

**Technology  
for**

# **Alaskan Transportation**

*Summer 1987 — Volume 4  
University of Alaska — Fairbanks  
Transportation Technology  
Transfer Program*

## **In This Issue**

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## **Traffic Demands Remain High**

While some indicators of the Alaskan economy are down, most 1986 traffic volumes remain at or near record highs. One of the most significant gains from 1985 (noted in a review of available statewide traffic data) was just over 10% on the Parks Highway in west Fairbanks. Typical of many traffic volume changes now occurring in urban areas, this gain is largely attributable to new highway construction—in this case—an extension of the Parks Highway into south Fairbanks. Likewise, a 7% decline on the Seward Highway south of downtown Anchorage can be attributed to recent improvements on the parallel A and C streets.

An insert in this issue details traffic activity at 12 locations across the state. Of these, the two locations showing the strongest long-term growth are the Glenn Highway north of Anchorage and the Parks Highway west of Fairbanks. Traffic at these two locations has grown by two and one-half times over the last 10 years, representing a compounded annual growth rate of just under 10%. Much of this growth is a result of suburban development in Alaska's two largest cities.

Traffic data play an important role in planning and engineering decisions for agencies with responsibilities for streets and roads. Which roads should receive priority for snow removal? Will an intersection upgrade require any special lanes? How thick should the pavement be? Where are the greatest needs for improving capacity?

Traffic data also provide useful information for a variety of decision-makers. What site is suitable for a commercial development? How much is a commercial property worth?

The Federal Highway Administration provides by far the largest source of funding for traffic data activities, in part because this information is used in formulas allocating federal gas tax funds back to the states for road construction. Along with this funding comes a requirement for mandated activities: volume data (just how many vehicles are using our streets and highways?); traffic safety data (which areas have the most pressing need for safety improvements?); speed studies (are motorists complying with speed limits?); truck weight data (what loads are our

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## **Fish Passage Through Drainage Structures**

For a number of years, officials of the Alaska departments of Transportation and Public Facilities (DOT&PF) and Fish and Game (ADF&G) have been concerned about annual migration of fish through highway drainage culverts. These stream crossings can impede access to feeding, spawning or overwintering habitats. In order to facilitate fish

passage, ADF&G has established maximum allowable water velocities for varying culvert lengths that must not be exceeded during a mean annual flood discharge.

To meet the fish passage criteria, DOT&PF must often design and install large-diameter culverts or even bridges when a smaller

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## Traffic Demands

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highways actually carrying?); and classification data (what types of vehicles are using our highways?). To carry out this program, the Alaska Department of Transportation and Public Facilities (DOT&PF) has 68 permanent traffic counters that electronically detect and record traffic activity every hour of the year. At a handful of these locations, such counters have been collecting data since statehood. This provides a solid historical profile of traf-

fic activity. These data are supplemented by periodic counts with portable equipment and manual counts. In 22 locations across Alaska, state-of-the-art equipment transmits data electronically to microcomputers for analysis and offers the capability for real-time observation of traffic activity.

In addition to DOT&PF, the Municipality of Anchorage and the City of Fairbanks collect traffic data to meet their specific needs. Other

sources of information include the U.S. Customs Service (Treasury Department) and the Division of Parks (Alaska Department of Natural Resources).

For more traffic information, see the note enclosed with this newsletter entitled, "Alaskan Traffic Data." It provides a figure summarizing Alaskan traffic data as well as addresses of agencies in Alaska that can provide additional information. **AT**

# News & Views

## Share Your Views and News

Don't be shy—contribute to this newsletter. Share your handy hints. A paragraph is all you need. Or send us newsworthy tidbits, or events for our calendar. Feature articles are also welcome. This is your newsletter, and your active participation is welcome. You know what's going on out there, and we are here to pass on that knowledge.

