American Journal of Engineering and Applied Sciences

Original Research Paper

Dynamics of Buses - Part III

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Article history
Received: 02-03-2018
Revised: 02-04-2018
Accepted: 18-04-2018

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Abstract: Dynamics, or dynamic processes, is the part of mechanics dealing with the study of processes trying to describe as real as possible the movement of a body, element, mechanism, car, etc., also taking into account the action of the forces on the respective system with their influence on the actual movement of system. The present paper aims to present the study of the dynamics of the vehicles, with particularization on the buses. Here are the main elements of the bus dynamics, taking into account all the elements that influence the dynamic operation of a bus, in general and in particular situations, with emphasis on the main systems and elements that act on the actual, dynamic, on a normal path or on an inclined with an alpha angle path. The position of the bus center on a bus needs to be known first in order to study the stability of the bus and then to determine the normal dynamic reactions for the suspension design... The position of the center of mass in the longitudinal plane is determined by weighing the bus on a tiller. In the beginning determine the maximum total mass of the G_t bus and then two other weights determine the loads G_1 and G_2 that belong to the front and to the rear axle. The stability of the bus will be studied, which means its ability not to overturn or slip during travel or in stationary. The longitudinal stability of the bus means its ability not to overturn around the rear or front wheels or to slip longitudinally when climbing a slope. Figure 3 considers a bus that climbs a slope at a low and uniform speed. The movement can be considered because the overturning can occur in the case of large slopes. Flipping around the straight line through the contact points B of the rear wheels with the road may occur when the tipping moment is greater than the moment of stability relative to the same point, i.e.

Keywords: Mechanisms, Machines, Buses, Dynamics, Kinematics

Introduction

Transport management is the responsibility of transport engineering and engineering for the design of transport networks and systems, aiming at optimizing transport systems, increasing transport safety, protecting the environment, etc.

The most widespread and efficient form of land transport uses vehicles equipped with liquid-fueled engines (Frăţilă *et al*., 2011; Pelecudi, 1967; Antonescu, 2000; Comănescu *et al*., 2010; Aversa *et al*., 2016a; 2016b; 2016c; 2016d; 2017a; 2017b; 2017c; 2017d; 2017e; Mirsayar *et al*., 2017; Cao *et al*., 2013; Dong *et al*., 2013; De Melo *et al*., 2012; Garcia *et al*., 2007; Garcia-Murillo *et al*., 2013; He *et al*., 2013; Lee, 2013; Lin *et al*., 2013; Liu *et al*., 2013; Padula and Perdereau, 2013; Perumaal and Jawahar, 2013; Petrescu and Petrescu, 1995a; 1995b; 1997a; 1997b; 1997c; 2000a; 2000b; 2002a; 2002b; 2003; 2005a; 2005b; 2005c; 2005d; 2005e, 2016a; 2016b; 2016c; 2016d; 2016e; 2013; 2012a; 2012b; 2011; Petrescu *et al*., 2009; 2016a; 2016b; 2016c; 2016d; 2016e; 2017a; 2017b; 2017c; 2017d; 2017e; 2017f; 2017g; 2017h; 2017i; 2017j; 2017k; 2017l; 2017m; 2017n; 2017o; 2017p; 2017q; 2017r; 2017s; 2017t; 2017u; 2017v; 2017w; 2017x; 2017y; 2017z; 2017aa; 2017ab; 2017ac; 2017ad; 2017ae; Petrescu and Calautit, 2016a; 2016b; Reddy *et al*., 2012; Tabaković *et al*., 2013; Tang *et al*., 2013; Tong *et al*., 2013; Wang *et al*., 2013; Wen *et al*., 2012; Antonescu and

Petrescu, 1985; 1989; Antonescu *et al.*, 1985a; 1985b; 1986; 1987; 1988; 1994; 1997; 2000a; 2000b; 2001).

Materials and Methods

The Bus Mass Center

The position of the bus center on a bus needs to be known first in order to study the stability of the bus and then to determine the normal dynamic reactions for the suspension design...

The position of the center of mass in the longitudinal plane is determined by weighing the bus on a tiller. In the beginning determine the maximum total mass of the G_t bus and then two other weights determine the loads G_1 and G_2 that belong to the front and to the rear axle (Fig. 1).

Knowing the loads G_1 and G_2 can determine the a and b distances of the center of mass at the axes of the two decks, using the relations (1):

$$\begin{cases} a = \frac{G_2}{G_t} \cdot L \\ b = \frac{G_1}{G_t} \cdot L \end{cases} \quad (1)$$

Determining the height of the center of mass hg is done by placing the bus in an inclined position (Fig. 2) with the rear wheels on a weighing platform.

