

ASSAYING

A. M. STRONG

MINING AND CIVIL ENGINEER

BISHOP, INYO CO., CAL.

George A Clarke, Pres. of the Board of Trustees,
Bishop, California.

Dear Sir: -

I wish to submit the following report on the grading of street in connections with a drainage system for the town of Bishop: -

The main purpose of grading the streets of a town is to have them in such shape that all storm waters gathering on them and all flood water entering the town may be carried off as quickly as possible.

Secondary to this the question of the looks of the streets should be taken into consideration. With this in mind we have three things to consider in regard to each street. (1st) That it shall have sufficient fall for the gutters to carry all waters that may accumulate ^{on} ~~the~~ ^{it}. (2nd) That the grade shall be as even as possible through the entire length of the street so that the sidewalks, tops of curbs, etc. may form straight lines. Brakes in grades may come at street crossing without making a noticeable difference in appearances. (3rd) That the grade shall come as near as possible to the present surface of the street, thus getting a minimum amount of labor in grading and avoiding unsightly cuts or fills in front of existing buildings.

Before taking up the streets in detail it is necessary to study the drainage of the town as a whole in order to determine the amount of flood and rain water to be handled and the best way of distributing it to prevent the flooding of any one street. Bishop lays between two(2) natural channels, the South Fork of Bishop Creek on the north and the China Town Slough on the south, forming the natural outlets for the street drainage. The fall from west to east throughout the town is quite heavy, averaging about six tenths percent or thirty one and a half feet for the mile. North and south the land is quite flat Bishop Creek on the north being but little higher than the China Slough on the south. The contour map shows that this is broken by a well defined ridge and swail running nearly east and west. The ridge ~~ge~~ starts on the high ground on which the Academy is situated and runs a little south of Academy place, crossing Main St. at the intersection with Willow St., thence a little north of east to the east boundary of the town at the east end of May St. The swale starts in the field north of Mr. Riggs house, follows nearly the entire length of Third St. to Main St. and thence northeast till it enters Bishop Creek. This naturally divides the town into three drainage divisions. (1st) All south of Academy and Willow Streets drains into China Slough. (2nd) All between Academy and Willow Streets and Grove and East ^{Third} Street drains east to the east boundary of the town from which the water will naturally find its way into Bishop Creek. (3rd) The northwestern part of town drains north into Bishop Creek.

All flood waters enter the town from the west in the old irriga-

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tion ditches and can be diverted by means of them.to the different divisions.

From these general considerations it is evident that we can draw the following conclusions. (1st) That in general the water must be carried by the east and west streets with their heavy natural grade. (2nd) That by small cuts or fills on them any change in the elevation of the crossings with the north and south streets can be met. (3rd) That the three drainage divisions must be maintained by breaking the grades on the north and south streets. (4th) That where ever it is necessary to carry the water accumulating from several streets from an east and west street to another it must be done at a point where the greatest fall in the north and south streets can be secured.

For convenience in study of the necessary grades there has been prepared the following rough table of the capacity of gutters on the different grades. If the stream of water is eight inches deep and two feet wide with a smooth bottom we get for the different grades---

Grade	Discharge in feet per sec.	In inches
0.3%	1.61	64
0.4%	1.84	74
0.5%	2.06	82
0.6%	2.26	90
0.7%	2.44	98
0.8%	2.58	103
0.9%	2.77	111
1.0%	2.92	117

Another way to look at the same thing would be as follows,

On 0.3	grade a 3 inch obstruction will back water	83 feet
" 0.4%	" " " " " " " " " "	62.5 "
" 0.5%	" " " " " " " " " "	50 "
" 0.6%	" " " " " " " " " "	41.5 "
" 0.7%	" " " " " " " " " "	36 "
" 0.8	" " " " " " " " " "	31 "
" 0.9%	" " " " " " " " " "	28 "
" 1.0%	" " " " " " " " " "	25 "

West Line St. west of the intersection with Hammond St. has sufficient fall to clear itself and if it is built up, cross streets will be opened which will need to be considered in establishing grade on it. For this reason it will not be taken into consideration. The same applies to the west end of Grove St. and Home St. in the northwest part of town.

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In taking up the individual streets we will follow the drainage divisions of Main Street and show how the cross streets can be made to fit ~~them~~ ^{on Main St.}

Starting at the Bishop Creek channel, at a point two feet below the bridge and raising on a .4% grade the line will follow practically the present surface of the ground to the base of the culvert at West Street. A short fill south of this culvert will carry the grade to the south line of West Street. This line will carry the gutters into the creek at about the present water level, as low as it would be safe to go. A fill, as at present, in the approach to the bridge with deep gutters will meet the bridge level.

An even grade of .7% on West Street, from the level of the fill to the western end of the street, will be practically the present surface of the ground except for a distance of four hundred feet immediately west of Main Street, which will have an average fill of about .6ft. This will carry all the drainage on West Street into the Creek.

