inspections

The experimental approaches on the San Bernardino Freeway were constructed during the period of April 11 to May 8, 1956, at the locations shown in Figure III. The contract completion date was August 6, 1956.

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The first visual and instrument survey was performed in July 1958. At this time neither the visual observations nor the instrument work revealed significant changes in the slabs. A detailed visual inspection in July 1960 disclosed the traffic bounce and other defects as marked on Figure III. During a follow-up inspection completed in March 1961, to bring the records to date for this report, the patched area denoted at Lexington Avenue U.C. in Figure III represented the first instance of actual distress. The traffic bounce condition observed at various locations is difficult to appraise and may in reality be an optical illusion, especially in the inside lane where the higher traffic speed may exaggerate the condition relative to the corresponding slower speed lanes. Furthermore, roughness in the bridge decks may contribute to the apparent bounce.

H. Comparison Standard Slabs

With the exception of the patched area of the standard slab approaching Lexington Avenue U.C. the performance of the standard slabs has compared favorably throughout with the heavily reinforced special slabs.

I. Harbor Freeway Installations and Inspections

The three special study locations on the Harbor Freeway are sketched in Figure IV. Completion date for the contract was May 16, 1957. Inspection periods at these locations coincided with those on the San Bernardino Freeway, i.e., July 1958, July 1960, March 1961, and with similar findings. Except for a patched area on the special design slab at Slauson Avenue Overhead, as marked in Figure IV, both special and standard slabs remain free of visually discernible distress. The patch at Slauson Avenue O.H. was placed between the times of the July 1958 and July 1960 inspections, and is at a location where a large volume of truck traffic uses the off ramp to reach the nearby industrial area. This patch extends completely over the ramp lane as well as the outside travel lane.

J. Summary

This report deals with the performance to date of heavily reinforced PCC pavement approach slabs, and standard design comparison slabs, at six structure locations on the San Bernardino Freeway and at three structure locations on the Harbor Freeway. In addition, at two structure locations on the San Bernardino Freeway an extended length standard reinforcement arrangement was employed, to salvage the surplus standard reinforcement mats displaced by the special mats at the above mentioned six locations. Standard comparison slabs were not included at either of these two locations.

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Considering only the nine complete special study locations for the two freeways we have 56 standard comparison slabs, 33 special design 30' length and 23 special design 20' length slabs. Because of the skew of the San Bernardino Freeway structures there is a wide variation in the edge lengths of the nominal 20' and 30' basic slab lengths.

While there has occurred minor cracking and other defects as noted in Figures III and IV, there are only two instances of patching, one on each of the freeways. One patch appears on a standard slab and one on a special slab. There are no indications of mudjacking or other major maintenance operations.

With reference to the service life to date the San Bernardino Freeway contract was completed approximately 54 months prior to the last inspection reported herein, the Harbor Freeway 45 months.

There have been no developments as yet to indicate that the special slabs are performing in a manner superior to the standard slabs or vice versa.

K. Conclusions

In contrast to the District IV installations where the ineffectiveness of the special design slabs was obvious at a number of locations, the District VII installations have so far failed to provide data or evidence of value for comparison or appraisal purposes.

Because the cost of periodic visual inspections is not excessive it is recommended that such inspections be scheduled on an annual basis, to observe the performance of the slabs over a longer service period.

