ACRES OF HILLS, BUMPS, BUNKERS, PATHS & CURBS.

PRESENTING THE NEW WORKMAN® MID-DUTY

PLEASE REMAIN SEATED UNTIL THE RIDE COMES TO A COMPLETE STOP.

Thanks to your valuable input and the determination of Toro engineers, you've taken your last wild ride in a utility vehicle. Introducing the new Toro Workman® 1100 and 2100 utility vehicles featuring the biggest payload in their class, impressive traction, and an exclusive go-anywhere, do-anything suspension that is so smooth, it will change the way you work. No matter what kind of roller coaster terrain you work on.

Golf Course Superintendents

Sports Turf Managers

Grounds & Maintenance Managers

NO NEED TO STRAP YOURSELF IN.
YOU'RE RIDING THE REVOLUTIONARY NEW ACTIVE IN-FRAME™ SUSPENSION FROM TORO.

The radical new Toro Active In-Frame suspension is based on a torsional pivot point that allows the entire vehicle frame to literally twist and contort to respond to your terrain. But that wasn't enough for our engineers.

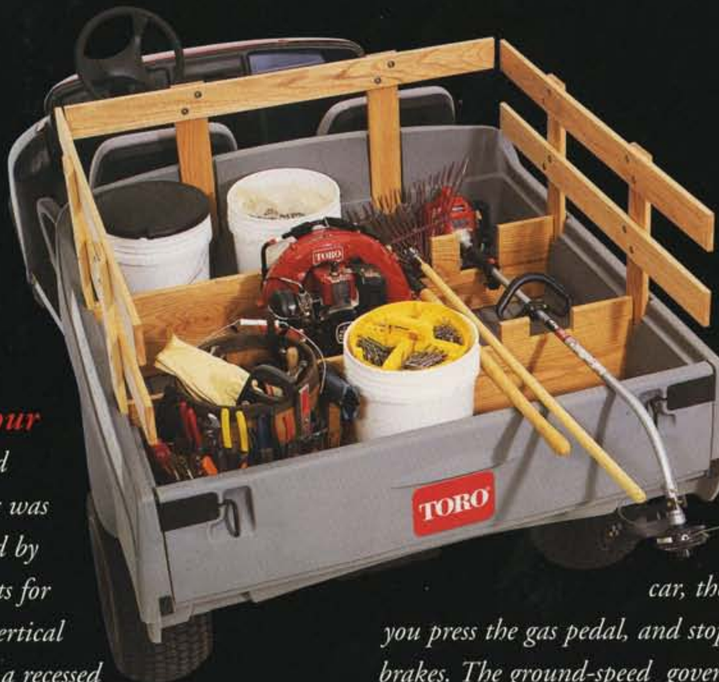
To top it off, they added an independent front A-frame suspension, so each wheel reacts separately. Even fully loaded, you'll smoothly deliver your cargo over curbs, bumps and dips. And because the Active In-Frame suspension also promotes better traction, you'll glide over hills, knolls, and loose turf without a slip.

Don't just drive. Float. *Large flotation tires, standard on both models, enhance your ride while decreasing compaction, even when fully loaded. High ground clearance leaves plenty of room for safe travel over obstacles.*

Smoother ride. Slip-free traction. *You'll feel the difference immediately with the Active In-Frame suspension. The heavy-duty frame literally twists around a torsional joint (shown below) to react instantaneously to your terrain for a smoother ride. It also gives the vehicle a "soft" traction – the wheels are always in firm contact with the ground, so tires grip better without damaging turf.*

The best turning radius around. *Like the Heavy-Duty Workman vehicles, the front wheels on the new Mid-Duty models turn an incredible 70 degrees for tight maneuvering.*

TORO® IT'S ABOUT PRODUCTIVITY



A custom fit for your crew. The double-walled 49x52x10-inch cargo box was designed to be customized by you, with 1x4-inch pockets for stake sides or tool racks, vertical slots for box dividers, and a recessed inner-box ridge to fit a deck or cover.

Efficient stop-and-go pedal start. Much like a golf car, the engine starts when you press the gas pedal, and stops when you hit the brakes. The ground-speed governor links the engine to the drive axle for a smooth top speed of 15 mph.