## New DOT&PF Commissioner

Mark Hickey is the new commissioner of the Alaska Department of Transportation and Public Facilities. Hickey's 10 years of experience with DOT&PF include service as deputy commissioner for operations and as transportation planner. As head of the Alaska Railroad Transfer Team, he managed the acquisition of the Alaska Railroad from the federal government. Over the years, he has also provided policy support to the Alaska Railroad Corporation, the Alaska Land Use Council, and the Alaska Power Authority. He has also performed special assignments related to state and federal legislation, and special negotiations such as the Klondike Highway Agreement.

## International Airports Merged

Doyle C. Ruff has been appointed to serve as executive director of international airports for DOT&PF. This is a new position that will unify both the Anchorage and Fairbanks airports under one director. This consolidation is an important step in bringing a more

business-like and cost-effective approach to the international airport system. Ruff will be responsible for the overall operations of the Anchorage and Fairbanks international airports, management of the International Airport Revenue Fund (which pays for airport operations), and interaction with the airlines, public and other units of DOT&PF. Ruff says that, while he isn't planning any major changes in airport operations, he does plan to focus on international and domestic marketing for both airports.

## New Regional Director and D & C Director for Northern Region

Lynn Harnisch is the new regional director for DOT&PF's Northern Region. Harnisch, who is a professional engineer, has over 13 years with DOT&PF in a wide range of responsibilities. Most recently, he has been self-employed with his own retail business. Harnisch served four years as president of APEA, and an additional three years in other elected positions with that agency.

Betsy Engle has been appointed director of design and construction for DOT&PF's Northern Region. She has more than 20 years of professional engineering experience (the last seven with DOT&PF). Engle has degrees in civil engineering and sanitary engineering, and she is a registered professional engineer and land surveyor.

## Bridge Safety

An under-strength bridge is a safety risk to motorists and a liability hazard to the government responsible for maintaining it. Motorists must know whether a bridge can safely sup-

port the loads normally carried over it. If not, it is essential that the bridge be either posted or strengthened. But, at a minimum, motorists must have the information they need to decide whether to drive across an under-strength bridge.

State and local officials in Alaska have done a good job of inspecting bridges and identifying deficiencies, according to Ray Barnhart, head of the Federal Highway Administration. Unfortunately, some local governments are afraid to install signs advising motorists of load restrictions because they fear that acknowledging the deficiency, but not correcting it, will make them liable if an accident occurs. They contend that, because they do not have enough funds to correct the deficiencies, not announcing them is their best defense.

Actually, nothing could be further from the truth. The history of court awards in cases involving under-strength bridges reflects just the opposite. The best defense is posting the bridge and developing a prioritized list of corrections to be made as funding becomes available. Of course, the reason for posting the bridges is to avoid accidents in the first place.

## Handy Hints

Starting with this issue, Technology for Alaskan Transportation will provide a steady stream of practical information that will take the form of inserts to the newsletter. The inserts will be color-coded into one of three subject areas:

- notes on publications and videos
- planning, design and field notes
- computer notes

These inserts will be punched for a three-ring binder so you can keep their handy information at hand.

## Fish Passage

(continued from page 1)

culvert would meet hydraulic requirements. Even after these structures have been provided, their general effectiveness for passing fish is greatly debated. As a result, some engineers feel that ADF&G's requirements are too restrictive and add an unjustified expense to highway projects. Contrary to this opinion, some fish biologists feel the criteria for design are too liberal and do not provide sufficient protection to the resource. Therefore, based on the need for additional data, further evaluation of existing criteria, and a desire to optimize cost effectiveness and resource protection, several joint projects were initiated by DOT&PF, ADF&G and the University of Alaska-Fairbanks to study fish passage problems.

These studies have contributed to our present understanding of fish passage. A survey was made of many culverts throughout

Alaska with particular attention paid to perched culverts and those in streams that contain fish. An extensive hydrologic survey has been made to determine peak and duration of flow rates, when they occur during the open water period and what the recurrence intervals are. New culvert designs are being studied which will minimize the tendency for a culvert to become perched and, at the same time, provide a zone of reduced velocities to aid fish migrating upstream.