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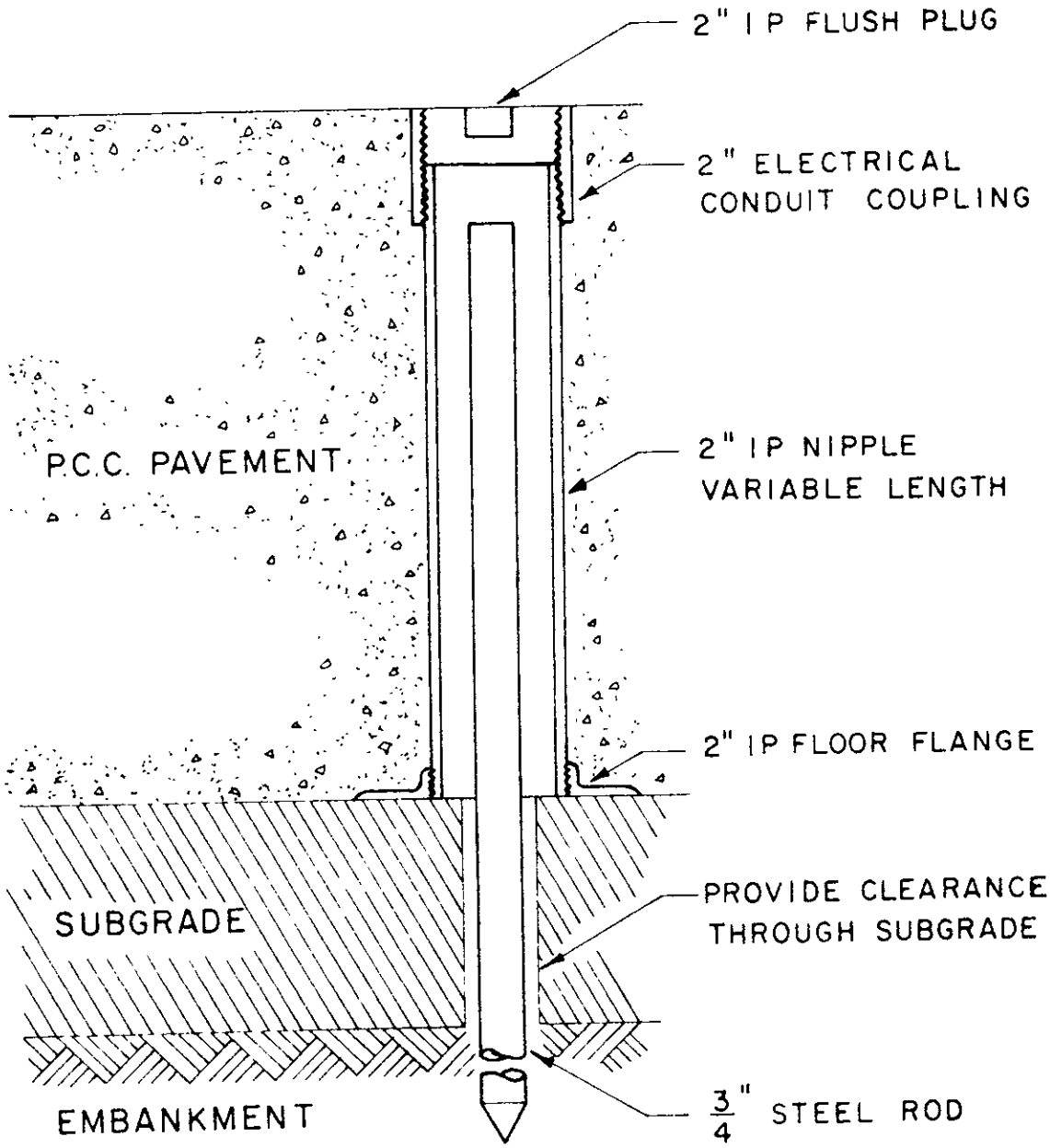