If the sum of the moments of all the forces in relation to the front wheel axle is obtained, the relation (2) where $G_2^{'}$ is the weight on the rear axle when the bus is inclined with an angle α and obtained by weighing:

$$G_2^{'} \cdot L \cdot \cos\alpha - G_t \cdot a \cdot \cos\alpha - G_t \cdot \left(h_g - r\right) \cdot \sin\alpha = 0 \quad (2)$$

Using the relationship (2) it is explicit from (2) the unknown h_g (thus, expression 3 is obtained):

$$h_g = \frac{G_2^{'}}{G_t} \cdot L \cdot ctg\alpha - a \cdot ctg\alpha + r \quad (3)$$

Replacing in relation (3) $G_t = G_2.L/a$, the final expression of the dimension h_g (4) is obtained:

$$h_g = a \cdot \left(\frac{G_2^{'}}{G_2} - 1\right) \cdot ctg\alpha + r \quad (4)$$

Next, the stability of the bus will be studied, which means its ability not to overturn or slip during travel or in stationary.

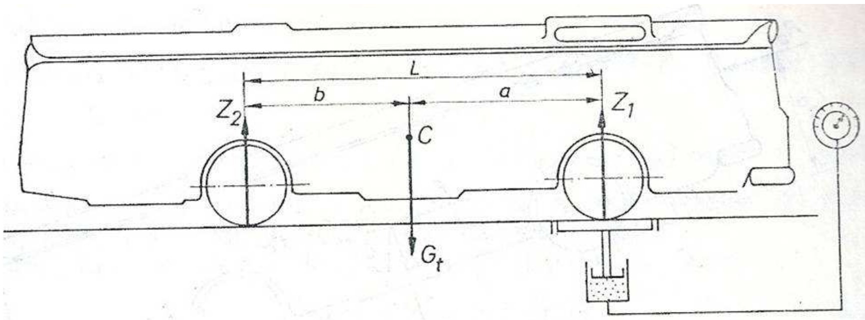

Fig. 1: Weighing the bus to determine bridging load

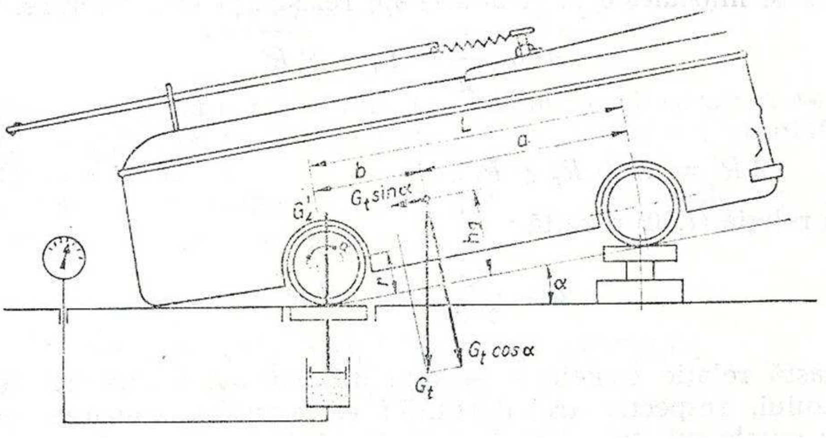

Fig. 2: Weighing the bus (trolleybus) to determine the height of the center of gravity

Longitudinal Stability of the Bus

The longitudinal stability of the bus means its ability not to overturn around the rear or front wheels or to slip longitudinally when climbing a slope.

Figure 3 considers a bus that climbs a slope at a low and uniform speed. The movement can be considered because the overturning can occur in the case of large slopes.