In 1984, a Fish Passage Task Force was formed which includes representatives from the University of Alaska, DOT&PF, ADF&G and the Federal Highway Administration. In 1985, a University of Alaska-Fairbanks study was initiated on an existing highway culvert at Poplar Grove Creek on the Richardson Highway near Glennallen, Alaska. Under some flow conditions, this culvert exhibited mean water velocities that exceeded the

(continued on page 4)

# Continuing Education

## Relocation Assistance

The International Right of Way Association will offer a two-day course on relocation assistance in Fairbanks, August 19-21, 1987. This comprehensive course was developed to train those who are involved with relocation assistance as a part or all of their job function. The objective of the course is to develop a knowledge of the relocation function and to effect uniform implementation of relocation law, rules and regulations.

Participants will increase their knowledge of agency obligations, agency goals and their knowledge of relocation. They will also become familiar with replacement housing requirements, calculating moving costs, after the interest differential payments, studies of relocation availability, determination of qualification, public hearings and last resort housing.

The course will run from 8:00 a.m. to 5:00 p.m. daily at Wedgewood Manor in Fairbanks. The course will cost \$237 for members of the International Right of Way Association and \$272 for nonmembers.

For more information, call Chuck Moyer at (907) 474-2411 or write him at 600 University Avenue, Suite F, Fairbanks, AK 99709-1096. The deadline for registration is August 5, 1987.

## Real Estate Acquisition for Local Public Agencies

Due to popular demand, the Transportation Technology Transfer Program again offered a course in real estate acquisition, this time in Juneau on May 12. Experts from the Federal Highway Administration presented the seminar. The course was designed for LPA (local public agency) personnel,

state LPA coordinators and Federal Highway Administration (FHWA) personnel who are responsible for implementing right-of-way programs. The seminar was appropriate for individuals responsible for conducting or supervising the acquisition of rights-of-way for federal aid highways, and the course provided helpful knowledge to those dealing with the acquisition of rights-of-way, in general. The seminar introduced a manual entitled "Real Estate Acquisition Guide" that was developed in response to the need to increase the knowledge of LPA personnel regarding the application of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. Upon completion of the seminar, participants understood the relationships among FHWA, state and LPA right-of-way programs. Participants also learned how to utilize the flexibility available in FHWA regulations for administering the real estate acquisition program.

## Rehabilitation of Existing Bridges

This three-day course was designed for officials or employees of local government units who are responsible for the care and upkeep of bridges. Dr. J. Leroy Hulsey, who is a faculty member of UAF's Department of Civil Engineering, taught the course on May 13-15 in Juneau.

The course was predicated on the assumption that participants had considerable experience and background in maintenance and operations of public works, but relatively modest experience concerning bridges.

There was, however, sufficient material contained in the course so that anyone even fairly knowledgeable in the field of bridge rehabilitation and repair could gain a substantial amount of useful information.

## About Our Newsletter

**Technology for Alaskan Transportation** is a quarterly newsletter that informs local transportation people in government and industry of useful publications and services. The newsletter reports on useful research findings, new technology, and learning opportunities such as workshops, seminars and video tapes. To get on our mailing list or to contribute to the newsletter, contact:

### Editor

**Transportation Technology Transfer Program**  
University of Alaska-Fairbanks  
Fairbanks, Alaska 99775-1760  
(907) 474-6116

## About Our Program

The goal of the Transportation Technology Transfer Program is to help local agencies obtain useful information and training related to local transportation needs. The program focuses on technology related to roads, bridges and public transportation. In addition to our newsletter, we will provide low-cost seminars and workshops, provide copies of useful technical reports upon request, and answer phone and mail inquiries related to transportation technology. If we don't have the answer, we will refer the question to a suitable specialist.

