

placed so as to equalize the compressive and tensile strength of the concrete. In the case referred to, steel rods with ends bent at each end, are placed across the culvert 1 1/2 inches from the exposed face, both bottom and top. A coating of concrete 1 1/2 inches in thickness will effectually protect the steel from rust. The steel used should be free from oil or grease. A thin layer of rust is not objectionable, but loose or scaly rust should be removed with a stiff wire brush. The concrete should be well consolidated and placed in close contact with the steel.

On the sketch accompanying this article, a clear width of driveway of 20 feet is shown. There is a tendency to make short-span bridges too narrow. A driveway 16 or 18 feet wide may be sufficient for long steel or other bridges, which are in plain view at all times; but for smaller waterways, the sides of which are not prominent on the highway, the width should be such as to minimize the tendency to drive over, or strike the hand rail. Where tile culverts are used, it is the practice in some municipalities to carry them the entire width of the highway. In this way, an absolutely safe crossing is provided. Hand rails on all culverts are important. They add to the safety of a bridge; and much attention should be given to their appearance, as this is the only part of the work to be seen by the travelling public. Strongly-built railings of good appearance give a feeling of safety and security in passing over the bridges, and with little, if any, added expense, they may be made a matter of ornament to the highway.

A discussion of bridge-building, using concrete and steel, with a view to enabling the average councillor or pathmaster to draw up plans and specifications for all bridges, must, of necessity, be a misdirected effort. Bridge-building is strictly within the sphere of the civil engineer, and efforts to discount this fact are foredoomed to ultimate failure. The skillful and experienced farmer looks with amusement upon attempts at farming made by inexperienced men who take up farming after a life spent in professional work. The newly-arrived "remittance man" is an example of such farming. When will councillors realize that their own well-meant attempts to build steel and concrete bridges without trained advice is equally enjoyable to the man who thoroughly understands bridge design?

A common practice is for councils to advertise for tenders, upon which steel-bridge companies submit alleged strain sheets, specifications and prices. Having little or no other experience and training to guide them, the work is awarded according to price. The lowest tenderer receives the contract. Price is the sole basis upon which judgment is formed. For a difference of \$5.00 in price, a bridge may be rejected in favor of one having \$1,000 less value. A premium is thus put upon inferior work. Having awarded the contract, councillors, without engineering training, are unable to determine to what extent even the plans and specifications submitted with the tender have been followed.

When a bridge is required in a municipality, the proper procedure is to at once employ a civil engineer experienced in bridge construction. He should prepare plans for the substructure, including abutments and piers. He may himself prepare complete plans and specifications for the steel superstructure; or, without preparing plans, he may submit such specifications in calling for tenders that all bridge companies will compete on a uniform basis. By the latter course, each company is free to submit its own design, which must, however, be prepared under a fixed specification as regards strength. Having received tenders for the work, the engineer is in a position to decide upon the most favorable tender. He will further scrutinize details of connections, etc., and will see that the bridge is erected in accordance with the specifications. The services of a capable engineer will commonly double the life of a bridge, as compared with a contract that is let without proper supervision. In the preparing of plans for abutments and piers he can frequently save sufficient material to pay for his services. Bridge construction is a work requiring mathematical training, as well as practical judgment and experience, and to this end it is most desirable that the public be thoroughly conversant with the fact that councillors should not be expected to erect steel and concrete bridges without the services of a trained and experienced man to guide them.

The strength of bridges is a matter for considerable readjustment in Canada. The common practice is to build them just strong enough.

Having future requirements in view, with materials that may last almost forever, it is only good judgment to build our bridges stronger than strong enough. Methods of traffic and transportation are rapidly changing. Motor traffic has been applied to rural transportation, and it is the belief of many that it will in the near future be adopted in Canada. This will mean on our country roads largely increased loads. The weight of rural traffic, through traction engines, is steadily demanding stronger bridges, and what the future may produce it is impossible to foresee. Other than that, with increasing population and improved means of traffic, bridges should be built capable of carrying very much heavier loads.

W. A. McLEAN, Engineer of Highways.
Department of Public Works, Toronto.

HORSE

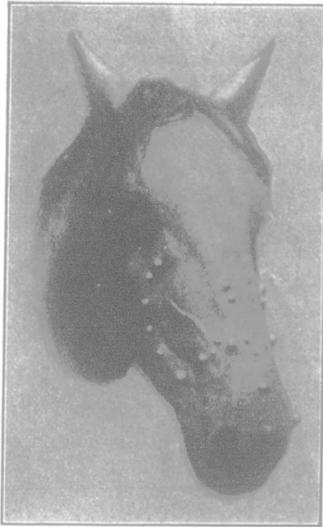
Glanders in Horses and Man.

It is important that owners of horses and mules should never overlook the possibility of glanders being transmitted from animals to man. Several cases have been reported in Canada in which the disease has been contracted from horses by their owners or attendants, and occasionally fresh instances arise when owners, through carelessness or dislike of governmental interference by inspection of their horses, have paid the penalty with their lives.

In years gone by the range horse has disseminated the disease throughout the country, but owing to the regulations promulgated and enforced in late years all horses, whether domesticated or branded (range) horses from south of the international boundary, are tested with mallein. This limits the sources of infection of outbreaks to domestic or native origin.