Flipping around the straight line through the contact points B of the rear wheels with the road may occur when the tipping moment is greater than the moment of stability relative to the same point, i.e. (5):

$$h_g \cdot G_t \cdot \sin\alpha + Z_1 \cdot L > b \cdot G_t \cdot \cos\alpha \tag{5}$$

If we consider the moment of the beginning of the overturning, when the point A deviates from the path, then the Z_1 reaction is canceled (no longer exists) and the relation (5) will be simplified by taking the form (6):

$$h_g.G_t.\sin\alpha > b \cdot G_t.\cos\alpha \tag{6}$$

Thus, we can determine the value of the slope angle α at which the overturning (7) can occur, or the condition that the overturning of the bus does not occur around the wheels of the rear axle considering a maximum permissible slope α = 45°, for which the tangent of the angle α take the unit value (8):

$$tg\alpha > \frac{b}{h_g} \tag{7}$$

$$\begin{cases} h_g < \dfrac{b}{tg\alpha} \\ with\,\alpha_{\max} = 45[\deg] \Rightarrow tg\alpha = 1 \Rightarrow \\ \Rightarrow h_g < b \end{cases} \tag{8}$$

It is understood from the relationship (8) that the secret of the longitudinal stability of the bus (in a possible longitudinal overturning of the wheels of the rear axle) is that its design should be such that the center of gravity of the bus is as low as possible with possibly, hg being as small as possible.

Transverse Stability of the Bus

Loss of lateral stability may occur by turning or side-by-side swing due to the centrifugal force that occurs.

In the case of transverse tilt roads (Fig. 4), the centrifugal force F_c and the bus weight are decomposed into parallel and perpendicular components on the road surface.

The overturning of the bus will occur when the sum of the moments of roll over the O_2 point is greater than the sum of the moments of stability (opposing the roll) relative to the same point (9):

$$\begin{aligned} &Z_d \cdot B + \left(F_c \cdot \cos\beta - G_t \cdot \sin\beta\right) \cdot h_g > \\ &\left(F_c \cdot \sin\beta + G_t \cdot \cos\beta\right) \cdot \frac{B}{2} \end{aligned} \tag{9}$$