Impressive power. Since it is equipped with either a twin cylinder, 16 hp or single cylinder, 11 hp Briggs & Stratton Vanguard™ engine, the Workman Mid-Duty offers the most power in its class. Letting you also tow an 800 lb trailer with ease.

Solid, non-corrosive, smart. The rugged Toro frame is surrounded by a durable, corrosion-proof polyethylene body and bed that absorbs sound for a quiet ride.

Room for everything. Including you. Exceptionally large in-dash and under-seat storage provide ample space for tools, lunchboxes and other items. Plus, the seating area is designed to give you plenty of leg room.

Optional accessories. Add any of these versatile attachments to increase your productivity: cab, canopy, windshield, electric bed lift, refreshment center, Rahn groomer, roll-over protection, off-road lighting, and signal lighting.

TORO® IT'S ABOUT PRODUCTIVITY

To learn more about the all-new Workman 1100 and 2100 Mid-Duty utility vehicles, visit www.toro.com, contact your Toro distributor, or call 1-800-803-8676.

Specifications and design subject to change without notice.

Matt Divine, both with four years of service; and Ryan Hix with two years. This staff, along with seven part-time employees, is responsible for 53 acres of Athletic Department grounds.

Bergstrom says, "This crew does a tremendous job of keeping up the standards Bucky established and putting in the extra effort for our players and coaches. We rotate our staff members as needed to handle the different fields but, in the early spring, conditioning the baseball field surface for the team takes priority. In-season routine maintenance is scheduled in the mornings so the crew can work elsewhere when practice begins. A five-person crew works the field at game time and performs a quick fifth-inning drag for college games. As much field preparation as possible is accomplished post-game."

Bermudagrass is the base turf for the field, despite the transition zone challenges. Vamont bermudagrass is used on the infield. The outfield was converted from Kentucky bluegrass to Quickstand bermudagrass during the summer of 1996 to better accommodate the heavy field use during the hot summer months.

Bergstrom notes, "We selected Quickstand because it grows quickly when conditions are right. If it's sunny and 75 degrees Farenheit, we'll not only get growth, but also lateral development from it. The Vamont needs the full 80 degree temperatures coupled with the sun to grow well. It may be mid- to late June before temperatures are consistently in the 80s here.

"The winter of 1997 was a tough one and we lost 90 percent of the Quickstand. When we transitioned out the perennial ryegrasses that spring, we had little remaining bermudagrass to get us through the camp season. We resprigged the outfield with Quickstand in July. Then we purchased enough geotextile blanket to cover the entire field to protect the bermudagrass from the winter and to keep the overseeded perennial ryegrass actively growing. We choose the white cover to increase the light factor. There are 14 sections of cover, and each is labeled for placement on the field."

The bermudagrasses are overseeded in late October with a three-way blend of perennial ryegrasses: Prism, Brightstar II, and Stallion. The blend was selected for its excellent germination rate, great color, and performance under the geotextile cover. The college baseball season is played on the perennial ryegrass. Summer camps and the Wildcats fall practice season are played on the bermudagrasses.

Managing the transition has been a learning curve for Bergstrom and crew. Initially, they wanted the perennial ryegrasses out by the second week in June for the high school games, but the bermudagrasses weren't active enough at that point. Now the transition back to the

Dan Bergstrom, left, accepts the 1999 STMA/Beam Clay/sportsTURF Baseball Diamond of the Year Award for the College Division from then STMA President Steve Guise.

Shively Field at Cliff Hagan Stadium, home field for the University of Kentucky Wildcats' baseball team: sportsTURF's college field of the year for 1999.

the summer compensating for that skinned area sand content by putting more water on to keep the desired moisture levels.

Bergstrom says, "The irrigation system was installed in the early 1980s and provides full coverage of all turf and skinned areas. There are 59 Hunter I-40 and I-25 heads in 15 zones controlled from a Rainbird control box. City water pressure of 65 psi is increased to 90 psi by our booster pump. Having irrigation on the infield skin saves many labor hours in the summer. We can get the same results with turning on the zone for a half hour as compared to five crew members hand watering with hoses for two hours."