A variety of organizations support the Transportation Technology Transfer Program:

- the University of Alaska Transportation Center (UATC is an interdisciplinary center with participation from the schools of Engineering, Mineral Engineering, Management, and Agriculture and Land Resources Management).
- the Alaska Department of Transportation and Public Facilities
- the Federal Highway Administration

**We invite you** to address your questions or comments to any of the following people:

**John D. Martin, P.E.**  
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Alaska Department of Transportation and Public Facilities  
2301 Peger Road  
Fairbanks, Alaska 99709-6394  
(907) 451-5150

**Dr. Jan Botha**  
University of Alaska Transportation Center  
University of Alaska-Fairbanks  
Fairbanks, Alaska 99775-0660  
(907) 474-7497

**Dr. Nick Coetzee**  
Director  
University of Alaska Transportation Center  
University of Alaska-Fairbanks  
Fairbanks, Alaska 99775-0660  
(907) 474-6124

## Calendar of Events

We will be happy to include any relevant events you would like to publicize. Call the editor at (907) 474-6116.

### 1987

**June 15-16—Pavement Design Workshop.** Juneau, Alaska. Contact Billy Connor at (907) 474-2472.

**June 29-July 1—North American Conference on Microcomputers in Transportation.** Boston, Massachusetts. Contact Campbell Graeb or Angie Arrington at (202) 334-2934.

**July 13-16—6th International Conference on Structural Design of Asphalt Pavements.** Ann Arbor, Michigan. Contact George Ring or Angie Arrington at (202) 334-2934.

**August 16-20—Relocation Assistance. International Right of Way Association.** Fairbanks, Alaska. Contact Chuck Moyer at (907) 474-2411.

**August 16-20—4th International Conference on Low Volume Roads.** Ithaca, New York. Contact the Local Roads Program (Cornell University) at (607) 255-8033, or call George Ring or Angie Arrington at (202) 334-2934.

### Fish Passage

(continued from page 3)

average sustained swimming capability of some size classes of Arctic grayling and also exceeded the design standards of ADF&G at that time. An extremely large water flow rate that spring provided researchers with a good opportunity to study fish swimming abilities. The positive results from the 1985 study led to a joint agency study at Poplar Grove Creek in the spring of 1986.

The field work in the spring of 1986 involved tagging 850 fish downstream of the culvert, collecting individual length information on 2,250 fish upstream of the culvert, and tagging some fish with special radio transmitters to monitor their behavior and swimming performance. Successful fish passage through the culvert ranged from 11% to 79% at weighted average culvert water velocities of 3.0 feet per second to 2.6 feet per second, respectively.

The results of the two studies at Poplar Grove Creek are being extended this spring to Arctic grayling in Fish Creek on the Denali Highway near Cantwell. The work this spring will include studying the effects on spawning of delaying upstream migration by delaying fish at a highway culvert. The purpose of the study is to determine if grayling

can be delayed a few days behind highway structures without harming the fish population. If the study shows that grayling may be delayed for short periods of time, then highway engineers could design fish passage structures using lower discharge rates than those which are currently used, and thus permit more conservative sizing of highway drainage structures.

The data obtained thus far suggest that the water velocity criteria previously used by the ADF&G could be redefined, allowing less costly structures to be installed, and still provide effective protection of Alaskan fisheries. In addition, new design techniques are being developed which can further enhance the ability of fish to easily pass through drainage structures.

If you would like to learn more about fish passage through culverts, you should read a 108-page report entitled, "Fish Passage Through Poplar Grove Creek," by T. Tilsworth and M. Travis. You can obtain a copy by requesting Report FHWA-AK-RD-87-15 from Publications, Research Section, Alaska Department of Transportation and Public Facilities, 2301 Peger Road, Fairbanks, Alaska 99701-6394. **AT**

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# Alaskan Transportation

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Many of Alaska's roads are not paved, yet these gravel roads carry a significant portion of the state's traffic.