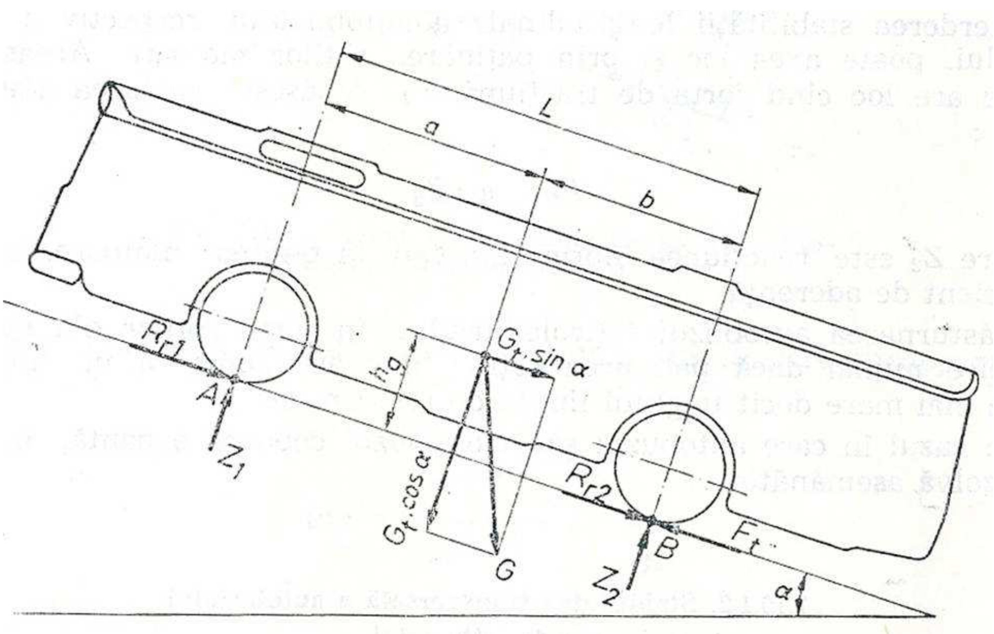

Fig. 3: The forces that act on the bus when climbing a slope

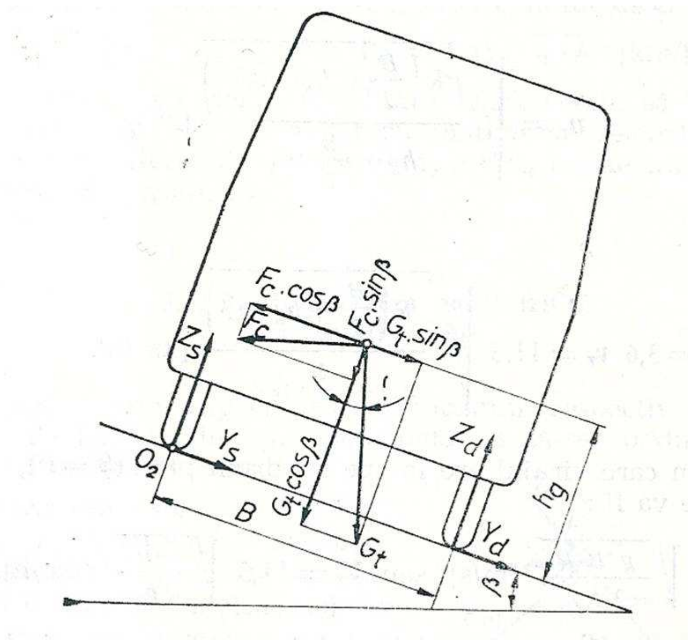

Fig. 4: Forces acting on a bus being in the curve

Because at the moment of the inversion Z_d is canceled, the relation (9) changes accordingly and we obtain the expression (10) in which *tgβ* must be limited in order not to overturn (in the expression 9 both terms were divided into costes and Z_d was considered 0, after which the value of (*tgβ*) is explicit. The expression on the right is the limit value for which rollback begins:

$$tg\beta = \frac{h_g \cdot F_c - \frac{B}{2} \cdot G_t}{\frac{B}{2} \cdot F_c + h_g \cdot G_t} \tag{10}$$

We know the centrifugal force that occurs during turn (11), where v is the bus speed in m/s and R is the radius of the turn in *m*:

$$F_c = \frac{G_t}{g} \cdot \frac{v^2}{R} \tag{11}$$

Entering the value of the centrifugal force (11) in the relation (10) gives the expression (12), which shows the value of the angle at which the overturning begins:

$$tg\beta = \frac{\frac{h_g \cdot v^2}{g \cdot R} - \frac{B}{2}}{\frac{B \cdot v^2}{2g \cdot R} + h_g} \tag{12}$$

From here you can explain the value of the tipping speed at the turn with a radius R on a tilt slope β (13):

$$v_r = \sqrt{\frac{g \cdot R \cdot \left(\frac{B}{2} + h_g \cdot tg\beta\right)}{h_g - \frac{B}{2} \cdot tg\beta}} \tag{13}$$

If the turn takes place on a flat road (β = 0), the tipping speed of the bus will be given by the particular relationship (14):

$$v_r = \sqrt{\frac{g \cdot B \cdot R}{2 \cdot h_g}} \tag{14}$$

In order to have cornering stability, the bus must have a distance B between the wheels on the same deck as large as possible, the radius of rotation R must be as large as possible (i.e., the swing should be as wide as possible) and the center height the hg weight must still be as small as possible.

The slip of the bus (Fig. 4) is possible when the relationship (15) occurs:

$$F_c \cdot \cos\beta - G_t \cdot \sin\beta > Y_s + Y_d \tag{15}$$

The maximum cross-reactive value $Y_s + Y_d$ is equal to the cross-link force (16):

$$Y_s + Y_d = \varphi \cdot \left(F_c \cdot \sin\beta + G_t \cdot \cos\beta\right) \tag{16}$$

By replacing the value (16) in relation (15) the expression (17) is obtained:

$$F_c \cdot \cos\beta - G_t \cdot \sin\beta > \varphi \cdot \left(F_c \cdot \sin\beta + G_t \cdot \cos\beta\right) \tag{17}$$

The expression (17) explains the value of the angle β at which the skew begins (18):

$$tg\beta = \frac{F_c - \varphi \cdot G_t}{\varphi \cdot F_c + G_t} \tag{18}$$

If the centrifugal force F_c is replaced with the relation (11), the expression (18) takes the form (19):

$$tg\beta = \frac{\frac{v^2}{R} - \varphi \cdot g}{\varphi \cdot \frac{v^2}{R} + g} \tag{19}$$

From relation (19), the derating speed v_d (20-21) results at the radius with a radius R on a cross-pivoting path β:

$$v_d\left[m/s\right] = \sqrt{\frac{R[m] \cdot g\left[m/s^2\right] \cdot (\varphi + tg\beta)}{1 - \varphi \cdot tg\beta}} \tag{20}$$

$$V_d\left[km/h\right] = 11,28 \cdot \sqrt{\frac{R \cdot (\varphi + tg\beta)}{1 - \varphi \cdot tg\beta}} \tag{21}$$

When cornering on a flat road ($\beta = 0$), the skid speed limit will be given by the simplified relations (22-23):

$$v_d\left[m/s\right] = \sqrt{g \cdot R \cdot \varphi} \tag{22}$$

$$V_d\left[km/h\right] = 11,28 \cdot \sqrt{R \cdot \varphi} \tag{23}$$

It is recommended that loss of transverse stability occurs by skidding and not by overturning, for security reasons. For this reason, the skid speed should be less than the tipping speed v_d.

