



## A Study And Analysis of Process And Material Used In Highways Construction

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### Abstract

The construction of a road is composed by different phases, starting with the stroke of the topographic line of design to determine the widths and heights corresponding to the cuts or fills that will have to do during the movement of land.

In accordance with the forward, are placed the sewers and sub-drains will serve to evacuate the water from rainfall and currents that can affect the foundations of the road. Completed the sub-flush, builds the layer of sub-base that is a combination soils and gravels properly classified to withstand and transmit the loads from the transit. As indicated by the design, will be built the base layer that can be of a material similar to the sub-base or use a black base with a low proportion of asphalt cement. As it moves the construction of the base, starts the construction of ditches. As a final layer, we build the surface of pavement or surface layer; if is of concrete, asphalt will be placed with a finalize of asphalt and shall be composed of a mixture of asphalt cement with coarse aggregates of low gradation and fine aggregates. Completed construction, places the vertical signaling, composed of traffic signals reflected in metal panels mounted on metal posts to a given height; it should also fit the horizontal signaling, composed by marks and signs that are made on the pavement surface such as the longitudinal lines side and center, zebra crossings, symbols, variable and others.

### 1. Introduction

One of the main reasons for developing this work, is to provide a means of information that middle and indicate what are the steps to follow during the stages of construction of a road, such that be of much help to someone who does not have experience in the branch or serve as a means of consultation for someone who already have.

Within its content is described the staff is required to have a good control and development activities, the manner in which they should be performing the work within the project will indicate the specifications and standards that must be fulfilled in order to obtain quality results, the requirements that must be met by the materials that are used in the construction,



as well as laboratory testing of soils that are applied usually in the process of construction. It is amply describe the steps that you must take to build each one of the layers that make up the pavement structure, departing from the cleanliness of the terrain where the road will until the last details prior to its receipt as completed project.

## **2. Stages that make up the construction of a Road**

The pavement is a structure which is composed of different layers of soil and stone materials from their point of foundation to the surface in the circulating the traffic. The surface on which it is to begin constructing the pavement structure is called sub-flush, which then has to comply with various specifications ranging from the plasticity and quality of materials (soils), until the value surface support that determines whether or not resist the loads he will be arriving with the passage of traffic.

## **3. Jobs that make up the movement of Lands**

The location of the topographic line is to rethink the line of the road, according to the plans of the project design; this work starts in charge of gangs of topography of the supervisor or is done by mutual agreement with the contractor. The staff of the supervisor will place the references of the control points horizontal and vertical, laid down in the plans, consisting in monuments of concrete, and corresponds to the contractor doing layout in detail to each 20 m above the center line. The staff of the supervisor will also provide the data to be used in the establishment of controls of the main elements of the project.

## **4. Jobs that make up the construction of Drains**

The structures are commonly called sewers, which have as their main objective to allow the passage of water by waging a particular obstacle. When performing the geometric design of a road, the same usually gets in the natural movement of runoff from the waters of the area of location; on a mountainside, it gets in the way of runoff from the waters that travel through the mountain; when he crosses a creek, a river or any other channel, and even in the flat spots, the topography of the terrain forces the water movement in either direction.

## **5. Jobs that make up the surfaces of Flooring&the sub-bases and bases**

It is a layer of coating formed by successive irrigation and alternating of bituminous material and crushed stone aggregates of uniform size scattered evenly that, through the process of compaction, are accommodated and oriented in its position more dense. This layer directly receives the action of the transit to the pavement providing the necessary conditions of impermeability, resistance to wear and softness to the shooting.



The placement of any layer of sub-base, sub must be completed. When you reach the level of sub-grazed by means of the construction of an embankment. When the level of sub-flush matches or is close to the level of a road previously built, and add or cut material to conform it to the level of the sub-flush designed. The remanufactured subgrade must be compacted with a tolerance of moisture content of 3 % of the Optimum Moisture and reach a 95% of compaction in respect of the maximum density. If you reach the level of sub-grazed by means of the cut-off of unclassified material, you must check the surface and check that there are areas that contain inappropriate material and, if this is the case, they have to be removed and replaced by materials which are not classified or with base material. It is recommended that the surfaces of sub-flush reached by means of court will also be scarified and compacted. To be completed the sub-flush, in addition to the compaction checks you must practice deflection checks through the Benkelman Beam.

#### **6. Jobs that make up the structures of Bridges**

A bridge is a structure of one or more lights, including their supports, which is constructed to save an obstacle, thus giving continuity to a track. The obstacle can be another track (either road or rail), a stream of water, a depression of the ground, or a vacuum anyone.

#### **7. Jobs that make up the signaling**

This type of work covers concerning what is vertical signaling, horizontal signaling, monuments of mileage and other add-ons as poles eyeliners, indicators of the right track and defenses to roads and bridges. For the signal processing, brands and add-ins, the general specifications for the construction of roads and bridges of the Directorate General of Roads determine the specifications and quality of the materials with which they must comply. In addition to this type of information and everything related to layout panels, dimensions, content, colors and types of signals (that generally indicated in the drawings), we should govern by the Central American Manual of Uniform devices for the control of transit, prepared by the Secretariat for Central American Economic Integration - SIECA.