A "good" gravel road has a good surface, a proper crown, and adequate drainage. Its good condition is maintained by periodically smoothing and reshaping its surface and shoulders. This note describes the characteristics of a gravel road and how to maintain one.

## Surface

A properly blended road gravel will produce a good surface. Good road gravel has three elements: gravel, sand and fines (clay and silt). A good blend has a mixture of all three sizes.

The gravel or stones can be any rock-like material down to 1/4" in diameter.

Sands range from coarse, a maximum of 1/4" in diameter, down to fine, 0.074 mm in diameter (about the smallest size you can see with your naked eye). Sand is granular, and the grains have little attraction to each other.

Silt is actually a very fine sand, the consistency of flour. Silt particles range from 0.074 mm down to 0.005 mm in diameter. Because it also is granular, there is no cohesion between grains. Therefore, silts compact very poorly and have little or no dry strength.

Clay's microscopic particles are cohesive. Moist clay becomes sticky and can be rolled into a ball. It is almost impermeable to water flow and has low strength when wet.

### Is your gravel "good" or "bad"?

Good road gravel needs gravel, sand, and silt in the proper proportions to support traffic loads, resist abrasion, shed water, and enhance the soil's ability to absorb and disperse water. There must be small sands and fines to fill the voids between the larger stones so the mixture can be compacted.

You can take samples from the gravel pit and submit them to a testing lab to analyze the gradation and amounts of stone and sand. In addition, with some experience you can inspect the samples yourself. Are the stones different sizes or are they all one size? Does there seem to be an equal number of stones of each size? Are there lumps of clay, silt, or other contaminants (like dark, soft organic material)? Do the fines (silt and clay) stick to your hands? If so, it's "dirty" gravel and may not be useful for roads because too many fines will give poor stability and drainage.

The percent of each component in good gravel can vary with the source, but in general there should be:

- o 40-80% hard stone, uniformly graded from 1/4" to 3" diameter;

- o 20-60% sand, smaller than 1/4" in diameter; and
- o 8-15% of the total gravel weight should be fines.

## Types of gravel

Pit run gravel has been taken out of a natural deposit, very often an old stream bed. Screened gravel is pit run gravel with oversized stones removed. (The maximum size stone in a gravel mixture should not exceed two-thirds of the thickness of the layer being placed on the road). Washed gravel is gravel in which excess fines are removed by water. Crushed gravel is made by breaking stones into uniform gradation.

## Crushed rock

In some parts of the state, good quality natural gravel is not available. Then crushed rock from a rock quarry is used. Well-graded crushed rock will have qualities and performance similar to gravel.

## Blending

For a good all-weather surface, road gravel must be properly blended. Blending allows the stones and fines to compact together forming a hard-durable surface crust to carry the traffic load and shed water.

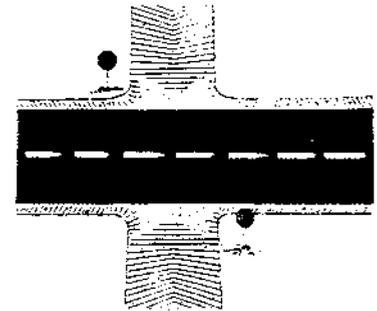
To blend, blade the road surface when it is moist, cutting with a grader to a depth of 2"-6". Moisture makes blading easier, and causes the fines to cement the stones into a crust. Too much moisture during blading will cause the crust to break up, reducing its load-carrying capacity and leading to rapid surface deterioration.

## Crown

The crown is the most important design element of a gravel road. A proper crown can enhance a road's usefulness, improve drainage, and ease maintenance.

In a proper crown, the center of the road is higher than the shoulders and the road slopes in a straight, uniform line to each shoulder edge. The road center should be 1/2" to 3/4" higher than the shoulders for each foot of lane width. For example, a 20' wide road (two 10' lanes) would have a 5" to 7" crown. This degree of slope should drain surface water without washing off surface material.