Results and Discussion

Maniability of the Bus

Maniability or maneuverability of a bus, is the ability of the bus to move in the direction controlled by the driver, or to maintain its rectilinear stroke.

It is considered a bussing turn (Fig. 5) with the parallel guides parallel to each other and inclined with the angle γ to the longitudinal plane (in reality the steering wheels are not parallel in the turn but describe concentric circles with the center in O). With the traction on the rear wheels, each front wheel is driven by its axis with a thrust force F parallel to the longitudinal axis of the bus. The two forces F can decompose into a component in the plane of the wheel F_x and one in a plane perpendicular to the plane of the wheel F_y. These components are given by the relationships (24):

$$\begin{cases} F_x = F \cdot \cos\gamma \\ F_y = F \cdot \sin\gamma \end{cases} \tag{24}$$

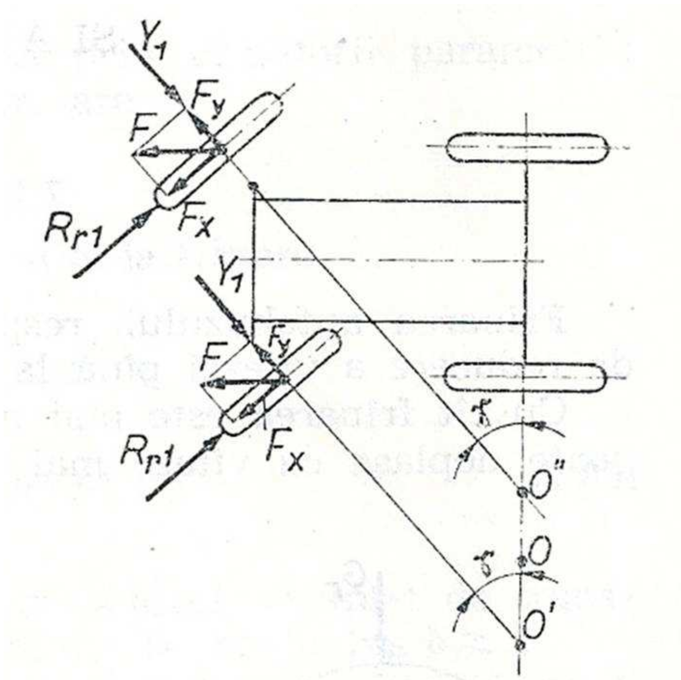

Fig. 5: Manageability of the bus when in a turn (in a curve)

The rolling resistance R_{r1}, which opposes the movement of a wheel, must be defeated by the force F_x. The condition of rolling the wheel (25) to be produced is:

$$F_x = F \cdot \cos\gamma \geq R_{r1} \tag{25}$$

The F_y component seeks to produce the transverse sliding of the wheel, but is prevented by the Y_1 transverse grip. The condition that the transverse sliding does not occur is (26):

$$F_y = F \cdot \sin\gamma \leq Y_1 \tag{26}$$

The condition of the maneuverability of the turn buss (30) (i.e., the turn is properly performed by the inclination of the steering wheels) is obtained by eliminating the force F between the relations (25) and (26). From the relations (24) the expression (27) is obtained:

$$F_y = F_x \cdot tg\gamma \Rightarrow F_x = \frac{F_y}{tg\gamma} \tag{27}$$

The expression (27) together with relation (25) generates the relation (28):

$$\frac{F_y}{tg\gamma} \geq R_{r1} \Rightarrow F_y \geq R_{r1} \cdot tg\gamma \tag{28}$$

Taking account of relations (28) and (26) simultaneously, the expression (29) can be written:

$$R_{r1} \cdot tg\gamma \leq F_y \leq Y_1 \tag{29}$$

From (29) we stop only the expression (30) which represents the maneuverability condition and which can be processed in the form (31) if the rolling resistance ($R_{r1} = f.Z_{r1}$) and the transverse adhesion ($Y_1 = \varphi.Z_{r1}$), where $Zr1$ is the normal path reaction at one of the steering wheels, φ is the coefficient of rolling resistance and f is the coefficient of adhesion:

$$R_{r1} \cdot tg\gamma \leq Y_1 \tag{30}$$

$$f \cdot tg\gamma \leq \varphi \tag{31}$$

When traveling on a dry road with hard cover, the maneuverability condition is automatically satisfied because the adhesion coefficient f is several times lower than the rolling resistance coefficient φ and $tg\gamma$ is less than 1 because the angle γ does not exceed 40 [deg].