Starting again at the proposed crown on the south side of West Street and going south on Main Street with a fall of .4% there will be a cut of .5 feet at East Third. A very short cut on East Third Street will bring ^{this} ~~it~~ out to the general grade of the street. East Third St. itself has a very even grade of .6% with practically no changes from its present surface.

Grove Street will meet Main Street with a cut of .3 feet for a distance less than two hundred feet. It again has a fairly even natural grade of .79%.

This leaves the grades on the cross streets too slight to drain. To get a grade between these two streets it would be necessary to start with a foot cut at Hobson and Grove and carry it to the entire length of Grove Street. This would be entirely too expensive under present conditions as well as interfering with the streets to the south. The only way out of this is to put a crown in the center of each block between Grove and West Streets, then the cross streets will drain each way. While this will look peculiar it will do for years to come, unless the town grows very extensively in that direction.

The greatest objection to this is that the drainage water from the upper part of Grove Street will have no way to reach West and North Main Streets. This can be remedied by means of a ditch or deepened gutter starting at grade on Grove and cutting through to West one foot below grade, thence along West on a .4% grade for two hundred and eighty feet where it will come out on grade again. This can be placed on Fowler Street or better still on the unopened alley on the block just east of Fowler Street. It is almost necessary to do this to prevent too great an accumulation of water on East Third Street.

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As there is grade to spare between East Third Street and the high ground on Academy and Willow Streets at Main Street, we will leave this division for later consideration and take up the lower division of Main Street next.

The present fall from Willow to New High Street is only one foot in nine hundred or .11%. The .4% grade line from Willow to Clark Sts that will meet the cross streets and give the least work come as follows. .6 foot fill at Willow, .2 foot fill at Church, .7 foot cut at Line, 1.3 feet cut at New High, .9 foot fill at Clark Street.

West Line Street can be given an even grade from the bridge over the Slough to Main Street ^{at the} ~~for a~~ proposed cut with a .58% grade. This will make a short cut near Main Street and an average fill of .5 ft. west of Warren Street. While this is considerable work it will give a good dry street and, as at present, the drainage can be turned south on Warren Street to the Slough and kept off of Main Street.

An even grade on Church Street from the present surface at Fowler St. to the proposed fill at Main Street will be .5%. This will require a fill from Main to Warren Sts. averaging .2 ft. and the leveling of a raise in the middle of the next block. Fowler St. will have a .38% grade to West Line St. and Warren .48%, sufficient in each case for the water that will gather on them.

An even grade on East Line St. from the proposed cut at Main to East St. will be .58%, the same as West Line St., and will be a cut averaging about .8 ft. as far as Sneden St. and a slight fill from there on.

Clark St. is very low and will have to be filled throughout for good work. If it be given a .64% grade to Sneden St. and .4% from there on to the present surface at Clark Boulevard, the average fill will be about one foot. Sneden St. will have a grade of .49% between the proposed grades on East Line and Clark Sts. and Clark Boulevard a .4%. In each case there will be a ridge to cut down to get the required grade.

This leaves New High St. in the worst position of any street in town. It will have a grade of .59% but will be an average cut of .7 ft. throughout. There is no way to avoid this without making increased work some where else that will more than offset it. While there will be a good deal of work in this part of town, the cuts and fills average up well and the dirt will only have to be moved a short distance.

Returning to the central division of Main St., there will be a grade of .59% from the proposed fill at Willow St. to the proposed cut at East Third St. meeting Academy St. with a fill of .3 ft., May St. fill .8 ft., Third St. fill .2 ft. Third St. forms the natural drain

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age on the west side. By breaking the grade on a fill of .5 ft. at the intersection of Warren the lower part will have a grade of .41* and the upper part .86*. This will give a small fill along most of it and a cut at the intersection with Fowler St. This is necessary to meet the intersecting streets giving Fowler St. a grade of .37* from Grove St, Hammond St. .41* and Warren .45*

Academy St. will also have to break grade at Warren St. to avoid an extensive fill. It can have a grade of .72* on the west side of Warren St. and .44* on the east side. Fowler will then have a grade .38* to Church by cutting through the present ridge and .68* to Third St. Hammond will have .73* to Third St. and ~~x22x22x22~~ Warren St. .77*. Warren between Academy and Church Sts. is too flat for any grade and will have to be crowned in the center of the block and divided. As this will always be a back street it will not be noticeable.

Willow St. if given an even grade would be too near the same elevation as May St. unless extensive fills were made. By starting at the proposed grade on Main St. a .66* grade will meet the present surface at High St. giving an average fill of one ft. .88* grade from High St. to East St. would about meet the present surface.

May St. on an even .6* grade from the proposed fill at Main St will require an average fill of .4 ft. to Bush St. and the remainder can be left untouched.

This will leave Rose St. with a .5* grade from Willow St. to East Third St., starting with a one ft. fill on Willow St. and meeting East Third at the present surface.

High St. will have a .36* grade from Willow to May Sts. and .48* from there to East Third with a very slight fill.