Without a proper crown, water saturates the surface instead of draining off. Vehicles traveling on a saturated, unpaved surface will create ruts. As these ruts increase in number and size, the road will become very rough, and its usefulness will be diminished. Blading the road with a grader will remove the ruts and restore the crown to its proper shape.



## Drainage

Proper side ditch and cross surface drainage are also important. Without proper drainage, road surfaces become rutted, surface materials wash away, and roads can become flooded and impassable.

Compaction of a proper crown and surface material affects cross surface drainage. If the crown is designed properly, then water will run off onto the shoulders. Well-compacted surface material has fewer voids to absorb water and lets most of the water run off.

The shoulders, (see figure on next page) should also be constructed of aggregate. The shoulder must slope as much or more than the crown for good drainage and to prevent water from flowing back toward the road surface.

Ditches collect runoff from shoulders and carry it to streams and other natural drainage locations. The right-of-way usually limits ditch sizes. The most common and economical to build ditch shape is a V. Look at the figure on the next page. The foreslope of the ditch (next to the shoulder) must slope at least as much as the shoulder (and usually more) to prevent water from flowing back onto the shoulder. A slope of between 2-1/2 to 1 and 4 to 1 is desirable. The backslope may be steeper than the foreslope. A good cover of vegetation helps ditches resist erosion, but you should keep at least the foreslope and ditch bottom mowed so water flows properly.

When ditches become clogged with sediments, clean them to avoid overflowing and possible washouts. A grader is most economical if the ditch slopes are not too steep. Some of the fines may be remixed with the road gravel to replace fines that have blown away.

## Maintenance

Good maintenance is crucial to the life and quality of an unpaved road. Use changes its original shape; the crown is flattened, chuckholes develop, and surface materials are blown, plowed or washed away.

While a correctly designed and built paved road will last for years with little maintenance, an unpaved road must be maintained almost from the beginning. The road surface and shoulders must be smoothed and reshaped, usually with a motor grader, as often as necessary for the amount and kind of use the road receives.

The crown is the most critical design element that grading tries to restore. Every motor grader should be equipped with a level bubble so the operator can correctly judge the crown slope.

When grading, consider the moisture content of the surface and the speed of the grader. Surfaces worked when they are too dry will not compact and chuckholes will quickly redevelop. Surfaces worked when they are too wet may not be stable. A damp surface is best. If the grader is operated too fast, the blade will bounce, creating a washboard effect on the road surface. Therefore, the operator should keep his speed low enough so the blade doesn't bounce. Three mph is recommended. The operator should also be careful that the edge of the blade doesn't leave a berm or windrow which will keep water from running into the ditch.

### Special grading techniques

A bridge may or may not have a crown. But if it does, the bridge will seldom have as much crown as the road. Starting 50' to 100' from the bridge, the operator must gradually reduce the crown to match the bridge and must also avoid dragging surface material onto the bridge.

At intersections with through roads, the through road crown should be

continuous. The crown on the side road should be gradually removed on its approach, matching its grade to the shoulder elevation of the through road. At the intersection of two minor roads, the crown is usually removed from all approaches.

Railroad crossings require similar techniques as bridges. It is more critical, however, that surface material not be dragged onto the rails.

### Washboards, chuckholes, dust and weeds

Rainwash and vehicle windwash remove the fines from the surface and start washboarding. This can be corrected by reshaping the road surface. Sometimes you must also add gravel.

Improper drainage usually causes chuckholes or potholes. Fix them by filling the holes with a mixture of half sand and half graded gravel up to one-half inch in diameter. Overfill the holes slightly to compensate for compaction and tamp the fill with the wheels of a truck before reopening the road to traffic.

Much of a gravel road's surface can be lost as dust stirred up by wind. Adding calcium chloride to the road surface attracts moisture from the air and helps keep dust settled. It also creates a harder, more durable surface by keeping small particles moist and cemented to the larger ones.