On slippery roads (poles, water, snow...) it is often possible that the maneuverability condition (8) is not satisfied if the bus is to move in a straight line and when it has the inclined wheels to turn, from the cause of slippage on wheels. This phenomenon is not desirable, as it is an inexperienced driver a great danger of producing road accidents.

Study of Bus Braking

Braking the bus is the process of reducing its speed to a certain value or to stopping.

The more secure, the more intense, the faster and the braked, the more the bus can move safely at higher speeds. The braking capacity therefore depends on the possibility of increasing the average speed of the bus and also the safety of the bus and its passengers depends on it.

Each bus is constructively provided with a braking system that acts on each wheel, giving rise to braking moments on each wheel, moments that seek to immobilize each wheel individually.

The brake torque M_f (Fig. 6) is produced by friction of a drum or disk 1 (solidarity with the wheel marked with 2) with some brakes with the fixed part of the deck (carter). The braking torque is opposed to the rotation of the wheel and seeks to immobilize it.

During the braking, the bus moves only under inertial forces, consuming the kinetic energy produced and accumulating at acceleration.

Under the action of the M_f braking torque in the contact area of the wheel with the road, the soil reactivity F_f is directed in the opposite direction to the bus movement.

When braking the brake apart from the braking force, it contributes to slowing speed and resistance to advancing.

According to the principle of dynamic balance in the bus braking, we can write the relation (32), where F_i is the inertia force of the bus:

$$F_i = F_f + R_r \pm R_p + R_a \tag{32}$$

Replacing F_i and all forward resistances with their already known expressions, obtain the expression (33):

$$\frac{G_t}{g} \cdot \delta \cdot a_f = F_f + G_t \cdot f \cdot \cos\alpha \pm G_t \cdot p + \frac{K \cdot A \cdot V^2}{13} \tag{33}$$

Taking into account that both rolling and air resistance to bus travel at speeds of less than 100 [km/h] are small compared to the braking force, both can be neglected so that the relationship (33) will take the simplified aspect (34).

$$\frac{G_t}{g} \cdot \delta \cdot a_f = F_f \pm G_t \cdot p \tag{34}$$

The braking capacity of a bus (like any other vehicle) is characterized by the following parameters: deceleration, braking area and braking time (eventually stopping).

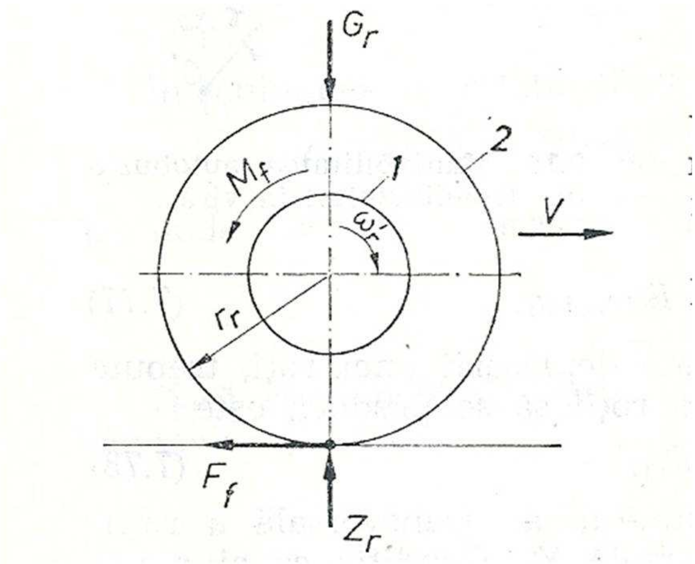

Fig. 6: The forces and moments acting on a braked wheel

Determination of Braking Deceleration

The expression of deceleration results from the relationship (35):

$$a_f = \frac{g}{\delta \cdot G_t} \cdot \left(F_f \pm G_t \cdot p\right) \tag{35}$$

If braking is considered to be with the engine off the transmission, the coefficient of mass influence in rotation can be taken $\delta \cong 1$. For a road with a certain slope p, the deceleration obtained will be maximum when the braking force has the maximum value (36):

$$\left(a_f\right)_{\max} = \frac{g}{G_t} \cdot \left(F_{f\max} \pm G_t \cdot p\right) \tag{36}$$