East St. will crown at May St. having a .55* grade to East Third and .5* to Willow St. The block between East Line and Willow Sts. is too flat to grade through but it can be ~~dnoped~~ into the natural swale by grading each way. To do this we will have to count on an alley being opened east and west through the block. The only other way out of it would be to fill the east end of Willow St. to give a grade each way from it. If it is found necessary at some future time, this change ~~ge~~ can be made with out interfering with any of the other streets.

The east ends of East Line and Clark Sts. with Short and Second Sts. present a hard problem as they are at present. By cutting Clark St. through from Clark Boulevard on a .4* grade Second and Short Sts. would have a grade of .3*. Another way would be to crown all three in the centers of the blocks and get a drainage from the lower end of Clark Boulevard to the Slough. This would not look near as well but would carry any water that might accumulate on them. Building up this

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part of town will probably bring in other factors to consider.

The grade lines necessary to give this system ^{are} ~~is~~ indicated on the accompanying Profile Sheets with the present street surfaces. The present surface of Main St. was determined by elevations taken every ~~x~~ fifty feet and give exactly the amount of cut and fill in the center of the street. On East and West Line Sts. the elevations were taken every hundred feet. The rest of the streets were taken only at the intersections. There are undoubtedly a number of minor depressions and elevations on them that are not shown on the profile map but they only become a matter of leveling the streets between the intersections.

This system is designed to give the best results for the least expenditure of money. Unquestionably a large growth in the outlying portions of the town would necessitate changes in those parts but this can be done at any time without effecting in any way the work already done in the central part. If the work on Main St. is taken up it will be necessary to do work as follows on the cross streets to prevent leaving them in worse shape than they are at present.

West St. filled for 400 ft to grade.

East Third St. cut for 100 ft to grade.

Grove St. cut for 100 ft. to grade.

Third St. filled to Warren to grade and for 100 ft. further to meet the grade of the upper end.

May St. filled sufficiently to give even drop to its present surface.

Academy filled as far as Warren to grade.

Willow St. filled to drop to present surface.

Church filled to Warren to grade.

West Line cut to Warren to grade.

East Line benched up to present surface.

New High benched up to present surface.

Clark filled to drop to present surface.

In grading thus far there will be dirt to spare which can be used on Clark St. and West Line Sts., as well as around the Court-house and on the unopened street north of it which we understand will need to be used soon.

If in the future this plan is kept in mind on all street work and whenever a hole needs filling, it is done with dirt from the nearest place above grade, most of the town will gradually work into the grade without much attention. The cut on East Line and New High Sts. and the fills on West Line and Clark Sts. will be good sized jobs. In two places we will have a cut of almost two feet below the present

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gutters, Main St. in front of Bell's Saloon and East Line St. in front of Yandells. It is probable that these will necessitate the lowering of the ~~l~~utternals from the water mains and possibly the main itself, adding considerable to the cost of grading at these points.

There are alternate propositions on Main and East Line Sts. that are worth taking into consideration. We can break the grade on Main St. at the intersection with West Line St. and raise on a .4* grade to the present surface near the center of the block and fall on a much steeper grade to Clark St. This would necessitate carrying all the drainage collecting at this point, on to East Line St. and a much further distance through town. East Line would have to be lowered to get a culvert grade. It again could be carried out on a .4* grade for a ways and then dropped to meet the proposed grade at East St. These changes would not affect the grades of any other streets.

The only point in favor of these changes is the one of expense. The cuts on Main St. would be very much less and that on East Line St. made more even. Against it is the increased drainage to be carried on East Line St. and the very important one of looks. These are the two principal streets of the town and the hollow at the main corner would be noticeable from every direction. Breaking the grade in the way in the middle of the block on Main St. will not only show on the street but in the sidewalks, curbs, and buildings. We certainly think that the difference in appearance gained by using the deep cut will offset the expense in the end.

Respectively submitted,

A. M. Strong

Jan. 28, 1907.

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ESTIMATED COST OF GRADING AND CURB ON MAIN STREET

	Fill	Cut
Fill at Clarke St end, 80 ft road way	218 yds.	
Cut to Line, 80 ft road way		1526 yds.
Cut to Church St., 60 ft road way		192
Fill to Third St. 40 ft. Road way	456	
Cut to Grove St.		183
Fill to with in 200 ft of bridge	250	
Fill on XXXXXX West St.	340	
Cut on Grove St.		40
Cut on East Third St.		30
Fill on Third St.	240	
Fill on May St.	30	
Fill on Academy St.	200 yds	
Fill on Willow St.	30	
Fill on Church St.	60	
Cut on East Line St.		30
Cut on West Line St.		30
Cut on New High St.		30
Fill on Clarke St.	200	
	-----	-----
Total	2036	2121

2121 yds. cut and placed in fills at 25 cts per yd.	\$530.25
Work with grader	\$150.00
10 culverts at \$ 30 each	300.00
4480 ft of stone curb at 20 cts. per ft.	896.00
Setting Street and curb grade stakes	50.00

Total \$1926.25
Per front foot of property .428

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REPORT OF THE

COMMISSIONER OF THE LAND OFFICE

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