Weeds and grass tend to creep into the road near the shoulder line in late summer and early fall. After prolonged dry weather and with insufficient moisture to blade, these weeds can be a major problem at the first blading. They drag under the blade, making it very difficult to leave a smooth surface, and then end up in a large berm. You may need to blade more frequently or use chemical herbicides to solve the problem.

## Summary

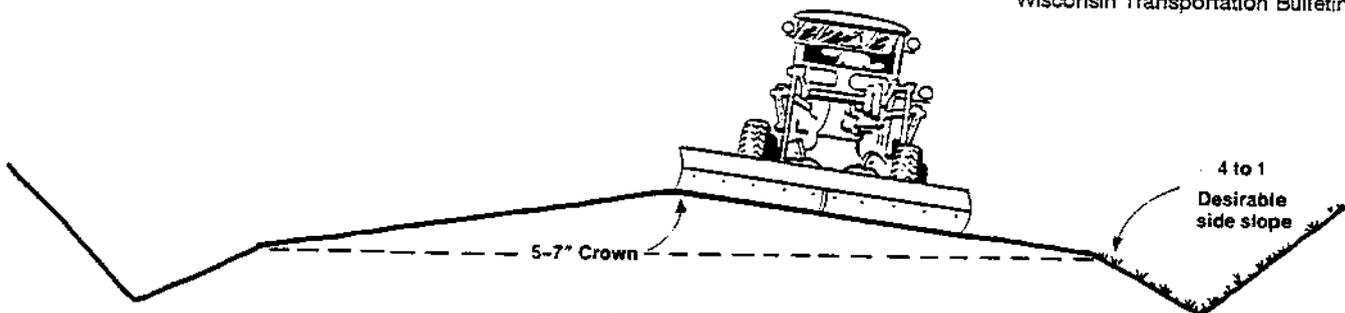
Gravel will provide a good all-weather surface when the roadway is properly constructed and maintained. The amount of required maintenance relates partly to how well the road is constructed.

When building a gravel road, pay close attention to surface material quality, crown design, and drainage adequacy.

No matter how well a road is constructed, it will need some regular maintenance. During maintenance, use special techniques for such road features as bridges, intersections, and railroad crossings. Washboards, chuckholes, dust, and weeds are unique problems to gravel roads and will require particular attention.

- o Not all gravel is good road gravel.
- o Good gravel is hard enough to resist breaking down under traffic and forming dust.
- o Good road gravel contains a uniform mixture of gravel, sand and fines: 40%-80% stone uniformly graded, 20%-60% sand, and 8%-15% fines.
- o For an all-weather road, blend different size aggregates so the pieces can compact into a strong, dense surface crust.
- o Proper blending is done by blading the top 2" to 6" of road surface when it is moist. You may need to add aggregate or fines.
- o A proper crown provides drainage. The center of the road is higher than the shoulders and slopes straight and uniformly to the shoulder edge on either side. A crown of 5" to 7" is desirable.
- o Ditches should have a "V" shape and should be mowed and cleared of sediments and debris to prevent washouts.

This publication was adapted from the Wisconsin Transportation Bulletin.