The maximum braking force is limited by grip (37), where G_{adf} is the adherent brake bus weight:

$$F_{f\max} = G_{adf} \cdot \varphi \tag{37}$$

In the case of a bus (trolley) having all the braked wheels when traveling on a slope, the relation (37) is written in the form (38):

$$F_{f\max} = G_t \cdot \varphi \cdot \cos\alpha \tag{38}$$

By replacing the expression (38) in the relation (36) we obtain the relation (39) which defines the deceleration of the deceleration of the bus on any slope road:

$$\left(a_f\right)_{\max} = g \cdot \left(\varphi \cdot \cos\alpha \pm p\right) \tag{39}$$

If the bus travels on a straight road at the moment of braking, the deceleration of the brake deceleration changes accordingly, simplifying it to form (40), being proportional to the gravitational acceleration g and the coefficient of rolling resistance φ:

$$\left(a_f\right)_{\max} = g \cdot \varphi \tag{40}$$

Determination of the Braking Area

During braking, according to the kinetic energy theorem, the variation of the kinetic energy is equal to the mechanical work (braking force) corresponding to the braking space.

Considering that the braking takes place with the off-set motor, according to the kinetic energy theorem, the relation (41), where m is the mass of the bus, v_1 is the speed at the start of braking in m/s, v_2 is the end braking speed in m/s and s_f represents the braking area in m:

$$\frac{m \cdot \left(v_1^2 - v_2^2\right)}{2} = \left(F_f + R_r \pm R_p + R_a\right) \cdot s_f \tag{41}$$

If the bus runs at speeds of less than 100 km/h when braking, the influences of the rolling resistance R_r and the air resistance R_a can be neglected, so that the relation (41) takes the simplified form (42-43) where the mass of the bus was substituted with G_t/g and all elements are measured in *SI*:

$$\frac{m \cdot \left(v_1^2 - v_2^2\right)}{2} = \left(F_f \pm R_p\right) \cdot s_f \tag{42}$$

$$s_f = \frac{G_t \cdot \left(v_1^2 - v_2^2\right)}{2 \cdot g \cdot \left(F_f \pm R_p\right)} \tag{43}$$

However, if we want to introduce the two speeds in km/h, the relation (43) takes the form (44) where V_1 and V_2 are introduced in km/h:

$$s_f = \frac{G_t \cdot \left(V_1^2 - V_2^2\right)}{26 \cdot g \cdot \left(F_f \pm R_p\right)} \tag{44}$$

The minimum braking distance corresponding to a certain slope shall be obtained when the braking force has a maximum value (45):

$$s_{f\min} = \frac{G_t \cdot \left(V_1^2 - V_2^2\right)}{26 \cdot g \cdot \left(F_{f\max} \pm R_p\right)} \tag{45}$$

For a bus that has all braked wheels, replacing F_{fmax} from relation (38) and $R_p = p.G_t$, the relation (46) or braking to stop (when $V_2 = 0$), (47):

$$s_{f\min} = \frac{\left(V_1^2 - V_2^2\right)}{26 \cdot g \cdot \left(\varphi \cdot \cos\alpha \pm p\right)} \tag{46}$$

$$s_{f\min} = \frac{V_1^2}{26 \cdot g \cdot \left(\varphi \cdot \cos\alpha \pm p\right)} \tag{47}$$

If the bus travels on a straight path, the expression (46) takes shape (48) and the relation (47) takes the simplified form (49), where (48) is the minimum braking space on a straight road, the minimum stop on a straight road, the bus:

$$s_{f\min} = \frac{\left(V_1^2 - V_2^2\right)}{26 \cdot g \cdot \varphi} \tag{48}$$

$$s_{f\min} = \frac{V_1^2}{26 \cdot g \cdot \varphi} \tag{49}$$

Determination of Braking Time

If the bus is considered to have an even slowed down motion during the braking period and if its deceleration is equal to (a_f) max, then the minimum braking time will be given by the relation (50), where all elements are given in the international system (v_1 and v_2 being entered in m/s), so the time will also result in s.

$$t_{\min} = \frac{v_1 - v_2}{\left(a_f\right)_{\max}} = \frac{v_1 - v_2}{g \cdot \left(\varphi \cdot \cos\alpha \pm p\right)} \tag{50}$$

In the case of braking to stop ($v_2 = 0$), the minimum braking time will be given by the simplified relationship (51):

$$t_{\min} = \frac{v_1}{\left(a_f\right)_{\max}} = \frac{v_1}{g \cdot \left(\varphi \cdot \cos\alpha \pm p\right)} \tag{51}$$

In reality, however, both the minimum braking distance and the minimum braking time have values higher than those calculated with the theoretically indicated relationships, because during the total braking time, the time needed to react to the bus driver and the time required to enter the action of the bus braking system.