In the farming districts glanders is soon noticed and quickly stamped out, but it will readily be understood that the disease will be more difficult to detect and control in large bands of horses not even halter broken, a difficulty increased by the practice of sophisticated breeders of range horses in shooting any horses in their bunches with suspicious discharge from the nostrils. Consequently in view of the fact that some ranches on the western ranges have been known to be badly infected and that the horses from many ranches range together all the time it may be well to view with suspicion all branded horses newly from the open range.

In the nineties, when branded bronchos used to be trailed down through Saskatchewan and



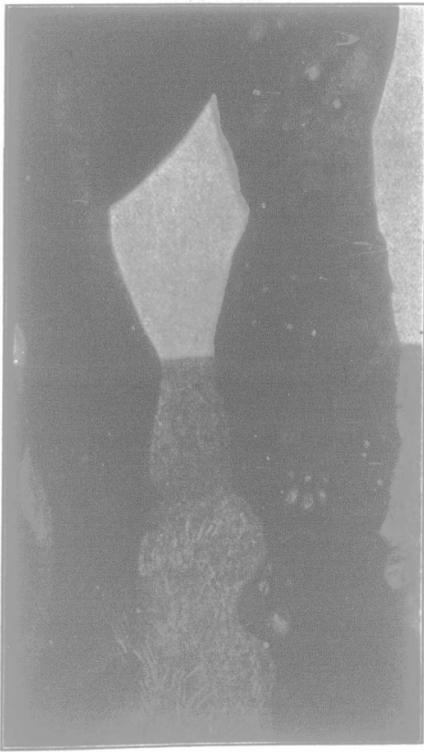
GLANDERS—FARCY BUDS ON FACE.

Manitoba for sale from the Medicine Hat and Maple Creek districts, quite frequently one could trace the route followed, it being marked by outbreaks of glanders wherever bronchos were sold, corralled or stabled with other horses. The bronchos, although infected when they started from the range, frequently did not exhibit any symptoms until worn out by travel and hard usage at the hands of their new owners.

A ranch broken up some ten years, the Ox Heart, was often accused of being a nursery for the disease and perhaps the suspicions were too well founded to be disregarded. It is also well known that during the Boer war one celebrated regiment horsed with western branded horses had a frightful mortality among its horses due to glanders. Horses under certain climatic conditions, such as exist in British Columbia, may harbor the disease yet live for years and show very few if any symptoms, the only means of detecting these none-the-less dangerous animals being by means of the mallein test. Range horses, as already mentioned, have been known to be infected, but until submitted to the vicissitudes of shipping, selling and breaking to harness, have not shown clinical symptoms, ill health, staring coat, irregular hacking cough, nasal discharge, either from one or both nostrils, enlargement of the glands under the jaws, loss of flesh, abscesses (farcy buds) on the limbs, trunk or face.

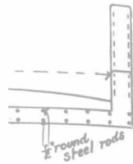
Recently a farmer in Saskatchewan died from an illness of several months standing, exhibiting symptoms which if noted in a horse by a veterinarian would have at once placed it under suspicion of glanders. The attending physician and specialist pronounced the patient to have tuberculosis, not suspecting a horse as the source of the infection and probably not knowing that for months their patient had been treating a mare with so-called nasal gleet — even to the extent of cleaning the old mare's nostrils of the glanderous discharge. Despite all treatment the man died, affirming in his last few weeks that "Whatever the old mare had, he had!" The man is dead. On examination some months later his horses were tested, found to be diseased and all shot. The old mare, also dead, had infected the victims to this dread disease.

Glanders is not a hard disease to diagnose by a professional man who is on the alert. Clinical cases should not be long undiscovered even by the farmer owner, if he will only think over the possible causes for the symptoms shown. The old idea that the glander discharge sinks in water and that if a discharge does not sink the disease is harmless, is a fallacy and is not worthy of further consideration. Discharges from the nose in horses that are very offensive are generally due to a decayed upper back tooth (molar). The discharge of distemper (strangles) is usually found in young horses, old horses rarely being affected with strangles, consequently always suspect a non-smelling discharge from the nose in an aged horse, especially if either of the glands below the jaw are enlarged, or there is a discharge from the eye also of the same side as the discharging nostril. Discharges from the nostril (either one or both) intermittent (now and again), rusty in color, gluey (viscid), sticky in nature and



GLANDERS (FARCY BUDS), NOT AN UNCOMMON FORM

GES



oranda

Door thickness	Abutment top
7"	12"
8"	12"
9"	15"
10"	15"
12"	18"

ed, and is again
ice is thoroughly
concrete is depos-
enced with a ce-
ar over the old
ce when the old
light coating of
should be depos-
place as quickly
As a rule, thirty
at should elapse.
e and is broken
the concrete, is
the work. For
has been put in
ntil it has thor-
concrete, when
be quickly ram-
as to make the
free from spaces

coarse stuff has
ated over with a
mortar, made in
nent to one part
t the center than
er that drainage
rous, and unless
ng, is certain to
pping through it.
t adhere to the
th oil before the
ination of crude
rush gives good
; be used. For
dressed lumber
cleaned and re-

to see that the
avings, sawdust,
, before putting
this kind would
re is evidence of
this. Time and
riter has found
n the concrete.
moved. Neglect
at the workmen
ob in the easiest
quences.

flooring of this
rods. There is
kind of iron will
steel is used to
n of the concrete
strong in com-
Wherever it is
ver a culvert to
on one half, and
steel should be