#### **8. Vertical signaling**

The vertical signals are transit control devices installed at the level of the road or on him, intended to transmit a message to drivers and pedestrians, through words or symbols on the traffic regulations in force or to warn about the existence of any danger in the track and its environment, or to guide and inform on routes, names and locations of populations, places of



interest and services From the functional point of view, the vertical signals are classified into:

**Restrictive signals:** are those that indicate the driver on the priority of step, the existence of certain limitations, prohibitions and restrictions on the use of the track, according to the laws and regulations in the field of transit of each country. The violation of the rules laid down in the message of these signals constitutes a misdemeanor, which is penalized in accordance with what is established in the law or regulation of transit.

**Preventive signals:** are those that indicate the driver of the conditions prevailing in a street or highway and its environment, to warn the driver of the existence of a potential danger and its nature. The signals of prevention require caution on the part of the driver either to decrease the speed or for which I have other maneuvers that result in their benefit and that of the other drivers and pedestrians.

**Informational Signs:** are those that guide or inform the driver about names and location of populations, mileages, distances, services, points of interest and any other geographic information, recreational and cultural relevant to facilitate the tasks of navigation and guidance of the users.

## 9. Usual laboratory tests of materials and soils

In this chapter we will mention some of the tests that are made in the field and within the laboratory of materials and soil during the process of construction of a road, gives a brief description of each of the tests indicate the norms with which must meet and a listing of the household goods needed to run the test in reference.

It can be said that the dry density of a soil, produced by the compaction, depends on the percentage of moisture it contains and the intensity of the compaction force applied to it. The compaction of a soil is measured and verified by the dry density of the soil, this is, the weight of the solid particles per unit of volume, the units of density are:  $\text{kg-m}^3$  or  $\text{lb/ft}^3$ . The comparison of the current dry density, with the maximum dry density is the percentage of compaction. The dynamic methods for soil compaction, are those in which the energy of compaction is applied by means of blows of ram (mallet or hammer) dynamically (Proctor). Due to that is currently used the test of Proctor Modified with greater benefits of the standard for the compaction, describes the four alternative procedures for this test:

- Method: mold of 10.16 cm (4 plug) with material that passes the sieve No. 4.  
Compact in 5 layers with 25 strokes each.



- Method B: mold of 15.24 cm (6 plug) with material that passes the sieve No. 4. Compact

in 5 layers with 56 strokes each.

- Method C: mold of 10.16 cm (4 plug) with material that passes the sieve 1.95 cm (plug). Compact in 5 layers with 25 strokes each.
- Method D: mold of 15.24 cm (6 plug) with material that passes the sieve 1.95 cm (¾ plug). Compact in 5 layers with 56 strokes each.

The test for the method Proctor must comply with:

- AASHTO T180-01: Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54 kg (10 lb) Rammer and 457 mm (18 in.).
- ASTM D1557-07: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 foot-lb./ft<sup>3</sup> (2,700 km)).

## 10. Occasional Problems in the Development of the Work

Then will review of certain setbacks or problems that tend to occur during the construction phase of a road, there are serious problems, but if not solved somehow may harm and prolong the implementation of the project.

The location of the topographic line is to rethink the line of the road, according to the plans of the project design; this work starts in charge of gangs of topography of the supervisor or is done by mutual agreement with the contractor.

### Conclusions

1. When applying the process that leads the construction of a road in the phases of movement of land, building bases, construction of sub-bases and the placement of running surfaces, you must optimize the use of equipment and machinery to be used in the project.
2. It is essential that the professional staff of foreign origin or which has been entitled abroad - which participate in a public tender-, must be integrated.
3. One must pay a lot of attention and comply with the specifications laid down for the construction of the lower and middle layers of the structure of the pavement, because if not, they may fail for consolidation when working with traffic loads that are applied and have an impact on the running surface of the same.
4. When, as part of the process of building a road changes are required to the standardized designs in levels of geometric design, structures or pavements, must



inform in advance to the Directorate General of Roads, or in the absence thereof, to the coordinating entity of the project in order to report and approve the changes that are proposed.

5. When you run the signaling line should not be spared in terms of the number of signals to be fit and comply with what was necessary, since the signaling helps maintain a secure road and reliable for the user.
6. Must be given special importance to tests and trials carried out by the staff of the laboratory of materials and soils, since their optimum results serve to maintain quality control of the work that is being done within the construction of a road.

### **Recommendations**

It must corroborate the quantities fully and lines of work submitted in bidding for the construction of a road, in order to have security in the amounts that will be submitted to compete in a public tender, this will prevent potential losses when they are executed the work.

1. Maintaining good communication between the staff of the contractor and the supervisor in order to avoid the repetition of field checks in the work they are performing.
2. You must request the contractor to submit the respective quality certificates when using steels, gauge steel sheets defined, asphalt and other materials which require support their quality before being used in the work of the project.
3. Should be given preventive maintenance of the machinery used in the project, which helps to avoid failures that delay the execution of the work.
4. Make an inventory and carry a history that supports the placement of traffic signals and defenses of metal will avoid further drawbacks to be present the Commission receiving the project, considering especially that, in some cases, these jobs have been damaged or stolen from the place in which they were installed.
5. Maintain documented the execution of all work carried out by means of reports and field notebooks erected for the collation of amounts that were paid in the estimate monthly work required in the construction of road.
6. In the process of the construction of a road it involved two main entities, one of them is the supervisory office, which represents to the Directorate General of Roads; and the other is the construction company or contractor who will perform the work of

construction. For this reason in this chapter we will mention of the staff of both sectors, and which in some cases may be one or more persons.

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