Observation

The previously determined formulas have all been deduced when all brakes instantaneously come into action with their full braking force.

Figure 7 shows the variation of deceleration over time as well as the braking time intervals.

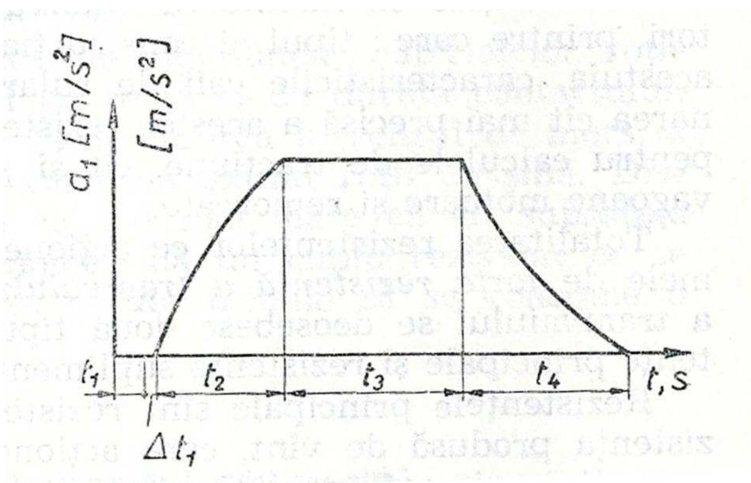

Fig. 7: Variation of deceleration in function of the time

Time t_1 is the response time of the driver and is equal to the time elapsed since the brake application was sensed until the actual start of braking. This time ranges from 0.4 to 1 s, depending on both the physiological state of the driver and his skill and experience.

The deceleration delay time Δt_1 depends on the operating time of the pedal brake transmission mechanism and is due to the joints in the joints, the fluids of the fluids through the pipes... ranging from 0.2 to 0, 5 s.

Time t_2 is the time elapsed from the moment when the braking force starts to reach its maximum value. It varies between 0.1 and 1 sec, depending on the type of braking control.

Time t_3 is the actual braking time at normal parameters, from the bus speed from the beginning of the braking v_1 to the braking end v_2 (which may be 0 in the event of braking until stopping).

Time t_4 is the time elapsed between canceling the pedal and canceling the braking force. It is between 0.2 and 2 sec but does not directly influence the previous braking area (from actual braking), but only indirectly when braking has only slowed the bus and a new slowdown is needed (a new brake), or even stopping it, its influence being only on the next possible braking.

The additional space s_{f0} traveled by the bus due to delays specific to the braking is given by the relation (52) with the speed v_1 given in m/s and is expressed by the relation (53) if the speed V_1 is introduced in km/h:

$$s_{f0} = v_1 \cdot (t_1 + \Delta t_1 + t_2) \tag{52}$$

$$s_{f0} = \frac{V_1}{3,6} \cdot (t_1 + \Delta t_1 + t_2) \tag{53}$$

Obviously, braking and using the engine brake is accomplished in a much shorter time and realizes increased braking security when necessary, being more efficient as the experience, skill and physiological state of the bus driver are better. Gradual or direct passage from the top to the bottom of the transaxle helps to effectively brake by the engine brake, usually passing to the third (from a higher stage) and eventually, then, even in step a two, if necessary. At the slope, especially at the descent, at high starting speeds for braking and when the road is slippery, the use of the engine brake is imperative.

Conclusion

The present paper aims to present the study of the dynamics of the vehicles, with particularization on the buses. Here are the main elements of the bus dynamics, taking into account all the elements that influence the dynamic operation of a bus, in general and in particular situations, with emphasis on the main systems and elements that act on the actual, dynamic, on a normal path or on an inclined with an alpha angle path. The paper presents the third part of the bus dynamics.

Acknowledgement

This text was acknowledged and appreciated by Dr. Veturia CHIROIU Honorific member of Technical Sciences Academy of Romania (ASTR) PhD supervisor in Mechanical Engineering.

Author's Contributions

All the authors contributed equally to prepare, develop and carry out this manuscript.

Ethics

This article is original and contains unpublished material. Authors declare that are not ethical issues and no conflict of interest that may arise after the publication of this manuscript.

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