A natural vein of clay was found when the University built their soccer facility three years ago. For budgetary considerations this is now the source of the mound and home plate clay. Bergstrom notes, "Straight clay requires different management techniques. There's a fine line between wet enough and too wet. If it becomes too wet it can get greasy and slippery."

The infield baselines were converted to grass in the early 1980s to trim maintenance for the coaches who, at the time, were responsible for field maintenance. The grass baselines have since become a tradition. They eliminate four lips and cut down on the chalking. For practices, the crew places heavy grade geotextile around the home plate area to protect the turf and batting practice tarp on the infield to cut down on wear from batted balls. They also place artificial turf mats, 8 feet long by 4 feet wide, on the baseline with one starting at home plate and extending toward first base, and one starting at third base and extending toward home plate. Bergstrom says, "The rest of the first base line holds up well because each runner has a little difference in stride and takes a slightly different line.

"Practices cause more wear than games because of the repetition of drills," Bergstrom says. "The grass lines are painted once a week during the season. We've determined the grass lines save our crew five minutes in pre-game raking and chalking. We do resod the first baseline near home plate after each spring season, but the cutouts near first and third bases keep those areas in good shape."

The field is core aerated with 3/4-inch hollow tines at least twice each summer. All cores are drug back into the field with a mat drag and the infield is topdressed with sand once or twice. During the collegiate season, aeration with 1/4-inch solid tines is used bi-weekly on such traditional wear areas as around the pitcher's mound and home plate and the turf edges around the infield.

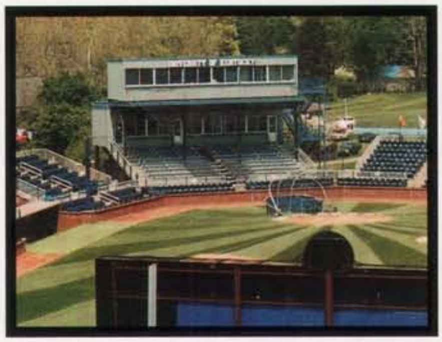
The Vamont outfield is maintained at a 3/4-inch height through the summer and fall. The Quickstand infield mowing height drops to 5/8-inch through the summer. The perennial ryegrass is maintained at 7/8-inch through the collegiate baseball season. A walk-behind reel mower is used on the infield, a ride-on triplex reel mower in the outfield. The field is mowed five days a week in the spring and daily during the summer's prime bermudagrass growing cycle.

Preemergence herbicides are applied for weed control in mid-March as soil temperatures dictate. Post-emergence spot treatment of grassy weeds is needed occasionally. No insecticides have been used for the past four years. Though there is some grub activity, the bermudagrass tolerates it with no noticeable effect.

Balancing nutrition is a perpetual challenge in the transition zone, especially when funds are limited. Bergstrom uses liquid fertilizers to wake up the turf in February and March, and even in January when conditions allow it, dissolving urea to apply 1/10 of a pound of nitrogen (N) per week to stiffen up the leaf blades of the perennial ryegrass. As the first game approaches, he'll add some iron to improve color. By mid-March, as soil temperatures reach the mid-50s and into the 60s, he switches to granular materials. The main fertilization program calls for a balance of nitrogen and potassium (K) at π pound of N and K per week or 1/2 pound every other week as weather allows. Phosphorus triggers poa annua and other weeds, so is used only in the 18-24-12 application made when overseeding with perennial ryegrass. In mid-June he switches to a hotter fertilizer, using either urea or ammonium nitrate at the rate of 1 pound of N per week for three to six weeks to kick off the bermudagrass and stress the perennial ryegrass. He then cuts the rate to 1/2 pound every two weeks through November. An application of slow release N at the rate of 1 pound per thousand square feet is made around Dec. 1 to maintain the turf until that first January or February fertilization.