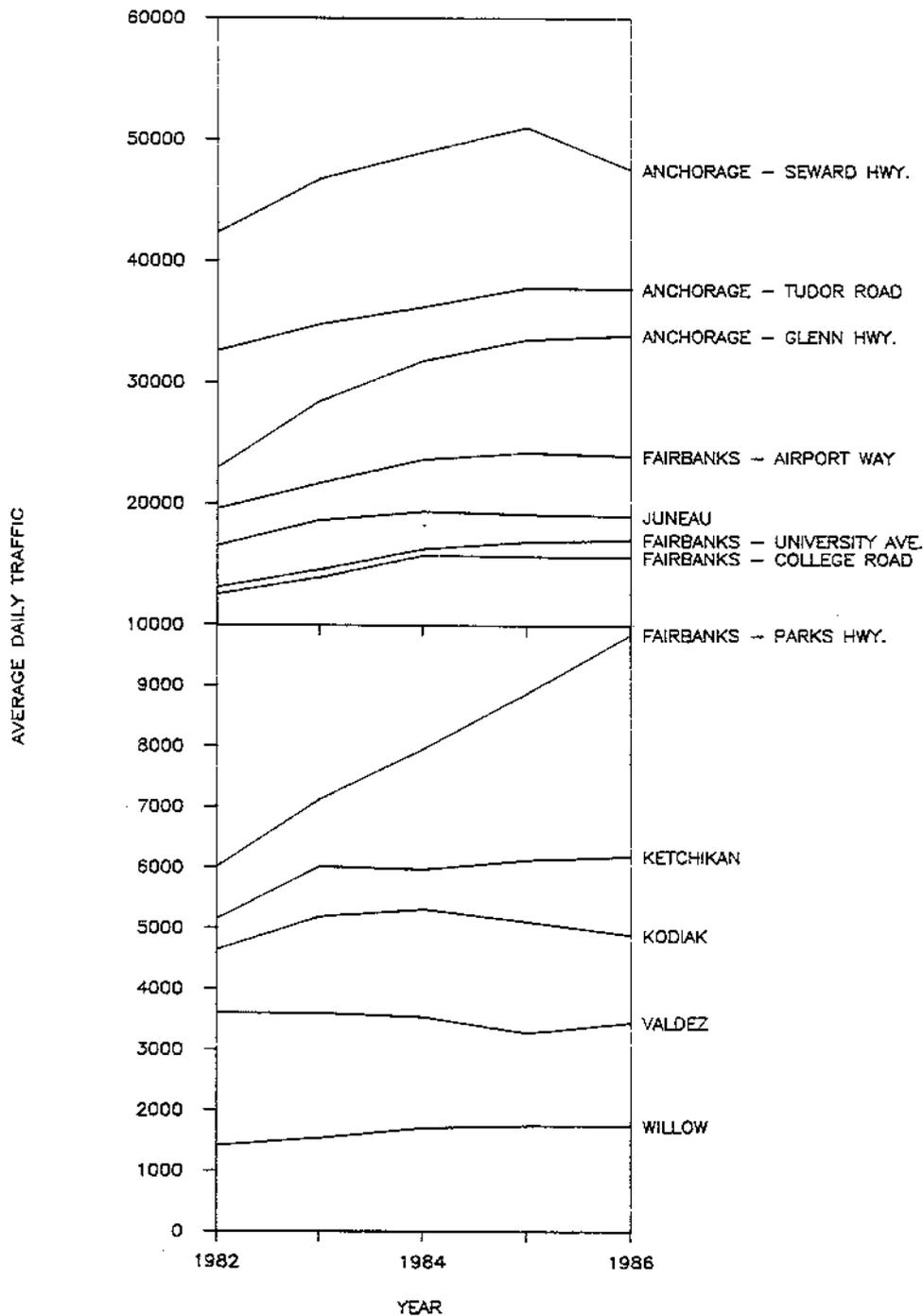
Gravel Road Cross Section

*Blade road to maintain smooth riding surface and good drainage*

## For More Information

For back issues of our newsletters and notes, or to get on our mailing list, write: Publications, Transportation Technology Transfer Program, University of Alaska-Fairbanks, Fairbanks, AK 99775-1760. For more information, you can also call John D. Martin, P.E., at (907) 451-5150 or Dr. Jan Botha at (907) 474-7497.

AT SELECTED FIXED TRAFFIC RECORDERS



## SOURCES TO CONTACT FOR ALASKAN TRAFFIC DATA

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Alaska Department of Natural Resources  
Division of Parks & Outdoor Recreation  
ATTN: Operation Services  
Box 10-7001  
Anchorage, AK 99510

Alaska Department of Transportation  
and Public Facilities  
Northern Region Planning  
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Alaska Department of Transportation  
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Alaska Department of Transportation  
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