SUBGRADE SETTLEMENT DEVICE

Materials & Research Department

Fig I

Dwg No. A-291

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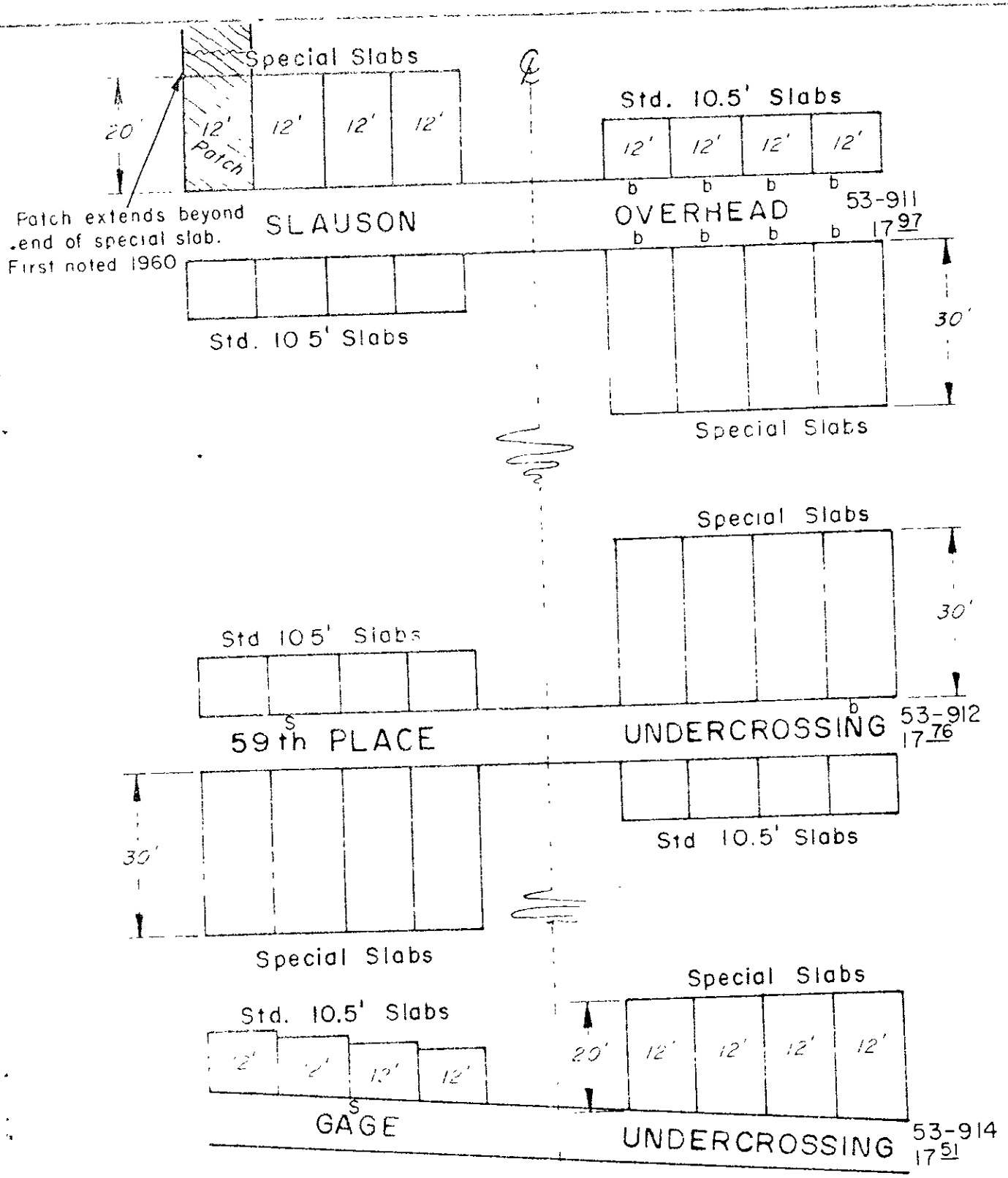

CONTRACT NO 55-7V049-F

LEGEND

Crack

S b

S - Spall

b - Bounce

FIG. IV

MATERIALS AND RESEARCH DEPARTMENT

INVESTIGATION of EXPERIMENTAL BRIDGE APPROACH SLABS

HARBOR FREEWAY

DATE	DIST.	CO	RTE	POST MILE	DWG. NO	TOTAL SHEETS
3-31-67	07	LA	26		2157	

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