Mentoring and networking have provided great support for Bergstrom. He's a former STMA undergraduate scholarship recipient and he made connections with Trotter at the STMA Annual Conference in Anaheim. He's keeping up those traditions as well. He's currently serving as President of the Kentucky Turfgrass Council and is an active member of STMA. Bergstrom says, "This industry is a complex mix of science and art. Everything we can share with each other makes our fields that much better for the athletes and that's what it's all about."

Bob Tracinski is the business communications manager for the John Deere Worldwide Commercial & Consumer Equipment Division headquartered in Raleigh, N.C. He serves as public relations co-chair for the STMA.



Modifying Rootzones with Sand

Where's the Economic and Agronomic Breakpoint?

by Dave Minner

Successfully built sand based fields can be very expensive. Just what are the agronomic and financial breakpoints of using sand in the rootzone? Can we use less sand, reduce the cost and still have a successful field? Can we take the existing soil, mix it with the proper amount of sand and produce an improved field?

In any field construction or modification, ultimately you want to spend your money wisely and be assured the finished product meets your expectations.

Start by asking yourself the right questions: How have your current fields performed, what has failed, what has worked well and what do you want changed? Do you have the budget, equipment and personnel to care for a new field system? How much traffic and what type of activities are planned for the field? What is your expectation for appearance and playing conditions? Do you want the fastest draining field possible or are you willing to cancel events or tolerate some excess moisture during high-rainfall events? Most field concerns involve drainage, compaction and surface stability

How have your current fields performed, what has failed, what has worked well and what do you want changed? Do you have the budget, equipment and personnel to care for a new field system?

Why sand?

Nearly all professional and collegiate football fields newly constructed or rebuilt in the last 10 years have utilized some type of rapid drainage sand based system. Sands are used because they are less likely to compact and puddle because of large pores in the rootzone media. Compared to "soil-type" fields, water rapidly enters a sand based field and quickly moves throughout the rootzone profile. From there, various types of under drainage pipe systems are used to move water away from the bottom of the porous rootzone.

Sand is divided into five different classes based on particle size: coarse, very coarse, medium, fine and very fine. The gradation of sand usually is specified as a guide to allow location of a material that can be mixed with soil, peat or inorganic amendments to provide specific performance criteria. Particle size analysis alone is not enough information to predict how a rootzone sand mix will perform. Other important performance criteria that require testing include aeration, porosity, capillary porosity, organic matter, bulk density, coefficient of uniformity and water infiltration rate.

The USGA concept was developed in the 1960s for golf green construction. It was modified in the 1990s and today stands as the most widely used concept for construction of sand based golf greens and athletic fields. In general, a 12-inch rootzone (usually a mixture of graded sand and peat) is placed over a 4-inch layer of 3/8-inch pea gravel. A network of trenched drains (perforated drain pipe in gravel on 20-foot centers) is connected to the bottom of the pea gravel layer. This unique system of layers creates a perched water table that stores sufficient water for plant growth, but also allows for rapid water infiltration and subsurface drainage. There are specific guidelines for selection of the sand, peat and gravel materials. Testing and quality control are a critical part of sand based systems.

Construction materials vary at different locations. The physical and chemical properties of local materials must be suitable for agronomic use. An accurate bid for construction cannot be submitted until sand and gravel

Table A—Examples of rootzone mixtures for athletic fields.

	Sieve Mesh	Dia. (mm)	USGA Specification % Retained	Football Field Specification % Retained	Example A USGA Clean Sand Mixed with Peat	Example B USGA Clean Sand Mixed with Soil	Example C Clean Sand Mixed Off-Site with Soil	Example D Sand Pad	Example E Till Coarse Sand into Soil on Site	Example F Native Soil
Gravel	10	2.0	≤3 Gravel	Max. 10	1	0	2	0	0	0
Very Coarse	18	1.0	≤10 Combined	Max. 10	8	8	3	10	20	0
Coarse	35	0.5	Min. 60	Min. 50	28	29	25	25	30	0
Medium	60	0.25	Min. 60	Min. 50	47	42	33	29	20	5
Fine	100	0.15	Max. 20	Max. 25	12	14	22	25	5	12
Very Fine	270	0.05	Max. 5	Max. 10	3	1	5	5	5	13
Sand					99	94	90	94	80	30
Silt		0.002	Max. 5	Max. 9	0.4	4	5	3	10	41
Clay		<0.002	Max. 3	Max. 6	0.6	2	5	3	10	29
Ksat Infiltration Rate (in/hr)			Normal: 6-12 in/hr; Accelerated: 12-24 in/hr	6-15 in/hr	21	15	9	12	1	0.1
Rootzone Depth			12"		12"	12"	12"	6"	6"	
Gravel Blanket Depth			4"		4"	4"	4"	None	None	
Drain Spacing			20'		20'	20'	20'	8'		
Est. Cost per 80,000 sq. ft. Football Field					$400,000—$600,000	$400,000—$600,000	$400,000—$600,000	$200,000—$300,000	$35,000—$110,000	

materials have been qualified since the cost of these materials can range from $15 to $50 per ton. The material cost for and average field (8,000 tons of sand and gravel) can range from $120,000 to $360,000.

I start with USGA specifications when recommending rapid drainage sand based fields. They have a proven track

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record in both the agronomic and playability arena. Failures with the USGA system usually are not related to construction or design, but are the results of poor planning. Stability is always a concern with sand systems. The footing required for baseball and soccer is less than that for football. If the field goes through one complete football playing season without the need for resodding it is unlikely that surface stability will be a problem. Stability problems that occur in the first season are often the result of insufficient grow-in time.

Fields that must be game ready in August should be sodded with cool season grasses by April 1. Preferred is fall/winter sodding during the previous year to allow a full season of spring rooting and possibly some winter rooting to insure stability of sand-based fields. Cool season sod installed after mid-May generally produces a weak root system during the summer that is simply insufficient to hold the field together during football activities. When replacing an old field with a new sand-based system have the starting construction date coincide with the last game in the fall. When given proper advanced planning an organized construction company can build the field in 25 to 45 days, allowing for an early winter sodding. Plan the sodding date first and then plan the rest of the project.

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There currently is no organization that specifically deals with sport field agronomic specifications. The American Society of Testing and Materials (ASTM) has many standards for testing materials and individual components that make up a field system. However, there are no standards for athletic field rootzones at this time. Fortunately, soil testing labs, turf and soil researchers at universities and construction and design companies have been working together to develop improved fields. Table A provides some of the basic field types and materials that are being used. They represent a wide range in cost and thus provide insight when determining how much to spend on a field—or where's the financial breakpoint. The estimated costs are provided to give a relative comparison among different field types. They may not represent the actual cost of building a similar type field in your area.

How much silt and clay?

Recently there has been a trend to maximize the amount of silt and clay in the sand rootzone without decreasing water infiltration too greatly. The USGA specification allows for a maximum of 8 percent silt and clay. Some athletic field mixes maintain adequate water infiltration rates (6 to 12 inches per hour) with 9 to 13 percent silt and clay. As the field matures, properly selecting topdressing materials and providing deep and conventional coring on a routine basis can maintain these infiltration rates. Many golf greens are built with accelerated infiltration rates (15 to 25 inches per hour) because USGA research has shown that as the greens mature the infiltration rates can drop as much as 10 inches per hour, due to organic build up in the rootzone. In my experience, this is less of a concern in sport fields if aerification, core removal and topdressing are carefully monitored. A sand-based field with an infiltration rate of 6 inches per hour and 10 percent silt/clay will grow-in faster and be more stable than one with an infiltration rate of 20 inches per hour and 2 percent silt and clay. So it is an easy recommendation to make—build a USGA-type field at the maximum limits of silt and clay content.

It is extremely difficult to locate a sand that naturally contains sufficient silt and clay that targets good stability and meets the minimum performance criteria relating to soil water, i.e. aeration porosity of 15 percent, capillary porosity of 25 percent and K-sat 6 inches per hour. Most sand suppliers have clean sands containing less than 2 percent silt and clay. These sands can be amended with peat to work well for golf, but not so well for football fields. Soil must be mixed with the sand to raise the silt/clay level to between 6 to 15 percent on a weight basis. A good supply of clean and shredded soil is necessary. Reputable blenders, sand suppliers and soil testing companies are good

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